

# **How to Generate and Run AOS/VS**

093-000243-06

*For the latest enhancements, cautions, documentation changes, and other information on this product, please see the Release Notice (085-series) supplied with the software.*

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# Preface

AOS/VS, the Advanced Operating System/Virtual Storage, is one of Data General's (DG's) operating systems for ECLIPSE® MV/Family computer systems.

This manual tells how to generate and run an AOS/VS system on your ECLIPSE MV/Family computer.

*Generating* includes formatting one or more blank disks, installing a starter system, bringing it up, generating a tailored system, then creating the AOS/VS multiuser environment. The whole generation procedure is usually done only once (often by a DG engineer); then parts of it may be repeated for new devices and for new revisions of AOS/VS. Whatever your role, Chapters 1 through 5 lead you through the generation procedure.

*Running* includes day-to-day operation: bringing up the AOS/VS system, shutting it down, making sure it runs smoothly for users, files for safekeeping, and making decisions that help the system run most efficiently. Whatever your role, Chapters 6 through 17 and the appendixes describe the tools and concepts needed to run AOS/VS.

Chapters 1 through 5 take a cookbook approach: they tell you what to do without detail. Chapters 6 through 17 are designed for reference; they describe the tools available, with details, and let you choose what you want.

The book is organized as follows:

- Chapter 1 is an overview of system software, MV/Family hardware, and the steps involved in generating and running on an AOS/VS system. It also describes keyboard control keys.
- Chapter 2 tells how to bring up your first AOS/VS system on ECLIPSE MV/4000® DC (departmental cluster), ECLIPSE MV/4000® SC (small cluster), or Data General DS/4000-series (distributed system) computers. It assumes you are starting with blank disks. Read it when you are starting from scratch with an ECLIPSE MV/4000 DC, ECLIPSE MV/4000 SC, Data General DS/4000, or Data General DS/4200 computer (but not with an ECLIPSE MV/4000 computer).
- Chapter 3 tells how to bring up your first AOS/VS system on the following ECLIPSE MV/Family computers: ECLIPSE MV/20000™ Model 2, ECLIPSE MV/20000™ Model 1, ECLIPSE MV/20000™ C, ECLIPSE MV/10000™ SX, ECLIPSE MV/10000™, ECLIPSE MV/8000®, ECLIPSE MV/8000® II, ECLIPSE MV/8000® C, ECLIPSE MV/6000®, and ECLIPSE MV/4000® computers. It assumes you are starting with blank disks. Read it when you are starting from scratch with any computer above.
- Chapter 4 tells how to run VSGEN to generate a tailored AOS/VS system. Read it whenever you want to generate or modify an AOS/VS system.
- Chapter 5 tells how to bring up the multiuser environment, which supports many timesharing and batch users concurrently. It leads you through creating user profiles, initializing the EXEC program, editing some macros to make things easier, and creating a tailored error message file. Read this chapter after you generate your first tailored system — later, you may want to read selected parts of it. This chapter ends the generating part of the book.

- Chapter 6 details system startup, normal shutdown, and abnormal shutdown. You'll follow the steps described here quite often. It includes several tab dividers (Startup-Shutdown and Memory Dump, ESD-FIXUP) for easy reference.
- Chapter 7 explains the user profile editor, PREDITOR. You may want this information when you create, edit, or delete a user profile.
- Chapter 8 details the EXEC multiuser management program: user logon, batch, spooling, user mount requests and labeled tapes, and all EXEC commands. Because EXEC manages so many important multiuser functions, this is the biggest chapter in the book.
- Chapter 9 explains runtime tools other than EXEC: the Command Line Interpreter (CLI), access control, display utilities, and system logging. It includes the tab divider PED-SYSLOG/REPORT.
- Chapter 10 tells how to back up and restore disk-based material. You can choose from several backup utilities. It includes the tab divider Backup.
- Chapter 11 explains how to handle unusual system conditions, using diagnostic messages and diagnostics.
- Chapter 12 details the Disk Formatter program, which formats physical disks into logical disk units for use with AOS/VS.
- Chapter 13 explains the Installer program, which installs an AOS/VS system on a logical disk unit.
- Chapter 14 offers some basic cautions and pointers: things to avoid and things to remember.
- Chapter 15 outlines system management considerations, excluding security: concepts and procedures that can help you make the system do what you bought it to do.
- Chapter 16 explains system management security issues — how to safeguard user privacy, sensitive material, and hardware from unauthorized access.
- Chapter 17 lists important error messages and recovery steps — from errors in all programs. It includes the tab divider Errors and Error Messages.
- Appendix A summarizes peripheral device names and codes.
- Appendix B is a fast-reference alphabetical summary of all EXEC commands.
- Appendix C lists and briefly describes files shipped with AOS/VS.
- Appendix D tells how to bring up AOS/VS, starting from scratch, on Data General DS/7000-series and ECLIPSE MV/2000™ DC computers. (Normally, this procedure isn't needed, since these computers are usually shipped with a special model of AOS/VS already installed on disk. Running this model of AOS/VS is described in *Starting and Running AOS/VS on ECLIPSE MV/2000™ DC and Data General DS/7000-Series Systems*).
- Glossary defines pertinent terms, like *process* and *SCP*. When you see a term you don't know, check the glossary.

For fast reference, insert and use the *tab dividers*.

## What About Peripherals?

Before you can begin, at least one appropriate disk unit, tape or diskette unit, and a system console (DASHER® terminal) must be connected to your computer, and all must have adequate power.

A DG engineer usually installs the hardware, so you need no information on this. In fact, a DG engineer often brings up the first system. But we include this material because you may want to do it.

## Peripheral Operation and Manuals

Peripherals include disk units, tape and/or diskette units, terminals (called consoles in this book), and line printers.

Operating disk units is not difficult; but if you need details, they are in the 014-series booklets supplied with each disk unit. (For older disk drives, see *DGC Disc Drives*, 014-000099.)

Operating a tape unit is sketched in this book, and detailed in the Operator Reference Series book *Magnetic Tape Transports*, 014-000095.

You will be using a terminal (called the system console) to communicate with the computer. If the system console is a DASHER® terminal, see the appropriate DASHER® Operator Reference Series book.

A line printer isn't absolutely *required*, but if you have one, you will want to know how to turn it on, change the paper, and so on. The operation of line printers is covered in *DGC Line Printers*, 014-000089.

For device status errors and other information, you may want the manual for the device you are running.

## Principles, Diagnostics, and SCP Manuals

For each computer there is a Principles of Operation manual. For example, *ECLIPSE MV/20000™ Principles of Operation*, 014-001169.

A group of CPU diagnostic tests called FRUs (Field Replaceable Units) is shipped with most MV/Family computers. These FRUs are specifically designed to test and identify problems with the CPU, IACs, and memory. This book tells how to run them. Some computers (like the MV/20000™ Series computers) rely instead on the complete system of diagnostics, including diagnostics for peripherals, provided by MV/ADES (Advanced Diagnostic Executive System). MV/ADES is described in the *ADES Operator's Manual*, 014-000744 and in *Installing and Running Coresident Diagnostics on the ECLIPSE MV/2000™ DC and DS/7000-Series Workstations*, 015-000257. Finally, many of the MV/Family computers allow remote diagnostic testing. If your computer permits this — and you have a contract with DG that supports it — you should read *Communications Switch-II User Operation and Installation Guide*, 015-000207.

The SCP (System Control Program) features that you need for routine operation are covered in this manual. You can find more on the SCP for your machine in the following manuals: *ECLIPSE MV/20000™ Series System Control Program*, 014-001171; *ECLIPSE MV/10000™ System Control Processor User's Manual*, 014-000740; *ECLIPSE MV/8000® System Control Processor*, 014-000649; *ECLIPSE MV/8000® II*, *ECLIPSE MV/8000® C*, and *ECLIPSE MV/6000® System Control Processor*, 014-000781; or *Data General 4000-Class System Control Programs Operator's Reference*, 014-001060.

If, in spite of running diagnostics, things go wrong and you get powerup or power supply faults, you can read about them in tables in Chapter 17 in this manual or in the following manuals. *Starting the ECLIPSE MV/20000™ Series Computer Systems* (014-001168); *ECLIPSE MV/10000™ System Control Processor*, (014-000740); *ECLIPSE MV/4000™-Class System Control Programs* (014-001060); *Setting Up and Starting Your System: ECLIPSE MV/2000™ DC and DS/7500 Series Systems*, (014-001213); *Setting Up and Starting Your System: DS/7700 Series Systems*, (014-001224); and *Starting and Running AOS/VS on ECLIPSE MV/2000™ DC and Data General DS/7000-Series Systems* (069-000129).

## Other Software Manuals

To create the multiuser environment, you will need to use a text editor. This book gives a brief sketch of DG's SED text editor, enough to start editing. SED is further described in *Learning to Use Your AOS/VS System*, 069-000031, and in the *SED Text Editor User's Manual*, 093-000249. If you like SED, you may want to look at these books later on.

The main program for communicating with an AOS/VS system is its Command Line Interpreter (CLI). The CLI is AOS/VS' command language. This book tells you about all the CLI commands you need; later, you will want to read about the CLI and its commands in the CLI manual, 093-000122 (full name *Command Line Interpreter (CLI) User's Manual (AOS and AOS/VS)*).

If your computer has a pixel-mapped (graphics) terminal, this book explains how to set up the necessary environment. You will also want to read *Using DG/View*, 069-000130.

For details on AOS/VS memory management, you may want to read sections of the manuals *AOS/VS System Concepts*, 093-000335, and *System Call Dictionary (AOS/VS and AOS/DVS)*, 093-000241.

Before you get your system up and running, if your computer is connected in a network with other computers, you should see *Managing and Operating the XODIAC<sup>TM</sup> Network Management System (AOS and AOS/VS)*, 093-000260. And, if you run the CEO<sup>®</sup> Comprehensive Electronic Office software on your system, you should see *Managing the CEO<sup>®</sup> System*, 093-000286.

Appendix D in this manual explains some of the more technical aspects of generating and running AOS/VS on ECLIPSE MV/2000 DC and Data General DS/7000 Series computers. If you have a *user-friendly* model of AOS/VS on these computers, your primary reference manual is *Starting and Running AOS/VS on ECLIPSE MV/2000<sup>TM</sup> DC and Data General DS/7000-Series Systems*, 069-000129.

Two reference cards should help you run the system. These are *Starting Up and Shutting Down AOS/VS*, 069-000107, and *AOS/VS CLI Commands, Macros, and Programs, and EXEC Commands* 069-000108.

If you have bought the Class Assignment and Scheduling Package (CLASP), a separate product, you'll want to read *Using the Class Assignment and Scheduling Package (CLASP)* manual, 093-000422.

After you get your system and multiuser environment up and running, you will want to run other software, like compilers and data management products. These are described in books shipped with the software.

## The Release Notice

The AOS/VS Release Notice has the latest details on all AOS/VS software: enhancements, new features, and improvements. The Release Notice is supplied both as a printed listing and as a disk file that you can print. The filename in directory :UTIL is RELEASE.n.nn, where n.nn is the revision number (for example, :UTIL:RELEASE.7.00).

You may want to read the Release Notice, or selected parts of it. If you want to know the features on an AOS/VS release, or have problems with a release, check the notice for solutions. The Release Notice assumes that you know the operating system well — so parts of it may be difficult to understand until you *do* know the system.

Document changes files, also in :UTIL, are part of each release but you must print these yourself after installing the new software. The document changes filenames have the form Oss\_nnnnnn\_rr, where ss is the series, nnnnnn is the part number, and rr is the revision (for example, 093\_000243\_06 is the document changes file for this manual). We suggest that — as you receive new software revisions from DG — you print the document change file(s) and update the manual(s) as needed.

## The Newsletter

Finally, you will find the *AOS/VS Monthly Newsletter* a useful source of information on the latest enhancements to the AOS/VS operating system.

## Reader, Please Note:

We call terminals consoles in this manual.

We use these conventions for command formats in this manual:

COMMAND required *[optional]* ...

Where	Means
-------	-------

COMMAND	You must enter the command (or its accepted abbreviation) as shown.
---------	---

required	You must enter some argument (such as a filename). Sometimes, we use:
----------	---

$$\left\{ \begin{array}{l} \text{required}_1 \\ \text{required}_2 \end{array} \right\}$$

which means you must enter *one* of the arguments. Don't enter the braces; they only set off the choice.

<i>[optional]</i>	You have the option of entering this argument. Don't enter the brackets; they only set off what's optional.
-------------------	---

...	You may repeat the preceding entry or entries. The explanation will tell you exactly what you may repeat.
-----	---

Additionally, we use certain symbols in special ways:

### Symbol Means

␣ Press the NEW LINE on your console's keyboard. If there is no NEW LINE key, press the carriage return (RETURN) key.

□ Be sure to put a space here. (We use this only when we must; normally, you can see where to put spaces.)

All numbers are decimal, except for device codes and numbers marked octal. For example

...27 buffers...	means 27 decimal.
------------------	-------------------

...device code 27...	means 27 octal.
----------------------	-----------------

...say 27 octal...	means 27 octal.
--------------------	-----------------

We show commands in UPPERCASE; but you can type them in lowercase, uppercase, or any combination. Finally, in examples we use

THIS TYPEFACE TO SHOW YOUR ENTRY )

*This typeface for system queries and responses.*

) is the AOS/VS operating system CLI prompt.

## Contacting Data General

- If you have comments on this manual, please use the prepaid Remarks Form that appears after the Index. We want to know what you like and dislike about this manual.
- If you need additional manuals, please use the enclosed TIPS order form (USA only) or contact your Data General sales representative.

End of Preface



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# Chapter 1

## About Generating and Running AOS/VS

Read this chapter when you want to learn how to generate, and secondarily to run, an AOS/VS system.

*Generating* your first system (Chapters 1-5) is one part of this. *Running* a system (Chapters 6-17) is another part. This chapter sketches both the *generating* and *running* parts. It assumes that AOS/VS is new to you. The major sections are

- What is AOS/VS?
- The MV/Family Computers
- AOS/VS File Structure
- What's Involved in System Generation?
- What's Involved in Running the System?
- Cautions and Control Characters
- If You Make a Mistake

### What is AOS/VS?

AOS/VS is a multitasking, multiprogramming, demand-paged, virtual storage operating system. You can use it to support users on a time-sharing basis, to run batch jobs, or to perform control applications on a real-time basis. You communicate with AOS/VS by typing Command Line Interpreter (CLI) commands on a console.

AOS/VS runs on all DG 32-bit, ECLIPSE® MV/Family computers.

The following figures show the hardware in typical minimum ECLIPSE MV/Family installations. The names MTB0, MTC0, DPJ0, and DPF0 are AOS/VS device names. There can be, and often are, additional tape and disk units.

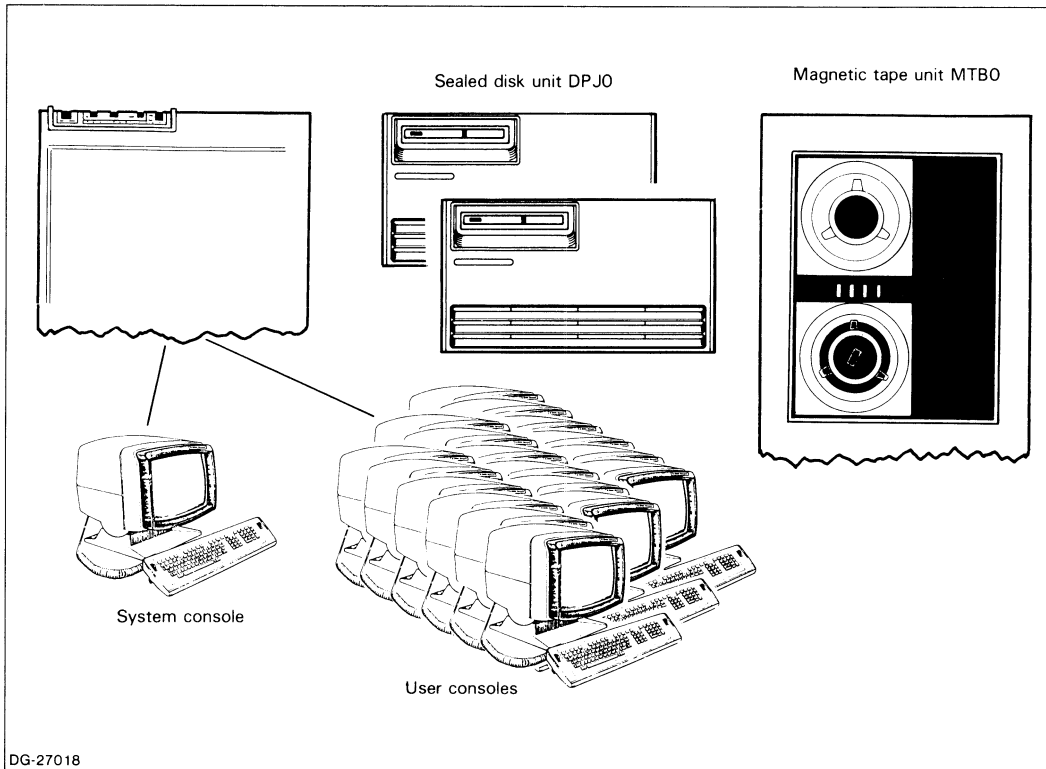


Figure 1-1. Sample AOS/VS ECLIPSE MV/10000™ System Hardware Configuration

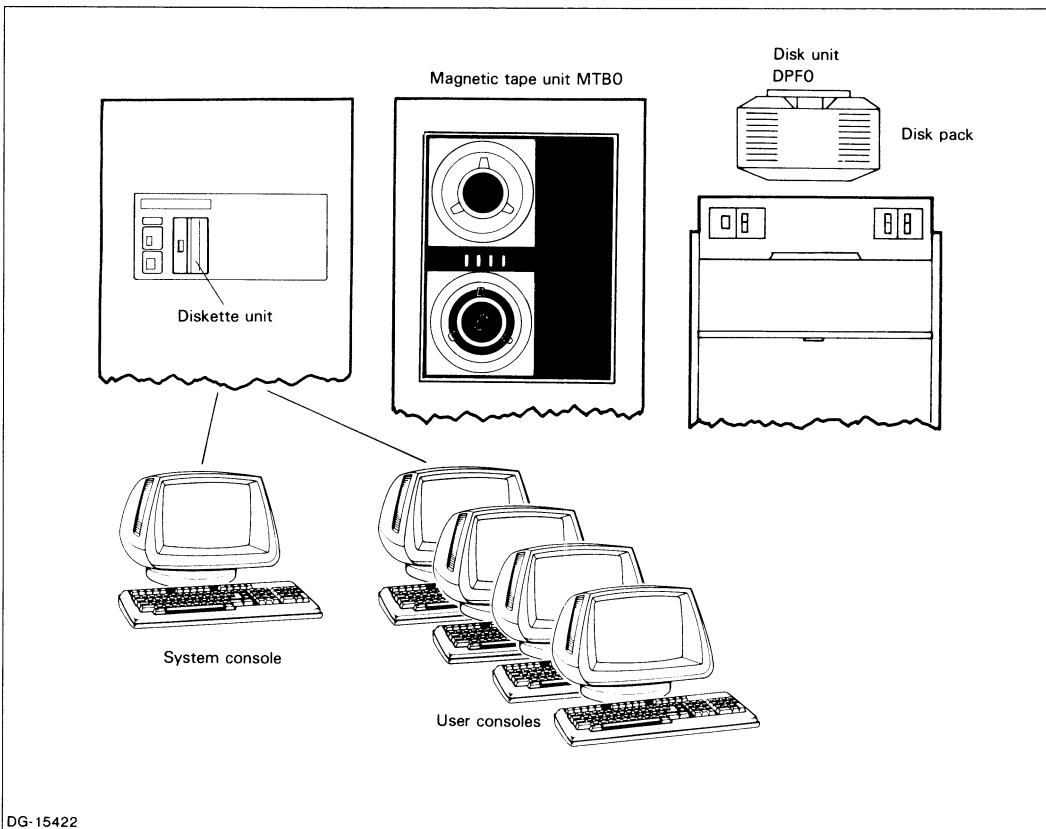
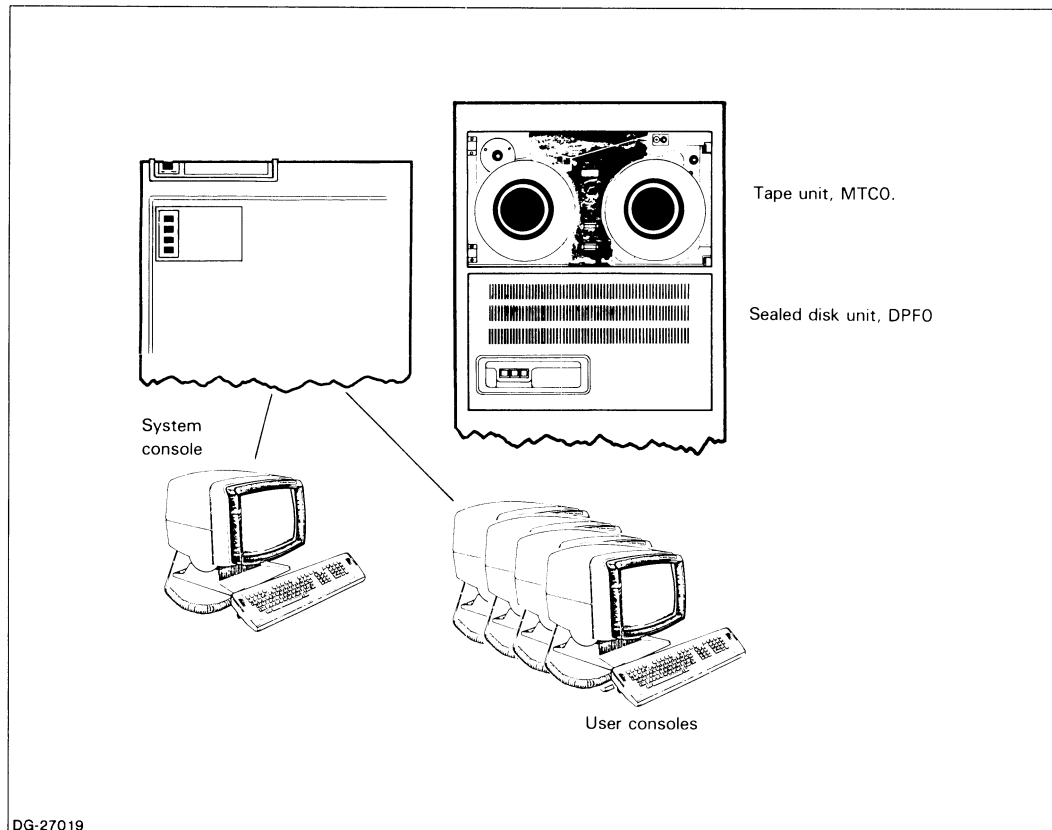


Figure 1-2. Sample AOS/VS ECLIPSE MV/8000® System Hardware Configuration



*Figure 1-3. Sample AOS/VS ECLIPSE MV/8000® II or MV/4000® System Hardware Configuration*

## The MV/Family Computers

DG's MV/Family has a broad range of 32-bit systems, including the ECLIPSE MV/20000™ Model 2, MV/20000™ Model 1, MV/20000™ C, MV/10000™ SX, MV/10000™, MV/8000®, MV/8000® II, MV/8000® C, MV/6000®, MV/4000®, MV/4000® DC, MV/4000® SC, MV/2000™ DC, Data General DS/4000-series, Data General DS/7500-series, and Data General DS/7700-series computers.

In all MV/Family computers, AOS/VS runs in the main processor. Another operating system, called the System Control Program (SCP or SCP-OS) serves to load vital microcode into the main processor(s), and boot (load) AOS/VS into main processor memory. The SCP also coordinates powerup and monitors system error conditions.

Physically, MV/Family computers range from the meter-high, two-bay MV/20000 Model 2 with separate peripherals to the compact, self-contained MV/2000 DC.

Operationally — after your first AOS/VS system is generated — procedures are similar for all MV/Family computers that have magnetic tape. Backup and update procedures differ, depending on whether or not you have magnetic tape. If you don't have a tape unit, you'll use diskettes.

NOTE: Although their names are similar, the ECLIPSE MV/8000 differs significantly from the MV/8000 II and MV/8000-C machines. Operating an MV/8000 II or MV/8000-C is more like operating an MV/10000 or MV/6000. In this book, “MV/8000” means the shoulder-high, blue and white machine; “MV/8000 II” and “MV/8000 C” describe the pertinent meter-high, earth-tone machine.

Similarly, the ECLIPSE MV/4000 differs from ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-series computers. The ECLIPSE MV/4000 is a meter-high computer with one or more peripheral bays. The ECLIPSE MV/4000 DC, MV/4000 SC and Data General DS/4000-series (outwardly identical) are quite compact, with integrated disks and diskettes, designed to fit under a desk if needed. In this book (and generally) the name “MV/4000” represents the first type of machine; the phrase “MV/4000 DC, MV/4000 SC, and Data General DS/4000-series” represents the second type of machine.

## AOS/VS File Structure

AOS/VS manages many parts of its file structure, but you need to understand the options that are under your control. A typical AOS/VS file system looks something like Figure 1-4.

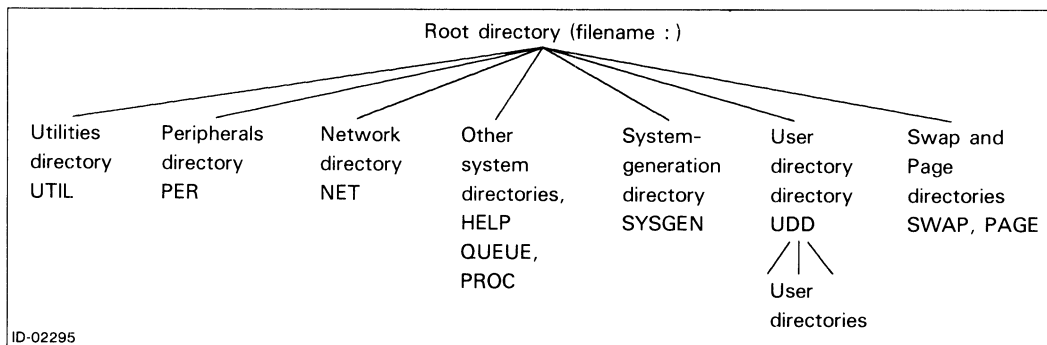


Figure 1-4. AOS/VS System File Structure

The root directory (:) and other system directories are created and managed by AOS/VS or its utility programs. The AOS/VS system program file is usually in directory :SYSGEN. It can be copied (installed) onto an “invisible” part of the disk, dissociated from the directory structure.

Directory :UDD has an entry for each timesharing *user* directory. A user is an authorized person who can execute other programs — often application programs. So UDD often has many subordinate directories and uses a lot of storage space.

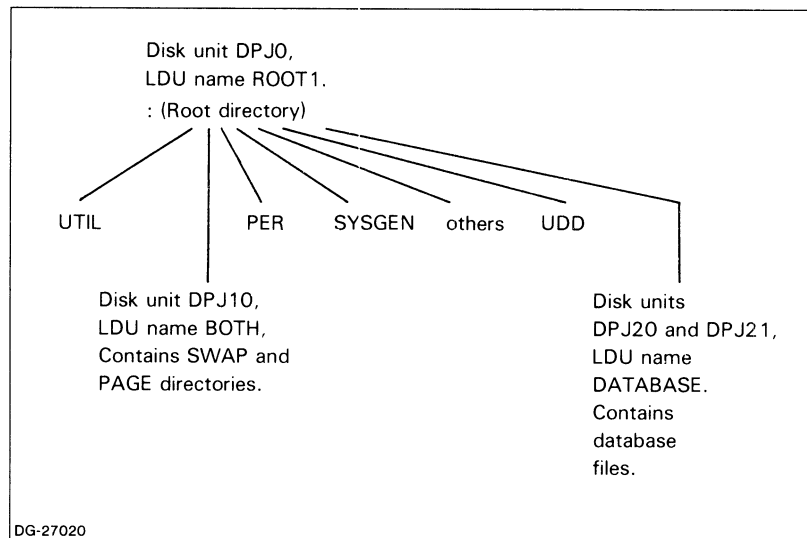
All these directories, and their subordinate directories, can reside on one logical disk unit (LDU). Or one or more directories can reside on *its own* LDU. An LDU is one or more physical disks, created by the Disk Formatter.

Generally, for the most versatile system, you will make each physical disk a single-disk LDU. The system disk is nearly always a single-disk LDU. (If you set up a multiple-disk LDU, all disks must be on line before you can even access the LDU.)

With the Disk Formatter, you can set up a structure in which everything will be on one LDU. Or, you can set up a system LDU with a separate database LDU, UDD LDU, swapping/paging LDU, or any combination — depending on your needs and number of disk units.

You might set up a multiple-disk LDU if you need to handle a very large file — perhaps a database file — that won’t fit on a single disk. The system will then access the multidisk LDU as one directory file, providing enough space for the large database file.

For an example of a single-disk LDU system, imagine the structure in Figure 1-4 on a single disk. For an example of a large multiple-LDU system, see Figure 1-5.



*Figure 1-5. Multiple-LDU System*

For your first system, you will create a single-disk LDU in disk unit 0 on the first disk controller. This will be the system disk. But after you have formatted this LDU, you may need to format other physical disks (if you have other units) — and make decisions about their names. We'll give more detail on the specifics later — but mention them here so that you'll know about your options.

## **What's Involved in System Generation?**

The entire system generation procedure assumes that you are starting with blank disks. It takes you all the way through power up and Disk Formatting; installing the starter system; AOS/VS system generation with the VSGEN program; and creating the multiuser environment, in which AOS/VS can serve many interactive and batch users simultaneously.

Figure 1-6 shows each step that you take in the system generation procedure — beginning to end.

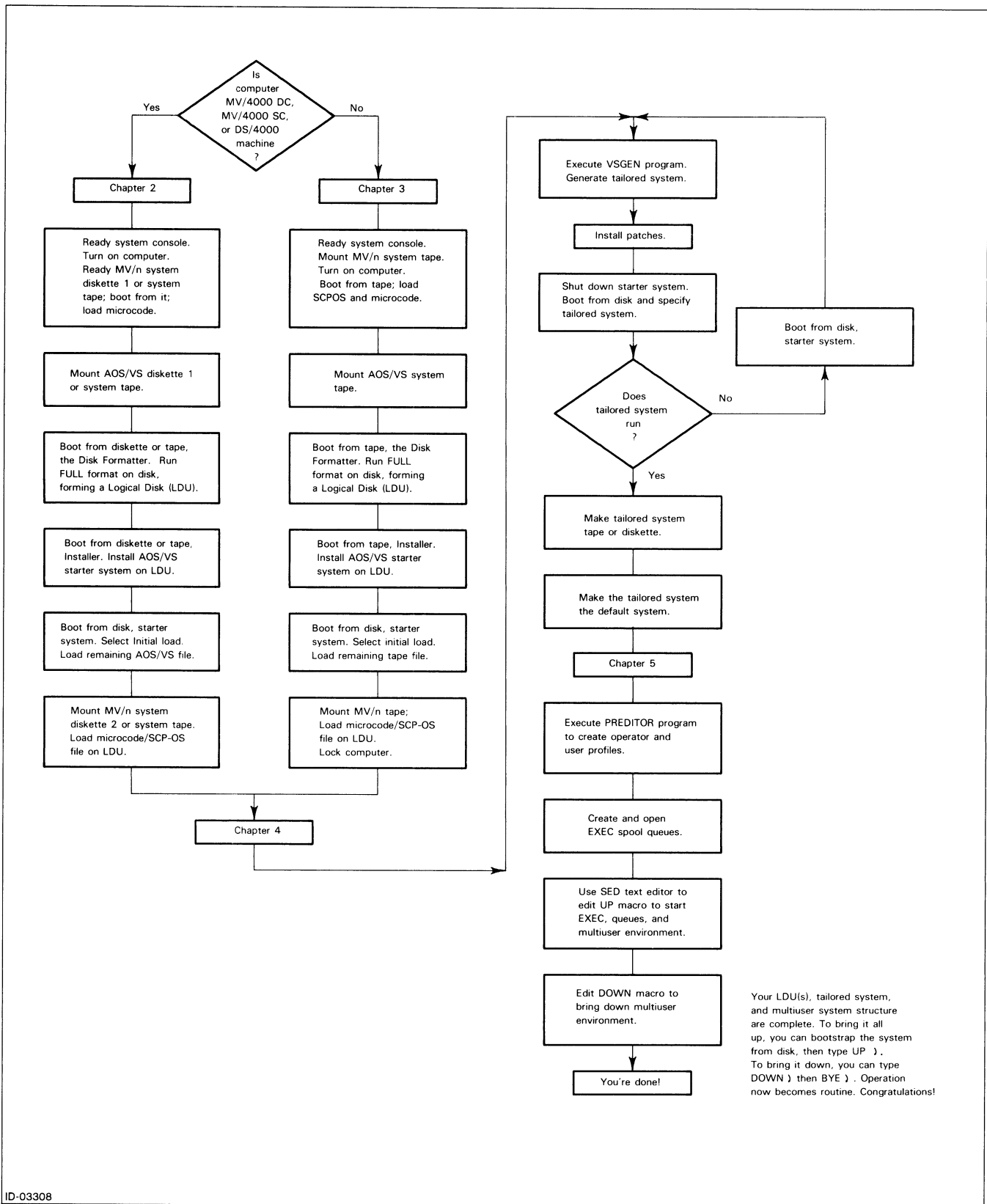


Figure 1-6. How to Bring Up Your First Tailored AOS/VS System



## What's Involved in Running the System?

After your tailored, multiuser system has been created, you'll need to determine how to run it.

Running a system is not as ordered a procedure as generating it. Each organization has its own definition of users, job, roles, development, and production. But generally, running the system includes tasks like

- starting up the system, shutting it down, and coping with abnormal shutdown;
- making sure the system serves users: creating and changing profiles for users; starting up the EXEC program and ensuring that batch and device requests run smoothly; perhaps mounting tapes or card decks for users; operating the line printer(s); perhaps doing preventive maintenance;
- executing the installation's main application programs and bringing up network/communications software (if any) on schedule;
- dumping user and system directories and files for backup;
- generating new AOS/VS systems to handle new devices or to make use of enhancements; and formatting new LDUs;
- deciding how to run the system efficiently: how to run program processes, system security, handle updates, and when to get in touch with DG;
- coping with system problems, perhaps running diagnostics;
- making management decisions: how the system can best serve your organization by making users productive. A lot of this involves other software, like data management systems. But there are a number of AOS/VS options as well.

Table 1-1 shows some of these tasks and programs, and the primary place in this book that has information on them. The topics are alphabetical, but this is *not* the main index; it's simply a general directory.

**Table 1-1. Finding Material to Help Run the System**

Topic	Where It's Described	Topic	Where It's Described
Abnormal shutdown	Chapter 6	Log file, system	Chapters 9 and 16
Backup procedures	Tabbed section in Chapter 10		
Batch	Chapters 8 and 10	Management decisions	Chapters 15 and 16
Bootstrapping (programs)	Tabbed section Startup-Shutdown in Chapter 6	Mounting tapes for users	Chapter 8
CLI commands (operator)	Chapter 9	Multiuser environment, creating	Chapter 5
Diagnostics	Chapters 11 and 17		
Dumping files for backup	Tabbed section Backup in Chapter 10	Operator tools for runtime	Chapters 7, 8, 9, 10
Executing user application programs	Chapter 15	Power failure	Chapter 6
Errors, serious	Tabbed section Errors/Error Messages in Chapter 17, and Chapter 6	Queues	Chapter 8
EXEC program	Tabbed section in Chapter 8	SCP operating system	Chapters 6 and 10
		Security	Chapter 16
First system	Chapter 2 or 3	Shutdown, normal and abnormal	Tabbed section Startup-Shutdown in Chapter 6
Fixing LDUs	Tabbed section Memory Dump-ESD-FIXUP in Chapter 6	Shutdown, persistent, abnormal	Chapter 11
		Software Trouble Report	Chapter 11
Formatting LDUs	Chapter 12	Startup	Tabbed section in Chapter 6
Generating a tailored system	Tabbed section VSGEN in Chapter 4	User profiles (PREDITOR)	Tabbed section PREDITOR in Chapter 7
Installing a system	Chapter 13	User log on	Chapter 8
Labeled diskettes	Chapter 10		
Labeled tapes	Chapters 8 and 10		

## Machine Operation

For the system generation procedure, you'll need to mount magnetic tape (if you have a tape unit). If your primary disk unit uses a removable pack, you'll also need to insert a pack in the unit. If you don't know how to do these things, check the Preface for pertinent manuals.

### Cautions and Control Characters

This section gives some hints and cautions that will help you during the system generation process. Simply read it; don't do anything yet.

#### CPU and Disk Switches

During the system generation procedure, power will be on to the CPU and the CPU POWER lamp will be lit. The primary disk will be ready and write-enabled. While you're working with the system (and whenever a system is running), *don't press these switches*.

If power stops to the CPU, the SCP (System Control Program) and microcode will be lost, and they must be reloaded. If power stops to the disk(s) when an AOS/VS program is running, the program will usually abort. In either case, you will need to start the program that was running again — a time-consuming nuisance that you can avoid by leaving the switches alone after the CPU and disks are ready.

When AOS/VS is shut down and the SCP is idle, you *can* shut off power to the disk(s) if you wish — but you may want to keep CPU power on permanently. Cutting power to the CPU saves energy, but adds a few steps and a few minutes when you bring the system up again.

#### System Console

During the system generation procedure (and afterwards) you'll use the system console (DASHER® display or printing terminal) extensively. Normally, when AOS/VS is not running, the SCP CLI controls the console. Its prompt is

*SCP-CLI>*

To the SCP CLI, you type commands that load and run other programs, including AOS/VS operating systems. These AOS/VS programs take control of the system console when they run. When they stop, they type an appropriate message on the console; the SCP CLI regains control of the console and displays *SCP-CLI>*.

Generally, while AOS/VS is running, you will not need, and should not use, the SCP CLI. If the *SCP-CLI>* prompt appears on the system console while AOS/VS is running, you may have accidentally typed the break sequence (described in Table 1-2). You can return control to AOS/VS as described in Table 1-2. Accidental breaks can be annoying. You can prevent them, if your computer has a LOCK switch, by keeping the computer locked during normal operations.

#### Keyboard Control (CTRL) Characters

There are several keyboard control sequences and keys that govern console display, interrupt program execution, and the like. You may need one or more of these for system generation; and it will help to know about them afterward — or if you accidentally enter one at the system console.

To type a control sequence, first press the CTRL key; while you hold the CTRL key down, press the other character.

Table 1-2 lists the control characters/keys and their functions.

**Table 1-2. Control Characters and Special Keys**

Key(s)	What it Does
CTRL-O	Discards console display for the portion of the command that remains to be executed, or until you type CTRL-O, whichever happens first. CTRL-O turns off display, then turns it on again. It does not halt the program. During system generation, you will not want to use CTRL-O. Later, especially on a hardcopy console, you can use it to speed up programs that do a lot of writing to the console.
CTRL-S	Suspends console display. Display resumes where it stopped when you type CTRL-Q. CTRL-S and CTRL-Q are useful when you want to read long files on a CRT screen, or any time display is too fast to read.
CTRL-Q	Resumes console display. If you suspended display with CTRL-S, then type CTRL-Q. If you stopped display with CTRL-O, CTRL-Q has no effect.
CTRL-U	Erases the current input line. This is handy when you have typed a long, erroneous command line and don't want to press the DEL key many times to erase it. CTRL-U is most useful on hardcopy consoles.
CTRL-C CTRL-A	Interrupts and restarts dialog in stand-alone programs like the Disk Formatter and the Installer. It also interrupts execution of an AOS/VS CLI command. You'll use all these programs, and will find this sequence useful.
CTRL-C CTRL-B	In AOS/VS, aborts the current program process (like the CLI or a text editor). You will probably use this occasionally.
CTRL-D CTRL-D	In AOS/VS, signals an end of file — which usually aborts the process you are running. Generally, avoid this sequence.
CTRL-C CTRL-E	In AOS/VS, creates a memory-image break file (useful for program debugging), and aborts the current process. Generally, avoid this sequence.
DEL key	Erases the last character typed. In AOS/VS stand-alone programs, DEL echoes as _ for each character erased. In the SCP CLI, DEL echoes as /x (a slash, then character) for each character erased.
BRK key; CMD and BREAK key; BREAK key	This is the break sequence (BRK key on hardcopy consoles, CMD and BREAK on DASHER D200 Display CRTs, or BREAK on DASHER D2 CRTs). You can disable this by locking the computer (LOCK switch if any), or using the SCP FLAGS command. Unless it is disabled, a break sequence on the system console gives control to the SCP CLI. To return control to AOS/VS, type TTY ). Or, on an ECLIPSE MV/4000, MV/4000 DC, MV/4000 SC, MV/2000 DC, or Data General DS/4000-series or DS/7000-series computer; type CONTINUE ).

## **If You Make a Mistake**

The programs in the AOS/VS package have good error messages and error recovery. But if you make what appears to be a fatal mistake, you can usually restart the program from the beginning without problems. At worst, you'll need to run a quick disk fixing program.

If, at the system console, everything seems to have stopped, type CTRL-Q. If CTRL-Q has no effect, type CTRL-O. If CTRL-O has no effect, type CTRL-O to undo the first CTRL-O. Finally, if the *SCP-CLI>* prompt has appeared, unexpectedly, type TTY 1 — or, on an ECLIPSE MV/4000, MV/4000 DC, MV/4000 SC, MV/2000 DC, or Data General DS/4000-series or DS/7000-series computer, type CONTINUE 1.

Chapter 17 describes important error messages and error recovery.

## **What Next?**

If your computer is an ECLIPSE MV/4000 SC, MV/4000 DC, or Data General DS/4000 (but not an ECLIPSE MV/4000), go to Chapter 2. For any other computer, skip to Chapter 3 or Appendix D.

End of Chapter



# **Chapter 2**

## **Bringing Up AOS/VS on Blank Disks — ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-series Computers**

Read this chapter

- when your computer hardware has just been installed and you want to bring up AOS/VS on it;
- whenever you want to format a new disk, install an AOS/VS system on it, load system files onto it, and bring up the installed system.

This chapter explains the steps needed before you run the VSGEN program to generate your first tailored system. It applies to ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-series systems only. For other MV/Family computers, including MV/4000s, see Chapter 3.

The major sections in this chapter are

- About Your Media
- Powering Up and Loading Microcode
- Running the Disk Formatter
- Installing the AOS/VS Starter System
- Bringing Up the AOS/VS Starter System

### **About Your Media**

All ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000 computer systems include at least one 737,000-byte diskette unit. An optional extra is a cartridge tape unit, model 6311.

If your system doesn't include a tape, all the system components you need to build AOS/VS were supplied on diskettes, in the following groups:

- I/O CB emulator, on one diskette;
- System media and microcode file, on two diskettes;
- AOS/VS system programs, the latest revision, on 14 or so diskettes;
- an AOS/VS update (updates for programs in the latest revision), on one or more diskettes. You get the update diskette(s) only if an update has occurred since the last AOS/VS revision.

If you have a tape unit, you may receive AOS/VS software programs and updates on two cartridge tapes; and you may receive system media and microcode on another cartridge tape. This depends on your contract with DG. It's important to identify your media and understand the order in which you'll use it. The order is as follows.

1. The I/O CB emulator, on one diskette. The diskette label, second line, includes the words "I/O CB EMULATOR."
2. System media and microcode, on two diskettes or a cartridge tape. If you received system media on diskettes, one of the diskette labels includes, on its second line, the words "... SYSTEM MEDIA;" this is the first diskette. On the other diskette, the second text line includes the words "MV4000xxx.MCF" and the last line includes "AOS FMT." You'll use the first diskette early and the second one much later.

If you received system media on tape, the tape label has the words "xxxxx SYSTEM MEDIA" on its second line.

3. AOS/VS programs (14 or so diskettes or one cartridge tape). The paper labels on AOS/VS diskettes/tapes have "AOS/VS n" printed on them.
4. AOS/VS update, if any (one or more diskettes or one cartridge tape). The paper labels on AOS/VS update diskettes/tapes have "UD" and "AOS/VS n" printed on them.
5. System media and microcode diskette set, again. This time, you'll use the second diskette, which has "AOS FMT" on its label. Or, with tape, you'll use the original "xxxxx SYSTEM MEDIA" cartridge tape again.

Software media products other than AOS/VS, like CEO® or FORTRAN 77, must wait until you have AOS/VS up and running.

After checking your media and reviewing the order given above, proceed.

## Powering Up and Loading Microcode

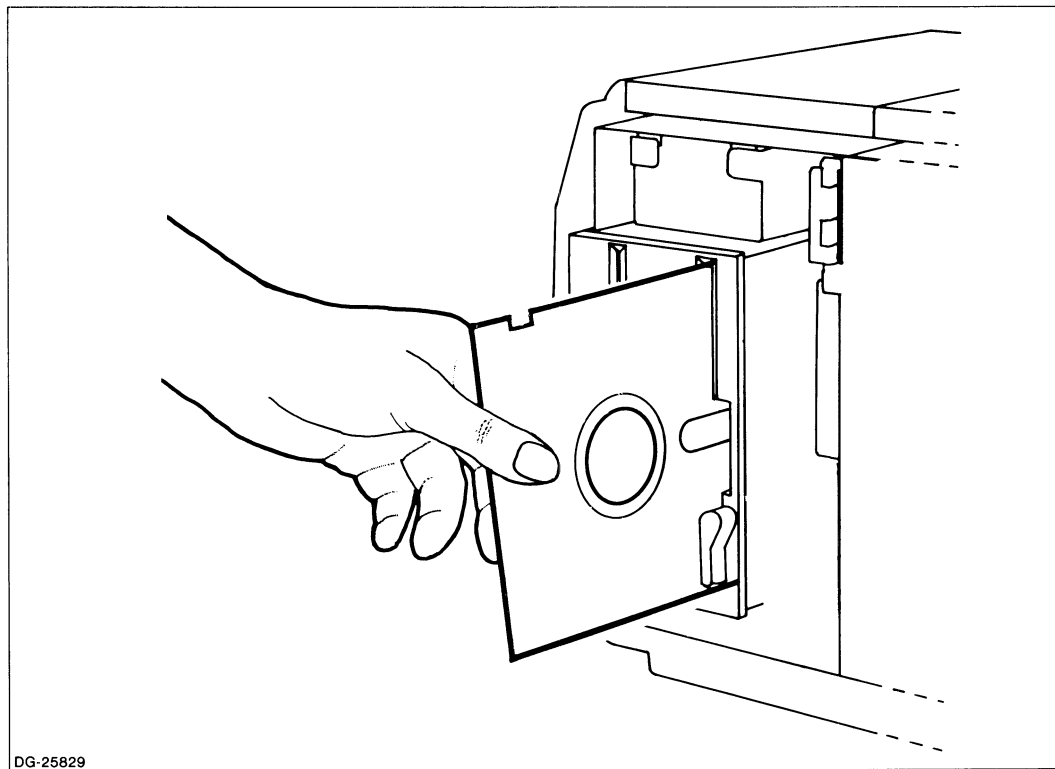
The following numbered steps lead you through the entire "from blank disks" procedure. The steps cover both tape and diskettes, and you'll be skipping the ones that don't apply.

The steps assume that CPU power is off.

1. Turn on the system console. The switch is an on/off rocker behind the console or a push switch on the front. The console may display a test message and beep. If there is an ON LINE light on the keyboard, it should glow. (If the light doesn't glow, press the CMD key, hold CMD down, and press the ON LINE key. The ON LINE light should glow.)
- 1a. If your keyboard has an ALPHA LOCK key (next to the space bar), press it to make the ALPHA LOCK light glow. You need to set ALPHA LOCK because one of the programs you'll use doesn't accept lowercase letters.
2. If you have a cartridge tape unit, turn it on now — by moving its switch to ON-1. (To use the tape unit, you must turn it on before turning computer power on.)
3. Find the diskette labeled "I/O CB EMULATOR." Insert it in unit 0 as follows. If you have two diskette units, the right one is unit 0.
- 3b. Turn the latch beside the slot to the vertical position.
- 3c. Remove the diskette from its outer envelope. Don't try to remove the inner envelope — the diskette must remain in this.



- 3d. Hold the diskette by the edges and examine it. One side has a paper label and the other is blank. On each side, the envelope is cut away to expose part of the diskette surface. Just a reminder — *don't touch the diskette surface*. The oil on your finger could make that part of the diskette unreadable. One edge of the diskette has a small notch (about  $1/4 \times 1/4$  inch). This is the *write-enable* notch. When this notch is uncovered, data can be written to the diskette.
- 3e. Hold the diskette with the write-enable notch up and your fingers on the label. Slide it into the unit slot as shown in Figure 2-1. The diskette should slide in smoothly and come to a firm stop.
- 3f. Turn the latch beside the slot to the horizontal position. This locks the diskette in the unit.



*Figure 2-1. Inserting a Diskette*

4. Turn computer power on via the power switch on the cabinet. The power light above the switch should glow. The computer runs power-up tests. Then, the system console prompts

*MV4000 READY*  
*IOC EMULATOR INSTALLER*

(Wait — 50 to 60 seconds.)

*STATUS OF IOC EMULATOR ON HARD DISK*

1. *INSTALL AND RUN IOC EMULATOR ON HARD DISK*
2. *VERIFY IOC EMULATOR ON HARD DISK*
3. *RUN ONLY*
4. *INSTALL ONLY*
5. *EXIT*

*CHOOSE ONE: [1]*

(If nothing happens after 30 seconds, perhaps you misinserted the diskette. Remove the diskette, turn computer power off, and return to step 3.)

(If you see an incomplete *READY* message after 30 seconds, turn computer power off and on again. If the full message still does not appear, consult Chapter 17 for the pertinent "Power Up Error Codes" table.)

5. You must now install the I/O CB emulator on the hard disk. To install and run the emulator, choose the default (1) by pressing

↓

A few moments pass. Then

*EMULATOR INSTALLED*  
*@*

- 5a. Remove the diskette from unit 0.
6. If you received system media on a cartridge tape, skip to step 9. If you received system media on diskette, continue.
7. Get the system media diskette with the label that has "... SYSTEM MEDIA" written on it.
8. Insert the diskette in unit 0 (right unit, if you have two) as shown in Figure 2-1.
- 8a. Next to the *@* prompt, type **64L** — for example,

*@ 64L*

A loader program reads the diagnostic operating system from the diskette. After 5 seconds or so, you'll hear a click as the diskette drive engages. Reading the system from diskette takes 10 to 20 seconds. The system displays

*TESTOK*

*COPYRIGHT DATA GENERAL ...*  
*ALL RIGHTS ...*

\*

(If this message doesn't appear after a minute or so, perhaps you misinserted the diskette. Type the break sequence (CMD and BREAK/ESC). Remove the diskette from the unit and return to step 7.)

With the prompt \* showing, skip to step 10.

9. Get the cartridge tape with SYSTEM MEDIA on it.
- 9a. Insert the cartridge tape in your tape unit, label facing right.
- 9b. Wait for the tape unit READY light to glow. Then, next to the @ prompt, type 22L — for example,

@ 22L

A loader program reads the diagnostic operating system from the tape. This may take a few moments. Then the system console displays

*TESTOK*

*COPYRIGHT DATA GENERAL ...*

*ALL RIGHTS ...*

\*

(If this message doesn't appear after a minute or so, type the break sequence (CMD and BREAK/ESC keys); then retry this step.)

10. Tell the diagnostic system to load the correct CPU microcode file.
  - With no options (firmware — not hardware — floating point, no graphics instruction set), the filename is MV4000
  - With optional hardware floating point, but without the graphics instruction set, the filename is MV4000FP
  - With optional graphics instruction set (without hardware floating point), the filename is MV4000G
  - With *both* hardware floating point and graphics instruction set, the filename is MV4000GFP

Next to the \* prompt, type the LOAD command, followed by the correct microcode filename for your machine. For example,

\* LOAD MV4000FP ) (For a computer with hardware floating point.)

After a few moments, you'll see messages like

*MV4000.. MICROCODE REV n LOADING*

...

*MV4000.. MICROCODE REV n LOADED AND VERIFIED*

\*

11. To exit from the diagnostic system, type

EXIT )

*CPU HALTED*

*SCP-CLI>*

Microcode is loaded into the CPU; and the SCP CLI, which allows you to start other programs, has control (as you can tell by the prompt).

12. Remove the diskette or tape from unit 0. For diskette, return the diskette to its outer envelope.
13. Insert the correct AOS/VS diskette or tape. If you received AOS/VS on diskette, insert AOS/VS diskette number 1 in unit 0 (as shown in Figure 2-1). If you received AOS/VS on cartridge tape, insert the AOS/VS cartridge tape in the unit, label to the right.

You've finished the power-up process and can run the Disk Formatter.

## Running the Disk Formatter

The Disk Formatter makes physical disks into logical disk units (LDUs). It does this by writing identifiers so that AOS/VS will know what disk and LDU it is accessing. The Formatter can also check the disk surface for *bad blocks* (flawed areas that won't hold information).

Running the Disk Formatter is relatively easy, but — because the Formatter checks each bit on the disk — it takes more time than other system-generation procedures.

### Mistakes and Errors

If you type an incorrect answer to a Disk Formatter question, and have not yet pressed **]** to enter the answer, press the DEL key or CTRL-U to erase the wrong characters.

If you have pressed **]** and want to abort formatting, type CTRL-C CTRL-A and go to step 22. If CTRL-C CTRL-A doesn't work, type the break sequence (CMD and BREAK/ESC keys) and return to step 14.

If you abort formatting by either method during surface analysis, be sure to run the entire FULL format again.

If the Disk Formatter reports a disk or other error, check the error message in the table near the end of the Disk Formatter chapter.

### Disk Formatter Dialog

14. The SCP-CLI prompt is still on the system console. Reset the computer by typing

RESET ]

After a few moments, the *SCP CLI* prompt returns.

15. With AOS/VS on tape, skip to step 20. With AOS/VS on diskette, continue.
16. Bootstrap (start) from your DG media. With diskette, type

BOOT 64 ]

#### *Operating System Load Menu*

- 1 Continue immediately with operating system load
- 2 Enter the Technical Maintenance Menu

...  
The default system pathname is

...  
Enter choice [1]:

17. There is no operating system on the disk; you must enter the Technical Maintenance Menu. Type 2 ↵.

*Technical Maintenance Menu*

...

*6 Run a specified program*

...

*Enter choice [1]:*

18. Choose option 6:

6 ↵

SYSBOOT prompts

*Pathname?*

19. Type the Disk Formatter's filename, DFMTR ↵ — for example,

DFMTR ↵

and skip to step 22.

20. With tape, wait for the tape unit READY light to glow. Then bootstrap by typing

BOOT 22 ↵

*Tape file number?*

21. Type the file number for the Disk Formatter, which is 2 ↵ — for example,

2 ↵

22. The bootstrap program now loads the Disk Formatter from the supply medium. This takes 15 to 20 seconds. The Formatter starts up and announces

*AOS/VS Disk Formatter Rev n*

*Full format destroys any AOS/VS file structure, Partial retains it.*

*Full (F) or Partial (P or NEW LINE)?*

Type

F ↵

*Full format*

*Specify each disk in the LDU (press NEW LINE when done)*

*Disk unit name?*

23. This *Disk unit name* question starts a sequence of questions to identify this LDU.

A sealed Winchester disk unit named DPJ0 and a 737,000-byte diskette unit named DPJ10 are built into your computer system. The add-on units shown in Table 2-1 are options. If you have any add-on Winchester disks, format them after you've done the first disk. For your first disk, type

DPJ0 ↵

**Table 2-1. Add-On Disks MV/4000 DC, MV/4000 SC, and Data General DS/4000-series Systems**

Disk Model Number and Description	Device Code	Disk Number on Controller	Disk Unit Name
6329. A 120-Mbyte, sealed Winchester disk.	24	Second	DPJ1
6328. A 71-Mbyte, sealed Winchester disk.	24	Second	DPJ1
6310. A 39-Mbyte, sealed Winchester disk.	24	Second	DPJ1
6309. A 737,000-byte, 5.25-inch minidiskette.	64	Second	DPJ11

After you answer the *Disk unit name* question, the Disk Formatter asks

*Device code [default] ?*

- 23a. The default device code appears in square brackets. Press **↓** to choose the default:

**↓**

*Disk unit name?*

- 23b. The Disk Formatter will repeat the *Disk unit name?* and *Device code?* questions until you answer **↓** to *Disk unit name?* This allows you to create an LDU that includes more than one disk.

You want a single-disk LDU, so answer

**↓**

*Do you want to allocate a diagnostic area? [Y]*

- 23c. This question lets you reserve an area on disk for later installation of DG's Advanced Diagnostic Executive System (ADES). ADES can run from a medium other than disk, but it runs much faster from disk; also, diagnostics are easier to run remotely if ADES is on disk. To use ADES, you must purchase it and have it installed on the disk by a DG field engineer. ADES for MV/Family machines requires a minimum of 8,000 disk blocks — 4.1 Mbytes. This space is lost for AOS/VS file storage.

If you don't want to install ADES and run it from disk, answer No by typing **N ↓**. ADES runs only from the system disk — which means you should always say No if the disk isn't the system disk (DPJ0). If you say No, skip to step 23e.

If you want to reserve an area for ADES, press **↓**. Then, the Disk Formatter asks

*Enter the number of blocks (1750 to 35230) required. [23420]*

- 23d. The displayed figures are octal. ADES needs at least 8,000 blocks (17500 octal). The default, 23420, is 10,000 blocks. Decide on the number of disk blocks needed for the diagnostics you want installed; then type this number (octal!). The Formatter will now assume that this disk is a system disk.

*Disk number 1:00000000000 through n*

*LDU unique I.D. (1 to 6 characters)? [ ]*

The numbers 0 through n are the first and last logical addresses on the disk, in octal.

- 23e. The Disk Formatter wants a unique ID for the disk. The ID must be 1 to 6 characters long. We suggest an ID of 1 for your first LDU and 2 for your second (if you have a second hard disk). For the first disk, for example, type

1 ↵

*LDU name (1 to 31 characters) [ ]?*

- 23f. Later, when you start up AOS/VS (or initialize this LDU), the name you type now will be displayed.

The first disk you format (DPJ0) will be the system root directory (:). For this, the name you type is not important in terms of file access.

If you have a second hard disk, and are formatting it, the name you type here becomes the filename of the LDU. People can use this name just as any other directory filename. For example, you might use the name UDD. You can always change an LDU name later with a Disk Formatter Partial format (covered in the Disk Formatter chapter).

For your first LDU, DPJ0, we suggest the name ROOT. So, for example, type

ROOT ↵

If you're formatting the second hard disk, note the name for later reference.

*Access Control List*

*Username or template (1 to 15 characters)?*

- 23g. A user, identified by a user name, or a group or users, identified by a template, can have different kinds of access to an LDU. A good general-purpose username template is +, which specifies all users. So type

+ ↵

*Access (O, W, A, R, E, or NEW LINE) ?*

- 23h. The Disk Formatter wants to know which access privileges to give the user name(s) you just specified. There are five types of privileges: Owner, Write, Append, Read, Execute (O,W,A,R,E). A NEW LINE (answer of ↵) gives the user no access. Execute (E) access will suffice for most LDUs. So type

E ↵

*Username or template (1 to 15 characters)?*

- 23i. The Disk Formatter will repeat the *Username* and *Access* questions, allowing you to give very specific user and access information, until you answer ↵ to *Username ...* Generally, answer ↵ to this question. Later, if needed, you can change access to the LDU. So press

↵

*Surface analysis? [N]*

24. This step starts a series on surface analysis for this LDU. (The value in brackets is the default, which the Formatter will use if you answer with ↵.)

During analysis, the Formatter writes a pattern to each 16-bit word on the disk and reads it back. Answer Yes by typing

Y ↵

*Disk number?*

24a. The Formatter wants the number of the disk to analyze. For a single-disk LDU, press

↓

*You may run up to five (5) patterns. How many would you like to run?*

24b. The Formatter can run up to five bit patterns on the disk. You can specify any number, 1 through 5. It's very important for the Formatter to identify all bad blocks so that AOS/VS will bypass them. We recommend that you run all five patterns on each disk you format.

Each pattern takes from about 8 minutes (on a 39-Mbyte disk) to about 24 minutes (on a 120-Mbyte disk). Decide on a number of patterns and type this number. For example, to run five patterns, type

5 ↓

*Analyzing disk #n*

*-- Running pattern n*

The Formatter runs the patterns you specified, one by one. If it finds too many bad blocks, it aborts. This may mean that the disk heads are misaligned. But in most cases, it's simply a matter of waiting.

When the Formatter has finished the patterns, it describes the bad blocks on the disk.

24c. If the Formatter found no bad blocks, it announces *0 bad disk blocks*. Skip to step 24d, *Additional bad block number?* question.

If it found any bad blocks, it prompts

*n bad disk blocks*

*Display bad block statistics? [N]*

24d. The Formatter is asking if you want to see the bad block statistics. These statistics may be useful, so answer yes.

Y ↓

The Formatter now displays the bad block statistics on the system console.

*Additional bad block number (press NEW LINE when done):*

24e. You have no additional bad blocks to enter, so press

↓

*n bad disk blocks*

*Display bad block statistics [N]*

24f. Press ↓

*n bad disk blocks*

*Bitmap size: n*

*Bitmap address? [default]*

The bitmap is a system table that describes which blocks are in use and which are free for data storage.



25. Select the default address by pressing  
 )  
*System disk? [Y]*
26. This step starts a series that determines whether and where an AOS/VS system will reside on the LDU. (The Formatter skips this step if you allocated a diagnostic area earlier, in step 23c.)  
 Your first LDU must be a system disk, so answer ) for the default. For your *second* LDU, type N ). But for the first LDU, press  
 )  
*Overlay area size? [default]*
- 26a. Choose the default area size by pressing  
 )  
*Overlay area address? [default]*
- 26b. Choose the default address by pressing  
 )  
*Disk number n remap area size? [default]*
27. Choose the default remap area size by pressing  
 )  
*Disk number n remap area address? [default]*
- 27a. Choose the default remap area address by pressing  
 )  
 -- LDU created  
 Done!  
 ...  
 SCP-CLI>

Congratulations! You've formatted an LDU as a system disk. It will rarely — if ever — need full formatting again. If this LDU may be run as a nonmaster LDU, we suggest that you note the date, LDU ID and unit name, and any bad block information — and attach the note to the computer cabinet.

The Formatter is done and the SCP-CLI has control. If you have other new disks, someone must format them into LDUs before they can be used. You might want to create the LDU(s) now — while you're familiar with the procedure. To do it now, type **CONTINUE** ) and return to step 22. To format a disk *not* described in this chapter, see the Disk Formatter chapter.

If you don't want to format other disks now, install the AOS/VS starter system.

## Installing the AOS/VS Starter System

The Installer program installs an AOS/VS system from DG-supplied media onto an LDU. (AOS/VS must reside on disk before it can run.)

## Mistakes and Errors

If you make a mistake, handle it the same way as with the Disk Formatter.

If the Installer reports a disk or other error, check the error message in the table near the end of the Installer chapter.

If the Installer stops with an *ABORT* message, return to the first Installer step (for diskette, step 28; for tape, step 44) and run the Installer again.

Depending on your AOS/VS media, proceed to the appropriate section.

## Installing the Starter System from Diskettes

28. The SCP-CLI prompt is showing on the console. Reset the CPU:

```
RESET ↵
```

(A few moments pass.)

```
SCP-CLI>
```

29. Bootstrap from diskette:

```
BOOT 64 ↵
```

(There's a delay of 5 to 10 seconds.)

*Operating System Load Menu*

*1 Continue immediately with operating system load*

*2 Enter the Technical Maintenance Menu*

...

*The default system pathname is*

...

*Enter choice [1]:*

30. Again, you need the Technical Maintenance Menu, so choose option 2:

```
2 ↵
```

This displays the Technical Maintenance Menu:

*Technical Maintenance Menu*

...

*6 Run a specified program*

...

*Enter choice [1]:*

31. Choose option 6:

```
6 ↵
```

SYSBOOT prompts

*Pathname?*

32. Type the filename of the Installer program (INSTL):

INSTL ↵

The bootstrap program now loads the Installer into memory. This takes about 15 seconds.  
The Installer prompts

*AOS/VS Installer Rev n*

*Specify each disk in the LDU*

*Disk unit name?*

33. Now, from unit 0, remove AOS/VS diskette 1, and insert AOS/VS diskette 2.

34. Type the name of your system disk, DPJ0:

DPJ0 ↵

*Device code [24]?*

35. Default the device code by pressing

↵

*-- Disk bootstrap installed*

*Do you want to install a System Bootstrap [Y]?*

36. You must install the system bootstrap, SYSBOOT, on the LDU, so press

↵

*Install from which unit [MTC0] ?*

37. To install from diskette, type the diskette unit name:

DPJ10 ↵

*Device code [64] ?*

38. Press ↵ for the default:

↵

The Installer now copies SYSBOOT from the diskette to the LDU. This takes about 30 seconds. Then it displays

*-- System Bootstrap installed*

*Do you want to install a System [Y] ?*

39. Now, remove AOS/VS diskette 2 from the unit, and insert diskette 3. This diskette has the starter system on it.

40. You want to install a system, so press

↵

*Install from which unit [DPJ10] ?*

41. Press ↵

*Device code [64] ?*

42. For the default, press

↓

The Installer now reads the AOS/VS system from diskette 3 and copies it to the LDU. This takes 2 to 3 minutes. Then it responds

*-- System installed  
Done!*

43. Remove the diskette from unit 0.

You've installed the needed bootstraps and an AOS/VS system on your LDU. Now you can bring up the system. Skip to "Bringing Up the AOS/VS Starter System," step 57.

## Installing the Starter System from Tape

44. The SCP CLI prompt is showing on the console. Reset the CPU:

RESET ↓

Wait a few moments for the SCP-CLI prompt to return.

45. To boot from tape (device code 22), type

BOOT 22 ↓

*Tape file number?*

46. The Installer is in tape file 3, so type

3 ↓

TBOOT moves the tape forward to file 3, reads the Installer file, and executes the Installer program. The Installer displays

*AOS/VS Installer Rev n*

*Specify each disk in the LDU  
Disk unit name?*

47. Type the unit name of your newly created LDU, DPJ0:

DPJ0 ↓

*Device code [24] ?*

48. Press

↓

*-- Disk bootstrap installed  
Do you want to install a System Bootstrap [Y] ?*

49. You must install the system bootstrap program, SYSBOOT, on the LDU, so press

↓

*Install from which unit [MTC0] ?*

50. Press

↓

*Device code [22] ?*

51. Take the default by pressing

↓

*File number [4] ?*

52. The system bootstrap, SYSBOOT, is in tape file 4. So press

↓

There's a delay while the tape moves forward to file 4. Then the Installer copies SYSBOOT to the LDU and displays

-- *System Bootstrap installed*  
*Do you want to install a System [Y] ?*

53. You want to install a system, so press

↓

*Install from which unit [MTC0] ?*

54. Press

↓

*Device code [22] ?*

55. Press

↓

*File number [5] ?*

56. The AOS/VS system is always in file 5 of a system tape, so press

↓

There's a delay while the Installer copies the AOS/VS system from tape to the LDU. Then it displays

-- *System installed*

*Done!*

...

*SCP-CLI>*

You've installed the needed bootstraps and an AOS/VS system on your LDU. Now you can bring up the AOS/VS system.

## Bringing Up the AOS/VS Starter System

57. The SCP CLI has control. Use it to reset the computer:

**RESET ↓**

Wait a few moments for the *SCP-CLI>* prompt to return.

58. Boot again, this time from *disk*. The disk device code is 24. So type

**BOOT 24 ↓**

*Operating System Load Menu*

*1 Continue immediately with operating system load*  
*2 Enter the Technical Maintenance Menu*

*Loading will continue automatically unless you respond within 45 seconds.*

...

*Enter choice [1]:*

59. Press ↵

(delay of 10 to 15 seconds)

*AOS/VS Rev xx.xx*

*Master LDU: xx* (xx is the name you specified to the Formatter)

*Date (MM/DD/YY)?*

60. Type the date as numbers for month, day, and year. Spaces or slashes can separate each number. For example, for May 23, 1986, you'd type

5 23 86 ↵

*Time (HH:MM:SS)?*

61. Type the time, based on a 24-hour clock, in hours, minutes, and seconds. (Minutes and seconds are optional. If you omit them, the system sets each to 0.) Use spaces or colons to separate items. For example, for 2:30 p.m., you'd type

14 30 ↵

*Override default specs [N] ?*

62. Specs are the parameters in the system specification file created during VSGEN. For your first system, you must answer yes, so type

Y ↵

*Number of buffers in cache [default]?*

63. Press

↵

*Swap directory definition [default]?*

64. Press

↵

*Page directory definition [default]?*

65. Press

↵

*Initial load [N]?*

66. In an *Initial load*, the system loads the CLI and other needed files onto the LDU. These files must be loaded the first time you bring up the starter system. They need not be loaded again unless — later on — you want to load a new AOS/VS revision. Answer yes by typing

Y ↵

*Filename [@MTC0:6]?*

67. If you are installing AOS/VS from cartridge tape, go to step 68. For AOS/VS supplied on diskettes, continue.

- 67a. Get the fourth AOS/VS diskette and insert it in diskette unit 0. This diskette has the CLI and essential system files on it.

- 67b. Type the labeled diskette pathname of the file on diskette. This is @LFD:VOL1:FIRST\_DUMP\_FILE, so type

@LFD:VOL1:FIRST\_DUMP\_FILE )

*PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED  
UNIT [@DPJ10] VOLUME ID [VOL1] ? [Y]*

- 67c. Confirm by pressing

)

The starter system now copies files from the diskette to the LDU. It takes about 2 minutes per diskette.

(If you see the message *PHYSICAL UNIT OFFLINE*, this probably means you misinserted the diskette. Remove it from the unit, reinsert it as described earlier (Figure 2-1), and press ). If the message is *THE LABEL ON THIS DISKETTE IS NOT THE LABEL REQUESTED*, or *AN UNLABELED DISKETTE HAS BEEN INSERTED*, this means you've inserted the wrong diskette. Find the fourth diskette in the AOS/VS set (not the system media set or the UD set). Insert it in unit 0, then retry. If the message is *FILE DOES NOT EXIST*, you probably typed the wrong pathname, or inserted a diskette from the wrong group. Remove the diskette, check its paper label and select another diskette if needed; then retry.)

When all files have been copied from diskette, it prompts

*PLEASE INSERT NEXT DISKETTE  
UNIT [@DPJ10] VOLUME ID [VOLn] ? [Y]*

- 67d. Get the next diskette in the AOS/VS set. Remove the diskette from unit 0 and insert the next diskette. Press ).

Again, the starter system copies files from the diskette to disk.

Repeat this step (67d) until the system console displays

*PLEASE REMOVE THE DISKETTE  
AOS/VS CLI REV x.xx date time  
)*

Congratulations! You've brought up AOS/VS and its CLI from diskette. The ) prompt means the CLI it is ready for a command.

(If you get a *FILE DOES NOT EXIST* message, a needed file wasn't loaded. Perhaps you forgot to answer Y ) to the *Initial load* question. In any case, run Emergency Shutdown (ESD) by typing RESET ), START 50 ), and ); then return to step 57 to try again. Type Y ) to each *REPLACE OLD COPY* message. For a description of errors by numeric code, see Chapter 17.)

- 67e. Remove the diskette from unit 0 and skip to the next section, "Loading AOS/VS System Files from Diskette", step 69.

68. For tape, press `]` to specify the default, tape file 6:

`]`

The starter system now copies files from tape to the LDU. This takes a while. Then

*AOS/VS CLI REV n date time*

`)`

Congratulations! You've brought up AOS/VS and its CLI from tape. The `)` prompt means the CLI is ready for a command. Skip past the next section, to "Loading AOS/VS System Files from Tape," step 83.

(If you get a *FILE DOES NOT EXIST* message, a needed file wasn't loaded. Perhaps you forgot to answer `Y ]` to the *Initial load* question. In any case, run Emergency Shutdown (ESD) by typing `RESET ]`, `START 50 ]`, and `]`; then return to step 57 to try again. For a description of errors by numeric code, see Chapter 17.)

## Loading AOS/VS System Files from Diskette

69. The next steps are to load all the system programs and files that are part of the AOS/VS system. These programs and files are on diskettes number 6 through m (m is the number of the last diskette). These files make up the second dump file of AOS/VS programs.

First, turn on Superuser to provide write access.

`) SUPERUSER ON ]`

`*)`

70. To load from a sequence of labeled diskettes, turn CLI Operator mode on:

`*) OPERATOR ON ]`

`*)`

71. Start loading from labeled diskettes via the `LOAD` command, using the pathname `@LFD:VOL1:SECOND_DUMP_FILE`, as follows:

`*) LOAD /V/R @LFD:VOL1:SECOND_DUMP_FILE ]`

*PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED  
UNIT [@DPJ10] VOLUME ID [VOL1] ? [Y]*

72. You want the defaults, unit DPJ10 and volume ID VOL1. So confirm by pressing

`]`

The system now copies the contents of the diskette to the LDU. This takes a few minutes. Because you used the `/V` switch in the `LOAD` command, the CLI verifies files loaded by displaying their names on the system console. The `/R` switch ensures that the most recent version of each file remains on the LDU.

(If you see an error message, check step 67c for recovery action.)

When all files have been copied from the diskette, the system console displays

*PLEASE INSERT NEXT DISKETTE  
UNIT [@DPJ10] VOLUME ID [VOLn] ? [Y]*

73. Remove the diskette from unit 0 and insert the next diskette in the AOS/VS diskette set.



74. Press

↓

The system copies files from diskette to the LDU. (If you see the message *PHYSICAL UNIT OFFLINE*, this means that the diskette was misinserted in the unit or that no diskette was inserted. If needed, remove the diskette; then insert the correct diskette properly, as shown in Figure 2-1 and press ↓ again to retry. If you see *THE LABEL ON THE DISKETTE IS NOT THE ONE REQUESTED*, this means you've inserted the wrong diskette. Find the correct diskette, which has the number displayed after *REQUESTED*:, less 5. Then retry.)

75. Return to step 73 and repeat the sequence until you see

*PLEASE REMOVE THE DISKETTE*

\*)

You've loaded all the AOS/VS software from diskettes. During the process, several directories were created: directory :UTIL (with utilities), directory :SYSGEN (for system generation), and directory :HELP (for help).

You still need to load the AOS/VS update (if any) and the microcode file.

76. Remove the last AOS/VS diskette from the unit and insert the AOS/VS update diskette, with UD on its paper label (described near the beginning of this chapter). If there is more than one UD diskette, use the first one.
77. Type the LOAD command again, using the labeled diskette pathname @LFD:VOL1:UPDATE, as follows:

\*) LOAD/V/R @LFD:VOL1:UPDATE ↓

*PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED  
UNIT [@DPJ10] VOLUME ID [VOL1] ? [Y]*

78. You want the defaults, unit DPJ10 and volume ID VOL1. So confirm by pressing

↓

The system now copies the contents of the update diskette to the LDU. If it prompts for a second diskette, remove the diskette, insert the next update diskette, and repeat this step. Generally, though, there will be just one update diskette. When all update files have been loaded, you'll see

*PLEASE REMOVE THE DISKETTE*

\*)

You're almost done. Next, you'll load a microcode file onto your hard disk.

## Loading the Microcode File from Diskette

79. Remove the diskette from unit 0. Get the *second* diskette in the system media set. The paper label of this diskette has the words "AOS FMT" on the last line of text. Insert this diskette in unit 0.

80. Load the microcode files from the diskette by typing

\*) LOAD/V/R @DPJ10 ↓ (Load from physical diskette.)  
MV4000....MCF (After 30 seconds or so, CLI verifies load of microcode  
file(s).)

\*)

This puts the microcode file(s) on your LDU.

81. Remove the diskette from unit 0.
82. If your computer has *neither* hardware floating point *nor* the graphics instruction set (GIS), you're done! Skip to step 94.

If your computer has *either* (or *both*) hardware floating point or the GIS, the next step is to choose the correct microcode filename. Skip to section "Choosing the Default Microcode Filename," step 93.

## Loading AOS/VS System Files from Tape

83. With tape, the next steps are to load all the system programs and files that are part of the AOS/VS system. These programs and files are in tape file 7. First, turn on Superuser to provide write access.

```
) SUPERUSER ON )
*)
```

84. Load the files in tape file 7 by typing

```
*) XEQ LOAD_II/V/R @MTC0:7 )      (Use the LOAD_II program.)
```

...

The LOAD\_II program verifies (/V switch) the filenames loaded by displaying their names. The whole directory structure on the tape is copied, creating directory :UTIL (with utilities) directory :SYSGEN (for system generation), and directory :HELP (for help). The /R switch ensures that the most recent version of each file remains on the LDU. This load takes quite awhile.

After all the files have been loaded, the CLI Superuser prompt returns:

```
*)
```

85. Rewind the tape by typing

```
*) REWIND @MTC0 )
```

86. Now, if you received an AOS/VS *update* tape, get it. If not, skip to step 88. Updates have revision numbers with the last two digits greater than 00. For example, 7.01 is an update number. Remove the tape from unit 0, insert the update tape in unit 0, and type

```
*) LOAD/V/R @MTC0:0 )
... (CLI verifies files loaded.) ...
*)
```

This puts AOS/VS update and patch files on the LDU, for access later on.

87. Rewind the tape by typing

```
*) REWIND @MTC0 )
```

88. Remove the tape from the unit.

If you received system media on tape, continue. If you received them on diskette, not tape, return to "Loading the Microcode Files from Diskette," and do steps 79, 80, and 81.

## Loading the Microcode File from Tape

89. Get the xxxxx SYSTEM MEDIA tape that you used earlier and insert it in the tape unit.
90. Load the microcode file onto the LDU by typing

```
*) DIR : ↓
*) LOAD/V/R @MTC0:1 ↓      (Load from tape file 1.)
MV4000...MCF                (CLI verifies load of microcode file(s).)
*)
```

This step puts the microcode file on the LDU.

91. Rewind the tape by typing

```
*) REWIND @MTC0 ↓
```
92. You're done with DG-supplied system tapes. Remove the tape from the unit, put the cover on it, and store it safely. You may need it again if you want to run CPU diagnostics. Put the covers on all DG-supplied tapes and store them safely too.

If your computer has *neither* hardware floating point *nor* the graphics instruction set (GIS), then you're done! Skip to step 94. If your computer has either of these options, continue with the next step.

## Changing the Default Microcode Filename

93. Next, you'll choose the correct microcode file by identifying it to SYSBOOT. SYSBOOT will then load it into the CPU automatically in the future. To do this, shut the system down and bring it up again as follows.

- 93a. Type

```
) BYE ↓
```

- 93b. *Do you really want to shut the system down?* Y ↓ (Type Y!)
- ```
System shutdown
SCP-CLI>
```

- 93c. Press the computer panel POWER switch to OFF, then back to ON.

Within 30 seconds, the system console displays either

```
MV/4000 READY
```

```
...
```

```
@
```

or

```
MV/4000 READY
```

```
...
```

### *Operating System Load Menu*

- 1 Continue immediately with operating system load*
- 2 Enter the Technical Maintenance Menu*

```
...
```

*Enter choice [1]:*

- 93d. You want to interrupt, so type 2 ↓.

93e. If you see the @ prompt (not *Operating System Load Menu*), type

24L

and then type 2 ).

*Technical Maintenance Menu*

...

9 *View or change the microcode filename*

...

*Enter choice [1]:*

93f. You want option 9, so type

9 )

SYSBOOT prompts

*Default microcode filename [default]:*

93g. Type the name of the *correct microcode file*. This depends on the options your computer has, as follows, in Table 2-2.

**Table 2-2. Microcode Filenames**

| <b>Hardware Floating Point</b> | <b>Graphics Instruction Set (GIS)</b> | <b>Microcode Filename</b> |
|--------------------------------|---------------------------------------|---------------------------|
| No                             | No                                    | MV4000.MCF                |
| Yes                            | No                                    | MV4000FP.MCF              |
| No                             | Yes                                   | MV4000G.MCF               |
| Yes                            | Yes                                   | MV4000GFP.MCF             |

For example, with a MV/4000 DC with hardware floating point, without the graphics instruction set, you'd type **MV4000FP.MCF** )

93h. Now, choose option 1 to load the default operating system *and* the new microcode file:

1 )

(If you see a *FILE DOES NOT EXIST* message, repeat the previous step.)

*AOS/VS Rev n*

93i. *Date (MM/DD/YY)?* 5 23 86 ) (Type the current date.)

93j. *Time (HH:MM:SS)?* 15 10 ) (Type the current time.)

93k. *Override default specs [N]?* ) (Press ) to say no.)

*AOS/VS CLI Rev n date time*

Via SYSBOOT's Technical Maintenance Menu, you chose the default microcode file that will be loaded automatically — allowing your computer hardware to do its job. The new default filename has been recorded on disk. Its name will be displayed as the "Default microcode filename" from now on, and the file will be loaded automatically when you bring up AOS/VS. You will rarely (if ever) need to select a default microcode file again.

94. Well done! You've powered up, formatted an LDU, installed an AOS/VS system on it, brought up AOS/VS, and loaded all files you need to generate and use your tailored system.

If you're interested in the files as shipped on the system diskettes, see Table 2-3. For files on the system tape, see Table 2-4. All these files are now on your LDU. The LDU also contains directory :PATCH, with current patch files (if you loaded an AOS/VS update). Also, the LDU contains the microcode file, MV4000xx.MCF.

Figure 2-2 is a summary of all the steps you've taken — turning on the system console to locking the computer.

**Table 2-3. AOS/VS System Diskettes File Format**

| Diskette Number | Program Filename | Tape File Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1               | DFMTR            | Disk Formatter utility, which formats physical disks into LDUs. You run this by typing <b>DFMTR</b> in response to the <i>Pathname?</i> query.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                 | INSTL            | Installer utility, which installs an AOS/VS system from a system tape. You run this by typing <b>INSTL</b> in response to the <i>Pathname?</i> query.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                 | FIXUP            | Disk Fixer utility, which finds and can correct (fix) disk file errors if abnormal AOS/VS shutdown occurs. You run <b>FIXUP</b> by choosing option 7 "Run Fixup" from the Technical Maintenance Menu.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 2               | SYSBOOT          | <b>SYSBOOT</b> is the system bootstrap program. This diskette has <b>SYSBOOT</b> on it in a form that the Installer can read. The Installer then installs it on an LDU.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 3               | AOS/VS system    | On the DG-supplied AOS/VS diskette, this is the AOS/VS starter system. Use the Installer to install the starter system on an LDU. On a system diskette you make yourself, it is your tailored AOS/VS system. Use <b>SYSBOOT</b> 's Technical Maintenance Menu to make the tailored system the default system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 4 — n           | First Dump File  | The CLI and other system program files, including the system Agent, peripheral manager (PMGR), and copies of programs in diskette 1. AOS/VS copies the contents of these diskette into the LDU root directory when you specify <i>Initial load</i> , then type the labeled diskette pathname.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| n + 1 — m       | Second Dump File | You copy the contents of this file onto the LDU using the <b>LOAD</b> command. This file contains nearly all AOS/VS system programs, including the <ul style="list-style-type: none"> <li>- <b>CONTEST</b> system exerciser</li> <li>- Disk File Editor (FED)</li> <li>- <b>DISPLAY</b> file display</li> <li>- Error message (ERMES) and message object files (.OBs)</li> <li>- <b>EXEC</b> and <b>PREDITOR</b></li> <li>- <b>HELP</b> directory and files</li> <li>- <b>LABEL</b> tape labeler</li> <li>- <b>Link</b></li> <li>- Library File Editor</li> <li>- Macroassembler (MASM)</li> <li>- Process Environment Display (PED)</li> <li>- Release Notice (latest on software)</li> <li>- <b>SED</b> and <b>SPEED</b> text editors</li> <li>- System macros</li> <li>- Utility program symbol table files (.ST)</li> <li>- <b>SYSGEN</b> directory with <b>VSGEN</b> system generation program and libraries</li> </ul> |

**Table 2-4. AOS/VS System Tape File Format**

| <b>Tape File Number</b> | <b>Program Filename</b> | <b>Tape File Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0                       | TBOOT                   | Tape bootstrap; a short program that can load files 1, 2, and 3 from this tape.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 1                       | FIXUP                   | Disk Fixer utility, which finds and optionally corrects disk file errors if abnormal AOS/VS shutdown occurs. TBOOT loads this program into memory and executes it after you type 1 ↵ to the Tape file number? query.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 2                       | DFMTR                   | Disk Formatter utility, which formats physical disks into LDUs. TBOOT loads DFMTR into memory and executes it after you type 2 ↵ to the Tape file number? query.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 3                       | INSTL                   | Installer utility, which installs an AOS/VS system from a system tape. TBOOT loads INSTL into memory and executes it after you type 3 ↵ to the Tape file number? query.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 4                       | SYSBOOT                 | The system bootstrap program loads an AOS/VS system or other program into memory <i>from disk</i> , then executes the program. The Installer installs SYSBOOT on an LDU.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 5                       | AOS/VS system           | On the DG-supplied system tape, this is the AOS/VS starter system. Use the Installer to install the starter system on the disk. On a system tape you make, it is your tailored AOS/VS system. Use SYSBOOT's Technical Maintenance Menu to make the tailored system the default system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 6                       | First Dump File         | The CLI and other system program files, including the system Agent, peripheral manager (PMGR), LOAD_II program, and copies of programs in tape files 0 through 4. AOS/VS copies the contents of this tape file into the LDU root directory when you specify <i>Initial load</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 7                       | Second Dump File        | <p>You copy the contents of this file onto disk using the LOAD_II program, as part of the initial load procedure. This tape file contains nearly all AOS/VS programs, including the</p> <ul style="list-style-type: none"> <li>- CONTEST system exerciser</li> <li>- Disk File Editor (FED)</li> <li>- DISPLAY file display</li> <li>- Error message (ERMES) and message object files (.OBs)</li> <li>- EXEC and PREDITOR</li> <li>- HELP directory and files</li> <li>- LABEL tape labeler</li> <li>- Link</li> <li>- Library File Editor</li> <li>- Macroassembler (MASM)</li> <li>- Process Environment Display (PED)</li> <li>- Release Notice (latest on software)</li> <li>- SED and SPEED text editors</li> <li>- System macros</li> <li>- Utility program symbol table files (.ST)</li> <li>- SYSGEN directory with VSGEN system generation program and libraries</li> </ul> |

## Powering Up and Loading Microcode

1. Have the system console on and on line.
- 1a. Press ALPHA LOCK key (if any) until ALHPA LOCK light glows.
2. If you have a cartridge tape unit, turn it on.
3. Get the I/O CB EMULATOR diskette. Insert it in unit 0, with write-enable notch facing up and label toward the right. Then close latch.
4. Turn computer power on via the power switch on the cabinet.

*MV4000 READY*

*...*

*1. INSTALL AND RUN EMULATOR ON HARD DISK*

*...*

5. *CHOOSE ONE: [1] ↵*

*... (Pause) ...*

*EMULATOR INSTALLED*

*@*

- 5a. Remove the diskette from unit 0.
6. If you received system media on cartridge tape, skip to step 9. For media on diskette, continue.
7. Get the first system media diskette, with "...SYSTEM MEDIA" on its label.
8. Insert the diskette in unit 0.
- 8a. Type  
*@ 64L* (Type 64L)  
*...*  
*\**

With the prompt \* showing, skip to step 10.

9. Get the cartridge tape with SYSTEM MEDIA on it.
- 9a. Insert the cartridge in your tape unit, label facing right.
- 9b. Make sure the tape READY light is on. Then type  
*@ 22L* (Type 22L)
10. Type *LOAD name ↵*, where name is the name of the microcode file: No hardware floating point, no graphics instruction set (GIS), it's MV4000; hardware floating point, no GIS, it's MV4000FP; no hardware floating point, GIS, it's MV4000G; with both hardware floating point and hardware, it's MV4000GFP; for example,

*\* LOAD MV4000FP.MCF ↵* (CPU with hardware floating point)

*...*

*MV/4000 MICROCODE LOADED AND VERIFIED*

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Figure 2-2. Step Summary, Bringing Up AOS/VS on Blank Disk(s), ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series Systems (continues)

11. \* EXIT ↵  
...  
SCP-CLI>
12. Remove the diagnostic medium (diskette or tape) from its unit.
13. Insert the correct AOS/VS medium (first diskette or tape) in its unit.

### Running the Disk Formatter

14. SCP-CLI> RESET ↵ (Type RESET ↵ and wait for prompt.)
15. With AOS/VS on tape, skip to step 20. With it on diskette, do this:
16. BOOT 64 ↵ (Type BOOT 64 ↵)  
*Operating System Load Menu*
17. Enter choice [1]: 2 ↵  
*Technical Maintenance Menu*
18. Enter choice [1]: 6 ↵
19. Pathname? DFMTR ↵  
Skip to step 22.
20. With tape, make sure the tape READY light is on. Then bootstrap by typing BOOT 22 ↵.
21. Tape file number? 2 ↵ (Type 2 ↵)  
*AOS/VS Disk Formatter Rev n*  
...
22. Full (F) or Partial (P or NEW LINE)? F ↵ (Type F ↵)
23. Disk unit name? DPJ0 ↵
- 23a. Device code [24] ? ↵ (Press ↵)
- 23b. Disk unit name? ↵
- 23c. Do you want to allocate a diagnostic area? [Y]  
Unless you want to allot 8,000 blocks for later installation of the Advanced Diagnostic system, type N ↵ and skip to step 23e. To allot an area, press ↵.
- 23d. Enter the number of blocks (1750 to 35230)...[23420] ? 17500 ↵  
*Disk number 1: 00000000000 through n*
- 23e. LDU unique I.D. (1 to 6 characters)? []? 1 ↵ (Type valid disk ID)
- 23f. LDU name (1 to 31 characters) []? ROOT ↵ (Type valid LDU name)
- 23g. Username or template (1 to 15 characters)? + ↵
- 23h. Access (O, W, A, R, E, or NEW LINE) ? E ↵

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Figure 2-2. Step Summary, Bringing Up AOS/VS on Blank Disk(s), ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series Systems (continued)



23i. *Username or template (1 to 15 characters)?* ↓

24. *Surface analysis? [N]* Y ↓

24a. *Disk number?* ↓

24b. *You may run up to five (5) patterns. How many would you like to run?* 5 ↓ (Choose pattern(s))

-- *Running pattern n* (Takes 8 to 24 minutes per pattern)

24c. If it found no bad blocks, go to 24e.  
*n bad disk blocks*

24d. *Display bad block statistics? [N]* Y ↓  
*Note bad blocks.*

24e. *Additional bad block number (press NEW LINE when done):* ↓  
*Bitmap size: n*

24f. *Display bad block statistics? [N]* ↓

25. *Bitmap address? [default]* ↓

26. *System disk? [Y]* ↓ (Skipped if you allocated a diagnostic area)

26a. *Overlay area size? [default]* ↓

26b. *Overlay area address? [default]* ↓

27. *Disk number n remap area size? [default]* ↓

27a. *Disk number n remap area address? [default]* ↓  
 — *LDU created*  
*Done!*  
*SCP-CLI>*

If you have another hard disk, type CONTINUE ↓ and return to step 22. For *Disk unit name*, answer DPJ1 ↓ and *System disk?* answer N ↓; all other answers are the same.

## Installing the AOS/VS Starter System

Proceed to the appropriate section, “Installing the Starter System from Diskettes” (next) or “Installing the Starter System from Tape” (step 44).

### Installing the Starter System from Diskettes

28. *SCP-CLI> RESET* ↓ (Type RESET ↓ and wait for prompt.)

29. *SCP-CLI> BOOT 64* ↓  
*Operating System Load Menu*

30. *Enter choice [1]: 2* ↓  
*Technical Maintenance Menu*

31. *Enter choice [1]: 6* ↓

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Figure 2-2. Step Summary, Bringing Up AOS/VS on Blank Disk(s), ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series Systems (continued)

32. *Pathname?* INSTL ↵ (Installer filename)  
*AOS/VS Installer Rev n*  
*Disk Unit Name?*
33. From diskette unit 0, remove diskette 1, and insert diskette 2.
34. DPJ0 ↵ (Type the disk name, DPJ0 ↵)
35. *Device code [24]?* ↵ (Press ↵)  
-- *Disk bootstrap installed*
36. *Do you want to install a System Bootstrap [Y] ?* ↵
37. *Install from which unit [MTC0] ?* DPJ10 ↵ (Type diskette unit name)
38. *Device code [64]?* ↵ (Press ↵)  
-- *System Bootstrap Installed*  
*Do you want to install a System [Y] ?*
39. From diskette unit 0, remove diskette 2 and insert diskette 3.
40. ↵ (Press ↵)
41. *Install from which unit [DPJ10] ?* ↵
42. *Device code [64] ?* ↵  
-- *System installed*  
*Done!*
43. Remove the diskette from unit 0.

### **Installing the Starter System from Tape**

44. *SCP-CLI>* RESET ↵ (Type RESET ↵ and wait for prompt.)
45. *SCP-CLI>* BOOT 22 ↵
46. *Tape file number?* 3 ↵  
*AOS/VS Installer Rev n*  
*.*
47. *Disk unit name?* DPJ0 ↵
48. *Device code [24] ?* ↵  
-- *Disk bootstrap installed*
49. *Do you want to install a System Bootstrap [Y] ?* ↵
50. *Install from which unit [MTC0] ?* ↵
51. *Device code [22] ?* ↵

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*Figure 2-2. Step Summary, Bringing Up AOS/VS on Blank Disk(s), ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series Systems (continued)*

```

52. File number [4] ? ↵
    (Delay)
    -- System Bootstrap installed

53. Do you want to install a System [Y] ? ↵
54. Install from which unit [MTC0] ? ↵
55. Device code [22] ? ↵
56. File number [5] ? ↵
    (Delay)
    -- System installed

    Done!
    ...
    SCP-CLI>

```

### Bringing Up the AOS/VS Starter System

```

57. SCP-CLI> RESET ↵      (Type RESET ↵ and wait for prompt.)
58. BOOT 24 ↵

    Operating System Load Menu

    ...

59. Enter choice [1] ↵
    AOS/VS Rev xx.xx

60. Date (MM/DD/YY)?  5 23 86 ↵      (Type current date)
61. Time (HH:MM:SS)?  14 30 ↵      (Type current time)
62. Override default specs [N] ?  Y ↵
63. Number of buffers in cache [default]?  ↵
64. Swap directory definition [default]?  ↵
65. Page directory definition [default]?  ↵
66. Initial load [N]?  Y ↵  (Be sure to type Y ↵)
    Filename [@MTC0:6]?

67. If installing AOS/VS from cartridge tape, skip to step 68. For AOS/VS supplied on diskettes,
    continue.

67a. Get the fourth AOS/VS diskette and insert it in unit 0.
67b. Type

    @LFD:VOL1:FIRST_DUMP_FILE ↵

    PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED

```

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Figure 2-2. Step Summary, Bringing Up AOS/VS on Blank Disk(s), ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series Systems (continued)

- 67c. *UNIT [@DPJ10] VOLUME ID [VOL1] ? [Y] ↓*  
 (2-minute delay while it copies files to disk)  
*PLEASE INSERT NEXT DISKETTE*  
*UNIT [@DPJ10] VOLUME ID [VOL1] ? [Y] ↓*
- 67d. Get the next diskette in the AOS/VS set. Remove the diskette from unit 0, and insert the next diskette. Press ↓.  
 (Delay while it copies files)  
*PLEASE REMOVE THE DISKETTE*  
*AOS/VS CLI REV x.xx date time*  
 )
- 67e. The CLI is running. Remove diskette from unit 0. Skip to step 69.
68. For tape, press ↓ to specify the default, file 6.  
 (Delay while it copies files)  
*AOS/VS CLI REV n date time*  
 )
- The CLI is running. To load system files from tape, skip to step 83.

### **Loading AOS/VS System Files from Diskette**

69. ) SUPERUSER ON ↓
70. \*) OPERATOR ON ↓  
 \*)
71. Load from labeled diskettes, path @LFD:VOL1:SECOND\_DUMP\_FILE; e.g.,  
 \*) LOAD/V/R @LFD:VOL1:SECOND\_DUMP\_FILE ↓  
*PLEASE INSERT A DISKETTE*
72. *UNIT [@DPJ10] VOLUME ID [VOL1] ? [Y] ↓*  
 (CLI copies and verifies files)  
*PLEASE INSERT NEXT DISKETTE IF NOT ALREADY INSERTED*  
*UNIT [@DPJ10] VOLUME ID [VOLn] ? [Y]*
73. Remove the diskette from unit 0 and insert the next diskette in the AOS/VS diskette set.
74. Press ↓  
 . . . (CLI loads and verifies files) . . .
75. Return to step 73 and repeat sequence until you see  
*PLEASE REMOVE THE DISKETTE*  
 \*)
76. Remove the last AOS/VS diskette from the unit and insert the AOS/VS update diskette, with UD on its label (if there is one).

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*Figure 2-2. Step Summary, Bringing Up AOS/VS on Blank Disk(s), ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series Systems (continued)*

77. Type

\*) LOAD/V/R @LFD:VOL1:UPDATE )

*PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED*

78. UNIT [@DPJ10] VOLUME ID [VOL1] ? [Y] )

... (It copies from diskette) ...

\*)

### **Loading the Microcode File from Diskette**

79. Remove any diskette from unit 0. Get the *second* diskette in the system media set (with "AOS FMT" on the last line of its paper label). Insert this diskette in unit 0.

80. \*) LOAD/V/R @DPJ10 )

... (It verifies load) ...

)

81. Remove the diskette from unit 0.

82. If your computer doesn't have hardware floating point or GIS, you're done; skip to step 94. If you *do* have hardware floating point or GKS, choose the microcode filename as shown in step 93.

### **Loading AOS/VS System Files from Tape**

83. ) SUPERUSER ON )

\*)

84. \*) XEQ LOAD\_II/V/R @MTC0:7 ) (Use the LOAD\_II program)

... (CLI displays file and directory names loaded.) ...

85. \*) REWIND @MTC0 )

86. Now, if you received an AOS/VS *update* tape, get it and mount it on unit 0.

87. Type

\*) LOAD/V/R @MTC0:0 )

... (CLI verifies patch files loaded.) ...

\*) REWIND @MTC0 )

\*)

88. Dismount the update tape from unit 0.

If you received the microcode/SCP files on tape, continue. If you received them on diskette, not tape, return to and do steps 79, 80, and 81.

### **Loading the Microcode File from Tape**

89. Get the system media tape (used earlier) and insert it in the tape unit.

90. Type

\*) DIR : )

\*) LOAD/V/R @MTC0:1 )

... (CLI verifies microcode filename(s).) ...

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*Figure 2-2. Step Summary, Bringing Up AOS/VS on Blank Disk(s), ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series Systems (continued)*

91. \*) REWIND @MTC0 ↓

92. Remove tape from unit and store tape.

### **Changing the Default Microcode Filename**

93. To choose a microcode filename other than the default:

93a. ) BYE ↓

93b. *Do you really want to shut the system down?* Y ↓

*System shutdown*  
*SCP-CLI>*

93c. Turn computer POWER switch off and on.

*MV4000 READY*

...

@

or

*MV4000 READY*

...

*Operating System Load Menu*

...

93d. *Enter choice [1]:* 2 ↓

93e. If you see the @ prompt (not *Operating System Load Menu*), type 24L and then type 2 ↓.

*Technical Maintenance Menu*

...

93f. *Enter choice [1]:* 9 ↓

93g. *Default microcode filename [default]:*

Type the name of the *correct microcode file* as follows:

Without hardware floating point, without GIS, file is MV4000.MCF

With hardware floating point, without GIS, file is MV4000FP.MCF

Without hardware floating point, with GIS, file is MV4000G.MCF

With both hardware floating point and GIS, file is MV4000GFP.MCF

For example, with an MV/4000 SC with hardware floating point, without the GIS, you'd type  
MV4000FP.MCF ↓

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*Figure 2-2. Step Summary, Bringing Up AOS/VS on Blank Disk(s), ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series Systems (continued)*

93h. Now, choose option 1 to load the default operating system *and* the new microcode file.

1 ↵

*AOS/VS Rev n*

93i. *Date (MM/DD/YY)?* 5 23 86 ↵ (Current date)

93j. *Time (HH:MM:SS)?* 14 40 ↵ (Current time)

93k. *Override default specs [N]?* ↵ (Press ↵ to say no)

*AOS/VS CLI REV n date time*

94. You're done!

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*Figure 2-2. Step Summary, Bringing Up AOS/VS on Blank Disk(s), ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series Systems (concluded)*

## What Next?

If you want to stop for a while, fine. To shut down AOS/VS, you can type **BYE** ↵, then **Y** ↵. To bring it up again, type **BOOT 24** ↵ and wait for the time out. Then choose the default for each question except the **DATE** and **TIME** by pressing ↵.

If this is your first system, and you want to generate a tailored system now, go to Chapter 4.

If you are rebuilding and restoring a tailored system, the next steps are to start **EXEC** (Chapter 5) and load user and application directories and files from backup media.

End of Chapter





# Chapter 3

## Bringing Up the Starter System on Blank Disks — ECLIPSE MV/20000, MV/10000, MV/8000, MV/6000, and MV/4000 Computers

Read this chapter

- when your computer system hardware has just been installed and you want to bring up AOS/VS on it;
- whenever you want to format a new disk, install an AOS/VS system on it, load system files onto it, and bring up the installed system.

This chapter tells you how to execute all steps needed before you run the VSGEN program to generate your first tailored system. It applies to ECLIPSE MV/20000 Model 2, MV/20000 Model 1, MV/20000 C, MV/10000 SX, MV/10000, MV/8000, MV/8000 II, MV/8000 C, MV/6000, and MV/4000 computers. The major sections are

- Powering Up and Loading Microcode
- Running the Disk Formatter
- Installing the AOS/VS Starter System
- Bringing up the AOS/VS Starter System

(Data General DS/7000-series and ECLIPSE MV/2000 DC systems usually arrive with an easy-to-use model of AOS/VS already installed on the disk. Managing such a system is explained in the manual *Starting and Running AOS/VS on ECLIPSE MV/2000<sup>TM</sup> DC and Data General DS/7000-Series Systems*. It is possible, however, to acquire standard AOS/VS on one of these systems. To bring up standard AOS/VS on one of these systems — starting with blank disks — see Appendix D.)

### Powering Up and Loading Microcode

The following steps assume that CPU power is off.

1. Ready the system console. If this is a hard copy (printing) console, turn it on with the power switch under the keyboard or behind the unit, near the floor. Press the ON LINE switch and the READY light will glow. Set ALPHA LOCK on.

If the system console is a CRT display, turn it on. The switch is a rocker switch behind the console or a push-pull knob on the front lower-right corner. The console may display a self-test message and beep. Check the ON LINE light. If this light glows, fine. If it doesn't glow, depress the CMD key, hold CMD down, and press the ON LINE key. The ON LINE light should glow. (If there is no ON LINE key, check the ON LINE switch behind the console.)

- 1a. If your primary disk unit is a sealed unit, press ON-1 (or READY or START). Soon, the READY light will glow.

If your primary disk uses a removable disk pack (multiple platters), make sure a pack is inserted in the unit. Doing this is described in the illustrated disk instruction booklet. First press DC POWER ON, WRITE ENABLE, and then DRIVE START; soon, the READY lamp will light.

If you want to format multiple disks, make sure they are ready as above.

2. With any machine except a blue and white MV/8000, skip to step 3.

With a blue and white MV/8000, proceed as follows.

- 2a. If the MV/8000 system diskette (supplied with the computer) is not in the computer's diskette slot, insert it. Then close the diskette door.

- 2b. Press the computer POWER switch to ON. The computer then runs some power-up tests, and prompts

**\*\*CONSOLE READY\*\***

...

*STARTING POWER UP SEQUENCE*

*ENTER DATE (MO DAY YR)*

If this message doesn't appear, make sure the diskette is correctly inserted; and turn power off and on again.

- 2c. Type the date, separating month, day, and year by a space, followed by a NEW LINE character (*␣*). For example:

5 23 86 *␣*

*ENTER TIME (HR MIN)*

- 2d. Type the time, based on a 24-hour clock. For example, for 1:30 p.m., type

13 30 *␣*

*MICROCODE(1= STD, 2= C350/MMPU[1])?*

- 2e. Accept the default microcode by pressing *␣*.

The SCP now loads its operating system and the MV/8000 microcode from the diskette. This takes a few moments. It displays

*LOADING FROM FILE ...*

*LOADING COMPLETE*

...

*END SYSTEM INITIALIZATION*

*SCP-CLI>*

The whole load takes a little over a minute. The SCP operating system, which allows you to run other programs, now has control. Skip all the way to step 13.

3. With any machine but a blue and white MV/8000, do the following.

On the computer's front panel, press the LOCK switch (if there is one) to the OFF or to the unlock position. Then press the computer POWER (or PWR) switch to ON. The computer runs some power-up tests. Then, depending on model, the system console displays either

```
** POWER UP TESTING COMPLETED **    (on MV/20000s)
WARNING: Configuration changed...
SCP-CLI>
```

```
** POWER UP TESTING COMPLETED **    (on everything else except
BOOT ...                             for MV/4000)
```

or

```
{ MV4000 READY }                      (on MV/4000)
{ @ }
```

If you see an incomplete *POWER UP/READY* message, or *POWER UP FAILURE xx-yy-zz*, or nothing, press power off and on again. If the message remains incomplete, consult Chapter 17 for the pertinent "Power Up Error Codes" table.

4. Now for a tape. There are several tapes involved in bringing up your first system. One is the *MV/n* system tape (for example, the MV/4000 system tape). This usually contains a diagnostic program, diagnostic operating system (SCP\_DTOS), CPU diagnostics, microcode, and the SCP operating system.

The second tape is the *AOS/VS* system tape, which contains all AOS/VS system software. There may also be an *AOS/VS update* tape. (There will also be tapes with other DG software, but these must wait until you get AOS/VS up and running.)

5. Select a tape unit and turn power on to it.

If the unit's control panel has a SELECT thumbwheel, it is a type MTB unit. The starter system requires that the MTB controller be connected to the first tape controller device code, 22. Dial 0 on the thumbwheel and make sure that no other unit that is ON LINE has the same number. Then press the MTB's panel switch to HIGH DENSITY.

If the tape unit has no SELECT thumbwheel and its reels are side by side, it is a type MTC unit. If it has no reels and accepts a tape *cartridge*, it is also a type MTC unit. Always, the MTC you use must be unit 0 on its controller. And the starter system requires that the MTC controller be connected to the first tape controller device code, 22.

If the tape unit has switches at the top, or if it has a touch-sensitive switch panel, it is a self-threading 1600/6250 bpi unit, type MTD. The MTD must be unit 0 on its controller, and *the controller must be connected to the second tape controller device code, 62.* (The starter system supports an MTB or MTC controller on device code 22 and an MTD controller on device code 62. This means that, if you want the starter system to operate an MTD unit, the unit must be connected on device code 62.)

6. Mount and thread the *MV/n* system tape (on an MTD unit, just mount the tape), or insert the cartridge, on tape unit 0. Then close the tape unit door. (Some units won't operate with the door open.)
7. Press the tape UNLOAD/BOT switch to BOT; then press ON LINE. The tape will move forward and stop. (On an MTD unit, press Reset, Load, and On Line.)

8. Now, you must tell the computer to program load from the tape:
  - With an MV/20000 Model 2, MV/20000 Model 1, or MV/20000 C, continue with step 9;
  - With an MV/10000 SX or MV/10000, skip to step 10;
  - With an MV/8000 II, MV/8000 C, or MV/6000, skip to step 11;
  - With an MV/4000, skip to step 12.
9. With an MV/20000, the system console displays  
*SCP-CLI>*  
 The next steps will have you enable SCP automatic bootstrapping and set the computer's battery-powered clock (boot clock) time.  
 Type the command *FLAGS AUTOBOOT* and set the startup device as follows:
  - 9a. *SCP-CLI> FLAGS AUTOBOOT* )  
*AUTOBOOT [DISABLED] 0 = DISABLE, 1 = ENABLE*
  - 9b. *> ENABLE* ) (Type *ENABLE* )
  - 9c. *ENTER DEVICE CODE> 24* ) (Type the device code of your primary disk unit; this is 24 unless the unit is a DPF-type disk.)
  - 9d. *ENTER CHANNEL # 0* ) (Type *0* )  
*SCP-CLI>*  
 From now until you change the autoboot device, it will remain your primary disk unit.
  - 9e. Turn computer power off, then on again. You'll see the power-up message as before, and — having set the default device — you'll see the Automatic Program Load Menu:  
*\*\*POWER UP TESTING COMPLETED\*\**  
*Automatic Program Load Menu*  
*1 Continue immediately with preset values*  
*2 Change preset values*  
*...*
  - 9f. *Enter choice [1]: 2* ) (Type *2* )  
*Change Preset Values Menu*  
*1 Continue the powerup*  
*2 Change the system date or time*  
*3 Start from a different device*  
*4 Change the default device*  
*5 Change the time-out delay*  
*6 Enter the SCP CLI*  
*...*
  - 9g. *Enter choice [1]: 2* ) (To set the time, type *2* )  
*Date [DD-MMM-YY]:*

- 9h. Type the correct date — numbers for day and year, three letters for the month. For example, to specify June 20, 1986:

*Date [22-MAY-86]: 23-MAY-86 ↵*

*Time [13:28:00]:*

- 9i. Type the correct time, using a 24-hour clock. For example, for 1:30 p.m., type

*Time [13:28:86]: 13:30:00 ↵*

*Offset to GMT [+00:00]:*

- 9j. “Offset to GMT” (Greenwich Mean Time) has meaning only if your system will communicate with another computer system in a different time zone. You can always set it later. For now, press

*↵*

- 9k. The cursor returns to the *Enter choice* prompt. The next steps involve getting to the SCP CLI, choice 6 on the menu so type 6 ↵:

*SCP-CLI>*

You’ve set the default startup device and the battery-powered clock (boot clock). AOS/VS can use these two items in the future. Skip to step 13.

10. On an MV/10000 SX or MV/10000, the system console prompts

*BOOT WHAT DEVICE? (CHANNEL AND DEVICE CODE):*

Type the break sequence: CMD and BREAK/ESC key, or BRK key, depending on your system console.

- 10a. This gives control to the octal debugging tool (! prompt). Next to the ! prompt, tell the debugging tool to load from the tape:

*! 22T* (Or type 62T if the tape is on a type MTD unit. If — as is usually not true — the tape is attached to the *second* I/O controller [IOC], type the channel number before the nnT; for example, type 122T)

The loader program reads the diagnostic operating system from the tape. It displays

*TOP OF MEMORY = n*

*HIDTOS REV n*

*COPYRIGHT DATA GENERAL ...*

*ALL RIGHTS ...*

*\**

(If this message doesn’t appear after a minute or so, retry by turning CPU power off and returning to step 4. If the message still doesn’t appear, the MV/n tape may be low density. On the tape unit, press OFF LINE, press the DENSITY switch to LOW DENSITY — if this applies — and leave it on LOW DENSITY. Press the CPU POWER switch to OFF and return to step 4.)

- 10b. Next to the \* prompt, type

\* LOAD SCPOS ↓

LOAD  
SCPOS REV.n

Now wait. You may see some *LOADING...* messages. After about 70 seconds or so, you'll see the messages

*MV/10000 SYSTEM CONTROL PROGRAM REVISION n*

...

*CHECK-SUM OK*  
*ENTER DATE (MO DAY YR)*

- 10c. Type the date, separating the month, day, and year by a space, followed by a NEW LINE character (↓). For example, for May 23, 1986, you'd type

5 23 86 ↓

*ENTER TIME (HR MIN)*

- 10d. Type the time, based on a 24-hour clock. For example, for 1:30 p.m., type

13 30 ↓

*BEGIN SYSTEM INITIALIZATION*  
*NUMBER OF ... MEMORY MODULES n*  
*MICROCODE REV.n*  
*END SYSTEM INITIALIZATION*

*SCP-CLI>*

Go to step 13.

11. On an MV/8000 II, MV/8000 C, or MV/6000, the system console prompts *BOOT DEVICE?* Type

*BOOT DEVICE?* 22 ↓ (Or type 62 ↓ if tape is on  
a type MTD tape unit.)

The loader program reads the diagnostic operating system from the tape. It displays

*TOP OF MEMORY = n*  
*HIDTOS REV n*  
*TESTOK*  
*COPYRIGHT DATA GENERAL ...*  
*ALL RIGHTS ...*

\*

(If this message doesn't appear after a minute or so, retry by turning CPU power off and returning to step 4. If the message still doesn't appear, the MV/n tape may be low density. On the tape unit, press OFF LINE, press the DENSITY switch to LOW DENSITY — if this applies — and leave it on LOW DENSITY. Press the CPU POWER switch to OFF and return to step 4.)

- 11a. Tell the diagnostic operating system to load the SCP operating system from tape, by typing

\* LOAD SCPOS ↓

*SCPOS REV n*

Now wait. After about 70 seconds or so, you'll see the messages

*MV/n000 SYSTEM CONTROL PROGRAM REVISION n*  
*COPYRIGHT DATA GENERAL...*  
*CHECK-SUM OK*

*ENTER DATE (MO DAY YR)*

- 11b. Type the date, separating the month, day, and year by a space, followed by a NEW LINE character (↓). For example, for May 23, 1986, you'd type

5 23 86 ↓

*ENTER TIME (HR MIN)*

- 11c. Type the time, based on a 24-hour clock. For example, for 1:30 p.m., type

13 30 ↓

*BEGIN SYSTEM INITIALIZATION*  
*# OF 256 KB MEMORY MODULES - n*  
*MV/n000 MICROCODE REVISION n*  
*END SYSTEM INITIALIZATION*

*SCP-CLI>*

Go to step 13.

12. With an MV/4000, the system console shows @. Type

@ 22L

The loader program reads the diagnostic operating system from the tape. It displays

*TOP OF MEMORY = n*  
*HIDTOS REV n*  
*TESTOK*  
*COPYRIGHT DATA GENERAL ...*  
*ALL RIGHTS ...*

\*

(If this message doesn't appear after a minute or so, retry by turning CPU power off and returning to step 4. If the message still doesn't appear, the MV/n tape may be low density. On the tape unit, press OFF LINE, press the DENSITY switch to LOW DENSITY — if this applies — and leave it on LOW DENSITY. Press the CPU POWER switch to OFF and return to step 4.)

- 12a. Tell the diagnostic operating system to load CPU microcode. For an MV/4000 with a hardware floating-point unit (FPU), the filename is **MV4000FP**; for an MV/4000 *without* FPU, the filename is **MV4000**. Type the **LOAD** command, followed by the appropriate filename for your machine. For example,

```
* LOAD MV4000 )      (or LOAD MV4000FP )
```

After a few moments, you'll see the message

```
MV4000 MICROCODE REV n LOADING
```

```
...
```

```
MV4000 MICROCODE REV n LOADED AND VERIFIED
```

```
*
```

- 12b. Exit from the diagnostic system by typing

```
EXIT )
```

```
CPU HALTED
```

```
SCP-CLI>
```

CPU microcode has been loaded; and the SCP CLI, which allows you to start other programs, has control, as you can tell by the prompt.

13. You're done with the MV/n system tape, so use the tape switches to take it off line, unload it, and remove it from the tape unit. You'll need it again later.
14. Get the *AOS/VS* system tape and mount it on unit 0. (Remove the plastic write-enable ring first, if any.) Make sure the tape **DENSITY** switch (if there is one) is on **HIGH DENSITY** or 1600 bpi. Put the tape unit on line.

You're finished powering up and can run the Disk Formatter.

## Running the Disk Formatter

The Disk Formatter makes physical disks into LDUs; it can also change LDU specifications. The Disk Formatter does this by writing identifiers so that AOS/VS will know what disk and LDU it is accessing. The Formatter can also check the disk surface for *bad blocks* (flawed areas that won't hold information).

Running the Disk Formatter is relatively easy, but — because the Formatter checks each bit on the disk — takes more time than other system generation procedures.

### Mistakes and Errors

If you type an incorrect answer to a Disk Formatter question, and have not yet pressed **)** to enter the answer, press the **DEL** key or **CTRL-U** to erase the wrong characters.

If you have pressed **)** and want to abort formatting, enter **CTRL-C CTRL-A** and go to step 18. If **CTRL-C CTRL-A** doesn't work, type the break sequence (Table 1-2) and return to step 15.

If you abort formatting by either method during surface analysis, be sure to run the entire **FULL** format again.

If the Disk Formatter reports a disk or other error, *make sure the disk unit is write-enabled*; if it is write-enabled, check the error message in the table near the end of the Disk Formatter chapter.

### Disk Formatter Dialog

15. The SCP-CLI prompt is still on the system console. Reset the computer by typing
- ```
RESET )
```



16. Bring in the tape bootstrap (TBOOT) from tape by typing  
 BOOT 22 ↵ (Or BOOT 62 ↵ if tape is on an MTD unit.)  
*Tape file number?*
17. TBOOT is asking for a file number. Type 2 ↵, the number of the Disk Formatter file.  
 2 ↵  
 TBOOT moves the tape forward to file 2, then loads and executes the Disk Formatter.  
 The Formatter prompts  
*AOS/VS Disk Formatter Rev n*  
*Full format destroys any AOS/VS file structure, Partial retains it.*  
*Full (F) or Partial (P or NEW LINE)?*
18. Type  
 F ↵  
*Full Format*  
*Specify each disk in the LDU (press NEW LINE when done)*  
*Disk unit name?*
19. The *Disk unit name* question starts a sequence of questions to identify this LDU.  
 Each AOS/VS disk unit name has the form DPx0, as shown in Table 3-1. Find the unit name of the first disk on the controller and type it. For example,  
 DPJ0 ↵ (Or DPF0 ↵ or DPI0 ↵)  
*Device code [default] ?*
- 19a. The default device code appears in square brackets. For any system, unless you *know* that this disk controller is connected to a nonstandard device code, press ↵ for the default.  
 ↵  
*Disk unit name?*
- 19b. The Disk Formatter will repeat the *Disk unit name?* and *Device code?* questions until you answer ↵ to *Disk unit name?*. This allows you to create an LDU that includes more than one physical disk. An LDU can include up to eight physical disks.  
 For your first system, you want a single-disk LDU — and in most cases, you will want every LDU to be a single-disk LDU. The pros and cons of multiple-disk LDUs are detailed in the Disk Formatter chapter. For now, answer the question with  
 ↵  
*Do you want to allocate a diagnostic area? [Y]*
- 19c. This question lets you allot an area on disk for later installation of DG's Advanced Diagnostic Executive System (ADES). ADES can run from a medium other than disk, but it runs much faster from disk. Also, diagnostics are easier to run remotely if ADES is on disk. To use ADES, you must purchase it and have it installed on the disk by a DG field engineer. ADES for MV/Family machines requires a minimum of 8,000 disk blocks — 4.1 Mbytes. This space is lost for AOS/VS file storage.  
 If you don't want to install ADES and run it from disk, answer No by typing N ↵. ADES runs only from the system disk. Thus, you should always say No for an LDU that won't be the system disk (DPF0, DPJ0, etc.). If you say no, skip to step 19e.  
 If you want to reserve an area for ADES, press ↵. Then, the Disk Formatter asks  
*Enter the number of blocks (1750 to 35230) required. [23420]*

**Table 3-1. Common AOS/VS Disk Models and Names**

Disk Model Number and Description	Default Device Code of Controller	Disk Number on Controller	Disk Unit Name
<p>6060, 6061, 6067, and 6122; 6160 and 6161.</p> <p>All are moving-head disks. The 6060, 6061, 6067, and 6122 are freestanding units that use removable packs; a controller can run four units. The 6160 and 6161 are sealed with nonremovable disks, rack mounted; a controller can run two units.</p> <p>A 6060 holds 90 Mbytes; a 6061 holds 190 Mbytes; a 6067 holds 50 Mbytes; a 6122 holds 277 Mbytes. A 6160 holds 73 Mbytes and a 6161 holds 147 Mbytes.</p>	<p>27</p> <p>67</p> <p>None; chosen at installation</p> <p>None; chosen at installation</p>	<p>first (0) second (1) third (2) fourth (3)</p> <p>first (0) second (1) third (2) fourth (3)</p> <p>first (0) second (1) third (2) fourth (3)</p> <p>first (0) second (1) third (2) fourth (3)</p>	<p>DPF0 DPF1 DPF2 DPF3</p> <p>DPF10 DPF11 DPF12 DPF13</p> <p>DPF20 DPF21 DPF22 DPF23</p> <p>DPF30 DPF31 DPF32 DPF33</p>
<p>6236 and 6237; 6239, 6290, and 6240. Each is a rack-mounted, sealed moving-head unit with the power switch on the upper right. It has a LED display that shows the unit number and can show the current cylinder or disk fault code. A controller can run four units. Up to three units fit in a cabinet.</p> <p>A model 6236 unit holds 354 Mbytes; a model 6237 is three 6236 units in one cabinet, on one controller.</p> <p>A model 6239 unit holds 592 Mbytes; a model 6290 is two 6239 units in one cabinet, on one controller; and a model 6240 is three 6239 units in one cabinet, on one controller.</p>	<p>24</p> <p>64</p> <p>None; chosen at installation</p> <p>None; chosen at installation</p>	<p>first (0) second (1) third (2) fourth (3)</p> <p>first (0) second (1) third (2) fourth (3)</p> <p>first (0) second (1) third (2) fourth (3)</p> <p>first (0) second (1) third (2) fourth (3)</p>	<p>DPJ0 DPJ1 DPJ2 DPJ3</p> <p>DPJ10 DPJ11 DPJ12 DPJ13</p> <p>DPJ20 DPJ21 DPJ22 DPJ23</p> <p>DPJ30 DPJ31 DPJ32 DPJ33</p>
<p>6214. A sealed, moving-head disk in a freestanding cabinet. It holds 602 Mbytes.</p> <p>6234. A sealed, moving-head disk, bay mounted. It holds 50 Mbytes.</p>	<p>27</p> <p>67</p> <p>33</p> <p>73</p>	<p>first (0) second (1)</p> <p>first (0) second (1)</p> <p>first (0)</p> <p>first (0)</p>	<p>DPF0 DPF1</p> <p>DPF10 DPF11</p> <p>DPI0</p> <p>DPI10</p>

\*

- 19d. The displayed figures are octal. ADES needs at least 8,000 blocks (17500 octal). A good minimum figure is the default, 23420 (10,000) blocks. Decide on the number of disk blocks needed for the diagnostics you want installed; then either take the default (press **↓**) or type the number (octal!). The Formatter will now assume that this disk is a system disk.

*Disk number 1: 00000000000 through n*

*LDU unique I.D. (1 to 6 characters)? [ **↓** ]?*

The numbers 0 through n are the first and last logical addresses on the disk, in octal.

- 19e. The Disk Formatter wants a unique ID for the disk. Later, AOS/VS will use this to keep track of the physical disks in this LDU. The ID must be 1 to 6 characters long. Any AOS/VS filename character is legal: A through Z (uppercase and lowercase are treated the same), 0 through 9, period (.), dollar sign (\$), question mark (?), and underscore (\_).

Generally, use an ID that is as close as possible to the name you want to give the LDU. For example, you could use an ID of ROOT1:

ROOT1 **↓**

*LDU name (1 to 31 characters) [ **↓** ]?*

- 19f. The Formatter wants a name for the LDU. Later, when you start AOS/VS (or initialize this LDU), the name you enter now will be displayed.

This is the master LDU; it will be the system root directory (:). So the name you type is not important in terms of file access.

But for any disk that is not the system disk, the name you type here becomes the filename of the LDU. People can use this name just as any other directory filename. For example, if you have a lot of users and want to put some of them on a nonsystem LDU, you might name the LDU something like UDD1. Or, for a big multidisk LDU, you might choose the name DATABASE. You can always change the LDU name later with the Disk Formatter Partial format (covered in the Disk Formatter chapter).

For optimum performance, if you have many large disks and can afford the disk space, you might want to dedicate an LDU to the AOS/VS SWAP and PAGE directories. To do this, assign a logical disk name of BOTH **↓**. Then assign a username of + **↓** and an access control list of E **↓**. This disk will *not* be a system disk. Later on, at VSGEN, you'll give this disk's unit name as the SWAP and PAGE file parameter. Then, when you bring up your tailored system, AOS/VS will use this LDU for swapping/paging. An LDU you dedicate for swapping/paging should be a DPJ- or DPF-type disk to be large enough; and it should — ideally — be on its own controller.

For your first LDU, come up with a name with from 1 to 31 filename characters and type it. For simplicity, you can make this the same as the unique ID. For example,

ROOT1 **↓**

Whatever name (and unique ID) you chose, note them for future reference.

*Access Control List*

*Username or template (1 to 15 characters)?*

- 19g. A user, identified by a user name, or a group of users, identified by a template, can have different kinds of access to a logical disk. A good general-purpose username template is +, which specifies all users:

+ **↓**

*Access (O, W, A, R, E, or NEW LINE)?*

- 19h. The Disk Formatter wants to know which access privileges to give the username(s) you just specified. There are five types of privileges: Owner, Write, Append, Read, Execute (OWARE). A NEW LINE gives the user no access. Execute (E) access will suffice for most disks. So type

E ↵

*Username or template (1 to 15 characters)?*

- 19i. The Disk Formatter will repeat the *Username and Access* questions, allowing you to give very specific user and access information, until you answer ↵ to *Username...* You can change the access control list of any LDU when AOS/VS is running — so the answers you give in steps 19g and 19h are not critical. Generally, answer + ↵ to question 19g, answer E ↵ to question 19h, and answer ↵ to this question. Later, if needed, you can change access to the LDU. So type

↵

*Surface analysis? [N]*

20. This step starts a series on surface analysis for this LDU. (The value in brackets is the default, which the Formatter will use if you answer with ↵.)

For each new disk, you should answer Y ↵ to this question. During analysis, the Formatter writes a pattern to each 16-bit word on the disk and reads it back. This destroys all existing information on the disk — but a new disk has no information. Answer yes by typing

Y ↵

*Disk number?*

- 20a. The Formatter wants the number of the disk to analyze. For a single-disk LDU, press

↵

*You may run up to five (5) patterns. How many would you like to run?*

- 20b. The Formatter can run up to five bit patterns on the disk to check for bad blocks. You can specify any number, 1 through 5. It's very important for the Formatter to identify all bad blocks so that AOS/VS will bypass them. We recommend that you run all five patterns on each disk you format.

Each pattern takes between 8 and 60 minutes, depending on the disk model, as shown in Table 3-2. So five patterns may take a while. To run five patterns, type

5 ↵

*Analyzing Disk n*

-- *Running pattern n*

The Formatter runs the patterns you specified, one by one. If it finds too many bad blocks, it aborts. This may mean that the disk heads are misaligned. But in most cases, it's simply a matter of waiting.

When the Formatter has finished the patterns, it describes the bad blocks on the disk.

- 20c. If the Formatter found no bad blocks, it displays *0 bad disk blocks*. Skip to step 20e, *Additional bad block number?* question.  
If it found any bad blocks, it displays  
*n bad disk blocks*  
*Display bad block statistics? [N]*

**Table 3-2. Surface Analysis Times for Popular Disks**

Disk Model	Capacity (megabytes)	Time per Test Pattern
6060	96	13 minutes
6061	190	17 minutes
6122	277	26 minutes
6160	73	11 minutes (approximately)
6161	147	22 minutes (approximately)
6214	602	52 minutes
6234	50	8 minutes (approximately)
6236, 6237	354 per unit	24 minutes per unit (approximately)
6239, 6290, 6240	592 per unit	50 – 60 minutes per unit (approximately)

- 20d. The Formatter is asking if you want to see the bad block statistics. These statistics may be useful, so answer yes.  
*Y ↵*  
The Formatter now displays the bad block statistics on the console. If there are bad blocks, you might want to note them. There should be few, if any, bad blocks on a new disk (but over a thousand bad blocks are allowed on a 602-megabyte model 6214 disk).  
*Additional bad block number (press NEW LINE when done):*
- 20e. You have no additional bad blocks to enter, so press  
*↵*  
*Display bad block statistics ? [N]*
- 20f. Press *↵*  
*Bitmap size: n*  
*Bitmap address? [default]*  
The bitmap is a system table that describes which blocks are in use and which are free for data storage.
21. Select the default by pressing  
*↵*  
*System disk? [Y]*

22. This step starts a series that determines whether and where an AOS/VS system will reside on the disk. The Formatter skips this question if you allocated a diagnostic area earlier in step 19c.

Your first LDU must be a system disk. Other LDUs need not be system disks. For your first LDU, answer *Y* for the default.

*Y*

*Overlay area size? [default]*

22a. Choose the default area size by pressing

*Y*

*Overlay area address? [default]*

22b. Choose the default address by pressing

*Y*

*Disk number n remap area size? [default]*

23. Choose the default remap area size by pressing

*Y*

*Disk number n remap area address? [default]*

23a. Choose the default remap area address by pressing

*Y*

— *LDU created*

*Done!*

*CPU HALTED*

<i>AC0</i>	<i>AC1</i>	<i>AC2</i>	<i>AC3</i>	<i>PC</i>	<i>C MAP</i>	(These lines don't appear on MV/4000)
<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>0 PHYS</i>	

*SCP-CLI>*

Congratulations! You've formatted an LDU as a system disk. It will rarely — if ever — need full formatting again. If this LDU may be run as a nonmaster LDU, we suggest that you note the date, LDU ID and unit name, and any bad block information — and attach the note to the disk unit (or, for a removable disk, the plastic housing).

The Formatter is done and the SCP-CLI has control. If you have other new disks, someone must format them into LDUs before they can be used. If you know what LDU configuration(s) you want, you might want to create the LDU(s) now — while you're familiar with the procedure. To do it now, type **CONTINUE** *Y* and return to step 18. To format a disk *not* described in this chapter, see the Disk Formatter chapter.

If you don't want to format other disks now, proceed and install the AOS/VS starter system.

## Installing the AOS/VS Starter System

The Installer program installs an AOS/VS system from a system tape onto an LDU. (AOS/VS must reside on disk before it can run.)

### Mistakes and Errors

If you make a mistake, you can handle it the same way as with the Disk Formatter.

If the Installer reports a disk or other error, check the error message in the table near the end of the Installer chapter.

If the Installer stops with an *ABORT* message, go to step 24 and start the Installer dialog again.

## Running the Installer

24. The SCP CLI prompt is showing on the console. Reset the CPU:  
RESET ↵  
SCP-CLI>
25. Boot the tape bootstrap into memory:  
BOOT 22 ↵ (Or BOOT 62 if tape is on an MTD unit.)  
Tape file number?
26. The Installer is in tape file 3, so type  
3 ↵  
TBOOT moves the tape forward to file 3, loads the Installer into memory, rewinds the tape, then executes the Installer program. The Installer displays  
AOS/VS Installer Rev n  
Specify each disk in the LDU  
Disk unit name?
27. Type the name of the unit that holds your newly-created LDU. This is the same unit name you gave to the Disk Formatter earlier, in step 19. For example,  
DPJ0 ↵ (Or DPF0 ↵ or DPI0 ↵)  
Device code [default] ?
28. As with the Formatter, press ↵ to select the default code:  
↵  
-- Disk bootstrap installed  
Do you want to install a System Bootstrap [Y] ?
29. You must install a system bootstrap the first time you install a system and when you install a new revision. The first disk in a system LDU must have a system bootstrap, so press  
↵  
Install from which unit [MTC0] ? (or MTD0)
30. Press  
↵  
Device code [22] ? (or 62)
- 30a. If the tape unit is on the default MTB/MTC device code (22), press ↵. If it is on a different device code (e.g., 62), type the device code and ↵.  
File number [4] ?
31. The system bootstrap, SYSBOOT, is in tape file 4. So press  
↵  
The Installer now copies SYSBOOT from tape to the LDU. Then it displays  
-- System Bootstrap installed  
Do you want to install a System [Y] ?
32. You want to install a system, so press  
↵  
Install from which unit [MTC0] ? (or MTD0)

33. Press  
↓  
*Device code [22] ? (or 62)*
- 33a. Answer this as you did the previous device code question, with ↓.  
*File number [5] ?*
34. The AOS/VS system is always in file 5 of the system tape, so press  
↓  
The Installer now copies the AOS/VS system from tape to the LDU. Then it announces  
-- *System installed*  
*Done!*  
...  
*SCP-CLI>*

You've installed the needed bootstraps and an AOS/VS system on your LDU. Now you can bring up the AOS/VS system.

## Bringing Up the AOS/VS Starter System

35. The SCP CLI has control; use it to reset the computer:  
*RESET ↓*  
*SCP-CLI>*
36. Boot again, this time from the *disk*. Use the device code shown in Table 3-1. For example,  
*BOOT 24 ↓* (Or *BOOT 27* for a DPF-type disk; or *BOOT 33* for a model 6234 disk)
- Operating System Load Menu*
- 1 Continue immediately with operating system load*  
*2 Enter the Technical Maintenance Menu*
- Loading will continue automatically unless you respond within 45 seconds.*
- ...  
*The default system pathname [INSTALLED SYSTEM]*  
...  
*Enter choice [1]:*
37. Press ↓  
*AOS/VS Rev n*  
*Master LDU: ROOT1* (Name you gave to Formatter)  
*Date (MM/DD/YY) ?* (Skipped on computers with a boot clock)
38. Type the date as numbers for month, day, and year. Spaces or slashes can separate each number. For example, for May 23, 1986, you'd type  
*5 23 86 ↓*  
*Time (HH:MM:SS) ?* (Skipped on computers with a boot clock)



39. Type the time, based on a 24-hour clock, in hours, minutes, and seconds. (Minutes and seconds are optional. If you omit them, the system sets each to 0.) Use spaces or colons to separate items. For example, for 2:30 p.m., you'd type
- ```
14 30 )
```
- Override default specs [N] ?*
40. Specs means the parameters in the system specification file created during VSGEN. For your first system, you must answer yes, so type
- ```
Y )
```
- Number of buffers in cache [default]?*
41. Press
- ```
)
```
- Swap directory definition [default]?*
42. Press
- ```
)
```
- Page directory definition [default]?*
43. Press
- ```
)
```
- Initial load [N]?*
44. In an *Initial load*, the system loads the CLI and other needed files onto the LDU. These files must be loaded the first time you bring up the starter system; they need not be loaded again unless — later on — you want to load a new revision of AOS/VS. Answer yes by typing
- ```
Y )
```
- Filename [@MTC0:6]?*
45. Answer ) to specify the default, tape file 6:
- ```
)
```
- The starter system copies files from it to the LDU. Then it displays
- ```
AOS/VS CLI REV n date time
```
- ```
)
```
- Congratulations! You've brought up AOS/VS and its CLI. The CLI's prompt, ), tells you that it is ready for a command.
- (If you get a *FILE DOES NOT EXIST* message, a needed file wasn't loaded. Perhaps you forgot to answer Y ) to the *Initial load* question. In any case, run Emergency Shutdown (ESD) by typing RESET ), START 50 ), and ); then return to step 35 to try again. For a description of errors by numeric code, see Chapter 17.)
- The CLI is far more sophisticated than any program you've been using. It has many commands and fine error handling; it has a HELP feature that you can use after you've loaded the next tape file. You can interrupt executing CLI commands by typing CTRL-C CTRL-A. As always, you can delete characters with DEL and delete bad lines with CTRL-U; and you can type CTRL-S to suspend display and CTRL-Q to restore it (useful for reading long files on a display console.)
46. Now you can load tape file 7 and all its programs. First, turn on Superuser to provide write access.
- ```
) SUPERUSER ON )
```
- ```
*)
```

With AOS/VS running, you are subject to file access controls — which means that you would get an error message if you tried to load files into the root directory. Superuser allows you to bypass all file access controls. The asterisk before the ) prompt means that Superuser is on.

47. Load the system utilities and files from tape file 7 by typing

\*) XEQ LOAD\_II/V @MTC0:7 ) (Or XEQ LOAD\_II/V @MTD0:7  
if tape is on an MTD unit.)

...

Even if the tape is mounted on an MTB unit, you must specify MTC to the starter system.

The CLI verifies (/V switch) the directory and filenames loaded from tape by printing their names on the system console. (Don't be surprised to see warning messages about files already loaded; some files in tape file 7 also exist in tape file 6.) The whole directory structure on the tape is copied, creating directory :UTIL (with utilities), directory :SYSGEN (for system generation), and directory :HELP (for help).

All these directories (along with files like DFMTR, the Disk Formatter) are copied into the *root* directory. The root directory's name is : (colon), so the pathname to any of these newly-created directories is

:directory-name

for example, :UTIL.

After all these files have been loaded, the CLI Superuser prompt returns.

\*)

48. Rewind the tape by typing

\*) REWIND @MTC0 ) (Or REWIND @ MTD0)

49. Now, if you received an AOS/VS *update* tape, get it. If not, skip this step. Updates have revision numbers with the last two digits not 00. For example, 7.01 is an update number. Mount the tape on unit 0, and type

\*) LOAD/V/D @MTC0:0 ) (Or LOAD/V/D @MTD0:0)

... (CLI verifies load of update notice and patch files.) ...

\*) REWIND @MTC0 ) (Or REWIND @MTD0)

This puts AOS/VS update and patch files on the LDU, for access later on. Dismount the update tape from unit 0.

50. Get the MV/n system tape that you used earlier and mount it on the tape unit. (For MV/8000, skip this step.) Load the microcode/SCP-OS file into the LDU root directory by typing

\*) DIR : )

\*) LOAD/V/R/NACL @MTC0:1 ) (Load from tape file 1. Use  
LOAD/V/R/NACL @MTD0:1 if tape is on  
an MTD unit.)

*MVn.MCF*

(CLI verifies load of microcode file; for example *MV8000\_II.MCF*. With some machines, there are two files: one with floating-point microcode and one without. For example, you might see names *MV4000.MCF* and *MV4000FP.MCF*.)

\*) REWIND @MTC0 ) (Or REWIND @MTD0)

This puts the microcode/SCP-OS file(s) on the LDU. In future, SYSBOOT will load the correct file automatically as needed.

51. You're done with the DG-supplied tapes. Remove the tape from the unit, clip the cover ring around it, and store it safely. You may need it again if you want to run diagnostics on the CPU. Clip cover rings on all DG-supplied tapes and store them safely too.

52. Turn Superuser off by typing

```
*) SUPERUSER OFF ↓  
)
```

The ) is the standard CLI prompt.

53. Now, for any machine *except* an MV/4000 with hardware floating point, skip to the next step, step 54.

For an MV/4000 with hardware floating point, you should identify the correct microcode file to SYSBOOT so SYSBOOT can load it in the future. (SYSBOOT can identify the proper file for all computers except MV/4000s with hardware floating point.) To do this, shut the system down and bring it up again as follows:

- 53a. Type

```
) BYE ↓
```

- 53b. *Do you really want to shut the system down? Y ↓* (Type Y ↓)

```
System shutdown  
SCP-CLI>
```

- 53c. Press the computer panel POWER switch to OFF. Then press the panel LOCK switch ON; and press POWER ON. This program loads from the primary disk device code (selected inside the machine with hardware jumpers).

#### *Operating System Load Menu*

*1 Continue immediately with operating system load*

*2 Enter the Technical Maintenance Menu*

...

*Enter choice [1]:*

- 53d. You want to enter the Technical Maintenance Menu, so type 2 ↓.

#### *Technical Maintenance Menu*

...

*9 View or change the microcode filename*

...

*Enter choice [1]:*

- 53e. You want option 9, so type

```
9 ↓
```

SYSBOOT prompts

*Default microcode filename [default]:*

- 53f. Type the name of the *floating-point microcode file*, which is MV4000FP.MCF:

- 53g. Now, choose option 1 to load the default operating system *and* the new microcode file:

1 ↓

*AOS/VS Rev n*

- 53h. *Date (MM/DD/YY)?* 5 23 86 ↓ (Type the current date. Skipped if you have a boot clock.)

- 53i. *Time (HH:MM:SS)?* 14 40 ↓ (Type the current time. Skipped if you have a boot clock.)

- 53j. *Override default specs [N] ?* ↓ (Press ↓ to say no.)

*AOS/VS CLI REV n date time*

Via SYSBOOTs Technical Maintenance Menu, you selected the floating-point microcode file as the default to be loaded automatically — allowing your MV/4000 floating-point hardware to do its job. The filename you specified has been recorded on disk. The file's name will be displayed as the "Default microcode filename" from now on, and the file will be loaded automatically when you bring up AOS/VS. You will rarely (if ever) need to identify the file again.

54. On the computer front panel, press the LOCK rocker switch ON (or LOCK) position (if the switch is not already at ON). On an MV/20000, press the DISPLAY switch, if other switches are lit, in order to disable them.

Well done! You've powered up, formatted at least one LDU, installed an AOS/VS system on it, brought up AOS/VS, and loaded all files you need to generate your tailored system.

If you're interested in the files on the system tape, see Table 3-3; all of these files are now on your LDU. The LDU also contains directory :PATCH, with current patch files (if you loaded an update tape). Also, the LDU contains the microcode file, MVn.MCF.

Figure 3-1 is a summary of all the steps you've taken — from turning on the system console to locking the computer.

**Table 3-3. AOS/VS System Tape File Format**

| <b>Tape File Number</b> | <b>Program Filename</b> | <b>Tape File Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0                       | TBOOT                   | Tape bootstrap; a short program that can load files 1, 2, and 3 from this tape.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 1                       | FIXUP                   | Disk Fixer utility, which finds and optionally corrects disk file errors if abnormal AOS/VS shutdown occurs. TBOOT loads this program into memory and executes it after you type 1 ) to the Tape file number? query.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 2                       | DFMTR                   | Disk Formatter utility, which formats physical disks into LDUs. TBOOT loads DFMTR into memory and executes it after you type 2 ) to the Tape file number? query.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 3                       | INSTL                   | Installer utility, which installs an AOS/VS system from a system tape. TBOOT loads INSTL into memory and executes it after you type 3 ) to the Tape file number? query.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 4                       | SYSBOOT                 | The system bootstrap program loads an AOS/VS system or other program into memory <i>from disk</i> , then executes the program. The Installer installs SYSBOOT onto an LDU.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 5                       | AOS/VS system           | On the DG-supplied system tape, this is the AOS/VS starter system. Use the Installer to install the starter system on the disk. On a system tape you make, it is your tailored AOS/VS system. Use SYSBOOT's Technical Maintenance Menu to make the tailored system the default system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 6                       | First Dump File         | The CLI and other system program files, including the system Agent, peripheral manager (PMGR, LOAD_II program), and copies of programs in tape files 0 through 4. AOS/VS copies the contents of this tape file into the LDU root directory when you specify INITIAL LOAD.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 7                       | Second Dump File        | <p>You copy the contents of this file onto disk using the LOAD_II program, as part of the initial load procedure. This tape file contains nearly all AOS/VS support software files, including the</p> <ul style="list-style-type: none"> <li>- CONTEST system exerciser</li> <li>- Disk File Editor (FED)</li> <li>- DISPLAY file display</li> <li>- Error message (ERMES) and message object files (.OBs)</li> <li>- EXEC and PREDITOR</li> <li>- HELP directory and files</li> <li>- LABEL tape labeler</li> <li>- Link</li> <li>- Library File Editor</li> <li>- Macroassembler (MASM)</li> <li>- Process Environment Display (PED)</li> <li>- Release Notice (latest on software)</li> <li>- SED and SPEED text editors</li> <li>- System macros</li> <li>- Utility program symbol table files (.ST)</li> <li>- SYSGEN directory with VSGEN system generation program and libraries</li> </ul> |

## Powering Up and Loading Microcode

1. Have the system console on and on line, ALPHA LOCK on.
- 1a. Have disk(s) READY, inserting packs first if removable.
2. With any machine (except a blue and white MV/8000), skip to step 3. With a blue and white MV/8000, do the following:
  - 2a. Make sure MV/8000 diskette is inserted in CPU diskette unit.
  - 2b. Press CPU power on.  
*\*CONSOLE READY\**
  - 2c. *ENTER DATE (MO DAY YR) 5 23 86* (Type current date.)
  - 2d. *ENTER TIME (HR MIN) 13 30* (Type the time, 24-hour clock.)  
*LOADING MICROCODE FROM FILE...*
  - 2e. *MICROCODE(1 = STD, 2 = C350/MMPU[1])?*  
*SCP-CLI>*  
Skip to step 14.
3. Press CPU panel LOCK switch (if there is one) to OFF or unlock position. Then press the computer POWER (or PWR) switch to ON.  
*\*\* POWER UP TESTING COMPLETED \*\**  
*WARNING: Configuration changed ... (MV/20000s)*  
*SCP-CLI>*  
or  
*\*\* POWER UP TESTING COMPLETED \*\**  
*BOOT DEVICE?* (Everything else except for MV/4000)  
or  
*MV4000 READY*  
*@* (MV/4000)
4. Get *MV/n* system tape (for example, MV/4000 system tape).
5. Turn POWER ON on to tape unit 0.
6. Mount (or insert) the *MV/n* system tape in tape unit 0.
7. With tape unit switches, put the tape unit on line.
8. With an MV/20000 Model 2, MV/20000 Model 1, or MV/20000 C, continue with step 9. With an MV/10000 SX or MV/10000, skip to step 10. With an MV/8000 II, MV/8000 C, or MV/6000, skip to step 11. With an MV/4000, skip to step 12.
- 9a. *SCP-CLI> FLAGS AUTOBOOT*  
*AUTOBOOT [DISABLED] 0 = DISABLE, 1 = ENABLE*
- 9b. *> ENABLE* (Type ENABLE)
- 9c. *ENTER DEVICE CODE> 24* (Or 27)
- 9d. *ENTER CHANNEL # 0* (Type 0)  
*SCP-CLI>*

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Figure 3-1. Step Summary, Bringing Up AOS/VS on Blank Disk(s), Systems Other Than MV/4000 DC, MV/4000 SC, and Data General DS/4000-series (continues)

- 9e. Turn computer power off, then on again.  
**\*\*POWER UP TESTING COMPLETED\*\***  
*Automatic Program Load Menu*  
 1 Continue immediately with preset values  
 2 Change preset values  
 ...
- 9f. Enter choice [1]: 2 ↵ (Type 2 ↵)  
*Change Preset Values Menu*  
 ...  
 2 Change the system date or time  
 ...
- 9g. Enter choice [1]: 2 ↵ (To set the time, type 2 ↵)
- 9h. Date [22-JUL-86]: 20-JUN-86 ↵
- 9i. Time [hh:mm:ss]: 13:30:00 ↵
- 9j. Offset to GMT [+00:00]: ↵
- 9k. Enter choice [1]: 6 ↵  
 SCP-CLI>  
 Skip to step 13.
10. On an MV/10000 SX or MV/10000, the system console prompts  
**BOOT WHAT DEVICE? (CHANNEL AND DEVICE CODE):**  
 Type the break sequence: CMD and BREAK key, or BRK, or BREAK key, depending on your system console.
- 10a. ! 22T (Or type 62T if the tape is on a type MTD unit.)  
 TOP OF MEMORY = n  
 HIDTOS REV n ...  
 ...
- 10b. \* LOAD SCPOS ↵  
 LOAD:  
 SCPOS REV n  
 ... (A minute or so passes.) ...  
 MV/10000 SYSTEM CONTROL PROGRAM REVISION n  
 CHECK-SUM OK  
 ...
- 10c. ENTER DATE (MO DAY YR) 5 23 86 ↵ (Current date)
- 10d. ENTER TIME (HR MIN) 13 30 ↵ (Current time)  
 BEGIN SYSTEM INITIALIZATION  
 ...  
 SCP-CLI>  
 Go to step 13.

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Figure 3-1. Step Summary, Bringing Up AOS/VS on Blank Disk(s), Systems Other Than MV/4000 DC, MV/4000 SC, and Data General DS/4000-series (continued)

11. On an MV/8000 II, MV/8000 C, or MV/6000, the system console prompts *BOOT DEVICE?*

*BOOT DEVICE?* 22 ↓ (Type 22 — or 62 if tape is on a type MTD tape unit.)

*TOP OF MEMORY = n*

*HIDTOS REV n*

*TESTOK*

...

- 11a. \* *LOAD SCPOS* ↓

*SCPOS REV n*

... (A minute or so passes.) ...

*MV/n000 SYSTEM CONTROL PROGRAM REVISION n*

*CHECK-SUM OK*

- 11b. *ENTER DATE (MO DAY YR)* 5 23 86 ↓ (Current date)

- 11c. *ENTER TIME (HR MIN)* 13 30 ↓ (Current time)

*BEGIN SYSTEM INITIALIZATION*

...

*SCP-CLI>*

Go to step 13.

12. With an MV/4000, the system console shows @.

@ 22L (Type 22L)

*TOP OF MEMORY = n*

*HIDTOS REV n*

*TESTOK*

...

- 12a. On MV/4000 without floating-point, type *LOAD MV/4000* ↓; with floating-point, type *LOAD MV/4000FP* ↓

*MV/4000 MICROCODE REV n...*

...

- 12b. *MV/4000 MICROCODE REV n LOADED AND VERIFIED*

\* *EXIT* ↓

*SCP-CLI>*

13. Dismount MV/n system tape.

14. Mount AOS/VS system tape.

### Running the Disk Formatter

15. *SCP-CLI>* *RESET* ↓

16. *SCP-CLI>* *BOOT* 22 ↓ (Or *BOOT* 62 if tape is on an MTD unit.)

17. *Tape file number?* 2 ↓

*AOS/VS Disk Formatter Rev n*

*Full format destroys any AOS/VS file structure, Partial retains it.*

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Figure 3-1. Step Summary, Bringing Up AOS/VS on Blank Disk(s), Systems Other Than MV/4000 DC, MV/4000 SC, and Data General DS/4000-series (continued)



18. *Full (F) or Partial (P or NEW LINE)?*    **F** ↓  
*Full Format*  
*Specify each disk in the LDU (press NEW LINE when done)*
19. *Disk unit name?*    **DPJ0** ↓            (Or DPF0 or other disk unit name)
- 19a. *Device code [default] ?*    ↓
- 19b. *Disk unit name?*    ↓
- 19c. *Do you want to allocate a diagnostic area? [Y]*    **N** ↓  
The Advanced Diagnostic system needs about 10,000 blocks of space. If you don't want to install and run this system from the disk, type **N** ↓ and skip to step 19e. To allot the space (system disk only), press ↓.
- 19d. *Enter the number of blocks (1750 to 35230) required [23420] ?* ↓  
*Disk number 1: 00000000000 through n*
- 19e. *LDU unique I.D. (1 to 6 characters)? []*    **ROOT1** ↓            (Valid disk ID)
- 19f. *LDU name (1 to 31 characters) []?*    **ROOT1** ↓    (Valid LDU name)
- 19g. *Username or template (1 to 15 characters)?*    **+** ↓
- 19h. *Access (O, W, A, R, E, or NEW LINE) ?*    **E** ↓
- 19i. *Username or template (1 to 15 characters)?*    ↓
20. *Surface analysis? [N]*    **Y** ↓
- 20a. *Disk number?*    ↓
- 20b. *You may run up to five (5) patterns. How many would you like to run?*    **5** ↓ (Choose patterns)  
*-- Running pattern n*            (Takes 8 to 60 minutes per pattern)
- 20c. If it found no bad blocks, go to 20e.  
*n bad disk blocks*
- 20d. *Display bad block statistics? [N]*    **Y** ↓  
Note bad blocks (except for a model 6214 disk).
- 20e. *Additional bad block number (press NEW LINE when done):*    ↓
- 20f. *Display bad block statistics? [N]*    ↓  
*Bitmap Size: n*
21. *Bitmap address? [default]*    ↓
22. *System disk? [Y]*    ↓ (Skipped if you answered **Y** to question 19c)
- 22a. *Overlay area size? [default]*    ↓
- 22b. *Overlay area address? [default]*    ↓

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Figure 3-1. Step Summary, Bringing Up AOS/VS on Blank Disk(s), Systems Other Than MV/4000 DC, MV/4000 SC, and Data General DS/4000-series (continued)

23. *Disk number n remap area size? [default] ↵*
- 23a. *Disk number n remap area address? [default] ↵*  
*-- LDU created*  
*Done!*
- ...
- SCP-CLI>*
- To format other disks, type CONTINUE ↵ and return to step 18.

### Running the Installer

24. *SCP-CLI> RESET ↵*
25. *SCP-CLI> BOOT 22 ↵* (Or BOOT 62 if tape is on an MTD tape unit.)
26. *Tape file number? 3 ↵*  
*AOS/VS Installer Rev n*  
*Specify each disk in the LDU*
27. *Disk unit name? DPJ0 ↵* (Or DPF0 or other disk unit name)
28. *Device code [default] ? ↵*  
*-- Disk bootstrap installed*
29. *Do you want to install a System Bootstrap [Y] ? ↵*
30. *Install from which unit [MTC0] ? (Or MTD0) ↵*
- 30a. *Device code [22]? ↵* (Or 62)
31. *File number [4] ? ↵*  
*-- System Bootstrap installed*
32. *Do you want to install a System [Y] ? ↵*
33. *Install from which unit [MTC0] ? ↵*
- 33a. *Device code [22]? ↵* (Or 62)
34. *File number [5] ? ↵*  
*-- System installed*  
*Done!*
- ...
- SCP-CLI>*

### Bringing Up the AOS/VS Starter System

35. *SCP-CLI> RESET ↵*
36. *SCP-CLI BOOT 24 ↵* (Or BOOT 27 for a DPF disk; or BOOT 33 for a model 6234 disk)
- Operating System Load Menu*
- ...

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Figure 3-1. Step Summary, Bringing Up AOS/VS on Blank Disk(s), Systems Other Than MV/4000 DC, MV/4000 SC, and Data General DS/4000-series (continued)

37. Enter choice [1]:  
AOS/VS Rev n  
Master LDU: ROOT1 (LDU name you gave to Disk Formatter)
38. Date (MM/DD/YY)? 5 23 86 (Current date. Skipped if you have a boot clock.)
39. Time (HH:MM:SS)? 14 30 (Current time, 24 hour clock. Skipped if you have a boot clock.)
40. Override default specs [N]? Y
41. Number of buffers in cache [default]?
42. Swap directory definition [default]?
43. Page directory definition [default]?
44. Initial load [N]? Y
45. Filename [MTC0:6]? (Or MTD0:6)  
(Tape file 6 is loaded)  
AOS/VS CLI REV n date time  
)
46. ) SUPERUSER ON
47. \*) XEQ LOAD\_II/V @MTC0:7 (Or XEQ LOAD\_II/V @MTD0:7 if tape is on an MTD unit.)  
... (CLI displays file and directory names loaded.) ...
48. \*) REWIND @MTC0 (Or REWIND @MTD0 with an MTD unit.)
49. Get and mount AOS/VS update tape (if any). Type  
\*) LOAD/V/D @MTC0:0 (Or LOAD/V/D @MTD0:0 with an MTD unit.)  
... (CLI verifies patch files loaded.) ...  
\*) REWIND @MTC0 (Or REWIND @MTD0)  
Dismount AOS/VS update tape.
50. Mount MV/n system tape (skip for MV/8000). Type  
\*) DIR :  
\*) LOAD/V/R/NACL @MTC0:1 (Or LOAD/V/R/NACL @MTD0:1)  
MVn.MCF (CLI verifies microcode filename(s).)  
\*) REWIND @MTC0 (Or REWIND @MTD0)
51. Dismount tape; store all tapes safely.
52. \*) SUPERUSER OFF  
)
53. For any computer except MV/4000 with hardware floating point, go to step 54.

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Figure 3-1. Step Summary, Bringing Up AOS/VS on Blank Disk(s), Systems Other Than MV/4000 DC, MV/4000 SC, and Data General DS/4000-series (continued)

- 53a. ) BYE ↓
- 53b. *Do you really want to shut the system down?* Y ↓  
*System shutdown*  
 SCP-CLI>
- 53c. Press computer POWER switch OFF. Then press LOCK switch ON and POWER switch ON.  
*Operating System Load Menu*  
 ...
- 53d. *Enter choice [1]:* 2 ↓  
*Technical Maintenance Menu*
- 53e. *Enter choice [1]:* 9 ↓
- 53f. *Default microcode filename [default]:* MV4000FP.MCF ↓  
*Technical Maintenance Menu*
- 53g. 1 ↓ (Loads and starts the starter system  
 and the new microcode file)  
 AOS/VS Rev n
- 53h. *Date (MM/DD/YY)?* 5 23 86 ↓ (Current date. Skipped if you have a boot clock.)
- 53i. *Time (HH:MM:SS)?* 14 40 ↓ (Current time. Skipped if you have a boot clock.)
- 53j. *Override default specs [N]* ↓ (Press ↓ to say no.)  
 AOS/VS CLI REV n date time
54. On computer front panel, press LOCK switch to ON or LOCK position (if not already at ON).  
 On an MV/20000, press DISPLAY switch (if other switches are lit).

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*Figure 3-1. Step Summary, Bringing Up AOS/VS on Blank Disk(s), Systems Other Than MV/4000 DC, MV/4000 SC, and Data General DS/4000-series (concluded)*

## What Next?

If you want to stop for a while, fine. To shut down AOS/VS, you can type BYE ↓, then Y ↓. To bring it up again, type BOOT device code (24, 27, or 33) wait for the time outs; then accept the default values for each question except the DATE and TIME if prompted by pressing ↓.

If this is your first system, and you want to generate a tailored system now, go to Chapter 4.

If you are rebuilding/restoring a tailored system, the next steps are to start EXEC (Chapter 5) and load user and application directories and files from backup media.

End of Chapter

# Chapter 4

## Generating a Tailored AOS/VS System

Read this chapter

- when you want to generate your first tailored AOS/VS system;
- whenever you want to generate a new AOS/VS system.

This chapter tells you how to run VSGEN, the AOS/VS system generation program. First, it describes bootstrapping (in case you shut down AOS/VS); then it explains VSGEN and leads you through a VSGEN session — devices, parameters, naming and building. Finally, it shows you how to test, patch and make the tailored system the default system. The major sections are

- System Startup (Power On)
- About the VSGEN Program
- VSGEN Session
- Installing Patches
- Testing the New System
- Making a Tailored System Tape or Diskette
- Making the Tailored System the Default System
- Generating Other Tailored Systems
- Supporting Synchronous Devices

VSGEN is really very easy — the only tricky part is specifying the device (IAC, MCP1, CPI, DRT, or ATI) that handles user consoles. If you know about this device, the only other things you need to specify are a disk, tape unit, and perhaps a line printer. The whole thing may take only a few minutes. This chapter is large because it gives details — but you can find summaries of simple VSGENs in Figures 4-6 and 4-7, later in the chapter.

There must be an AOS/VS system running before you can run VSGEN. This can be either the DG-supplied starter system or your own previously generated tailored system.

### System Startup (Power On)

Read this section only if AOS/VS is not running. If it is running (shown by the CLI ) prompt), skip to the next section.

The SCP-CLI prompt should be showing. Next to the SCP-CLI> prompt, type your response.

```
SCP-CLI> RESET )  
SCP-CLI> BOOT 24 )      (Or 27 for DPF-type disks; or 33 for model 6234 disks)
```

SYSBOOT displays

*Operating System Load Menu*

```
1 Continue immediately with operating system load  
2 Enter the Technical Maintenance Menu  
...
```

*Enter choice [1]:*

```
| Type 1 ↵ or wait for the time-out period to expire; the bootstrap program then loads AOS/VS.
Date (MM/DD/YY) ? 5 23 86 ↵      (Enter current date. Computers that have a boot
                                   clock supply the system date and time.)

Time (HH:MM:SS) ? 15 20 ↵      (Current time)

Override default specs [N] ? ↵

... (Pause occurs) ...

AOS/VS CLI REV n date time
)
```

The master CLI process is running. Now you can run VSGEN to generate a tailored system.

## About the VSGEN Program

VSGEN is a utility program that creates an operating system tailored for the hardware you specify; it also allows you to select some parameters for system operation. You can specify CPU model, add devices, review current specifications, change parameters, list devices, create a specification file (a source file from which VSGEN can build a system), or build a system (instruct VSGEN to build an operating system to your specifications).

The first time you run VSGEN, you'll be starting with a default specification. You will modify and add devices as needed. You'll probably use an existing VSGEN spec file for a base — and you'll edit or add only a few devices.

VSGEN is interactive, with extensive help messages. You can get help from it at any point by typing ? ↵.

VSGEN includes the following files:

|            |                        |
|------------|------------------------|
| VSGEN.PR   | The program file.      |
| VSGEN.ST   | The symbol table file. |
| VSGEN.DATA | A VSGEN data file.     |
| VSGEN.QUES | A VSGEN data file.     |

Directory :SYSGEN — created during the AOS/VS initial load — holds all VSGEN files and needed system generation libraries. So directory :SYSGEN is ready for system generation.

## Files VSGEN Creates

VSGEN creates several files, including temporary files, in directory :SYSGEN. The temporary files carry a .TMP filename suffix. Table 4-1 lists all files that VSGEN creates.

**Table 4-1. Files VSGEN Creates**

| Filename            | Comments                                                                                                                                                                                                                          |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| sys.PR              | This is the tailored operating system file, ready to run. VSGEN creates it after you issue the BUILD command. sys is the NAME you give the system with the NAME command.                                                          |
| sys.ST              | This is the operating system symbol table file, which may be useful to DG personnel if the system doesn't run perfectly. VSGEN creates it along with the tailored system file.                                                    |
| sys.CSF             | The Customer Specification (spec) File. It describes this system's hardware and software parameters. This file is in ASCII so you can print or type it. VSGEN creates this spec file in response to your SPEC or BUILD command.   |
| sys.SSF             | The System Specification File. It describes each system in a form that VSGEN can read. VSGEN creates this spec file in response to your SPEC or BUILD command.                                                                    |
| ?pid.VSGEN.CURR.TMP | A temporary data file where VSGEN keeps information during a VSGEN session. pid is the numeric VSGEN process ID; e.g., 003. VSGEN deletes this file when it terminates normally. If VSGEN aborts, this file remains.              |
| sys.CONFIG.pid.TMP  | A temporary configuration file, in a format designed for a system build. The pid is the numeric Process ID.                                                                                                                       |
| sys.KS_IN.pid.TMP   | A temporary input file that contains the CLI commands VSGEN needs to build a system.                                                                                                                                              |
| sys.KS_OUT.pid.TMP  | A temporary output file. If the new system does not run properly, you should type this file and check for error messages. When you run VSGEN interactively, VSGEN asks if you want to save this and the two preceding .TMP files. |

## VSGEN Default Answers

VSGEN, like other utilities, displays default answers in brackets after each question. The default values depend on whether you omit or include a spec filename in the VSGEN command line.

- When you omit a spec file name, or add a new device, the [defaults] are values that DG established for a general-purpose AOS/VS installation.
- When you include a spec filename with the VSGEN /DEFAULT=sys switch, the [defaults] are those specified in the spec file.

To answer a VSGEN question with a default value, press NEW LINE (↵). For example,

*Enter a command:*     A ↵

*Device to be added:*     DPJ ↵

*Device code [24]:*     ↵

Here, ↵ selects the default device code for a DPJ type disk: 24. When you don't want the default response, type the value you want and ↵. Or, if you want help, type ? ↵.

On MV/20000 and MV/10000 computers, AOS/VS supports multiple IOCs (I/O Controllers), and three-digit device codes. In a three-digit code, a 1 is the channel number selected for the second IOC; a 2 is the channel number of the third IOC. The second and third digits indicate the device controller. Under some circumstances, if a computer supports them, it's advantageous to have a group of devices (like disks or IACs) on the second or third IOC. If you

have controller(s) on the second or third IOC, *you must type the device code specifically to VSGEN*; for example, 165 1 for an IAC. VSGEN default device codes assume only one IOC, and have only two significant digits.

## Devices You Don't Have

During the VSGEN dialog, you may want to specify devices you don't have — perhaps if you plan to get them, and want to avoid adding them in a future VSGEN. Generally, this is a bad idea. It may cause problems later and always costs something in terms of main memory for the operating system. You can, however, specify console lines that aren't currently connected to consoles. For example, if you plan to get consoles for lines 10 through 15, and know what kind they will be, you can specify them to VSGEN before they are connected. Just don't expect — or try — to use the lines before you connect the new consoles.

## Correcting Mistakes

If you make a mistake while giving a device or parameter, simply finish the routine, defaulting all the questions you can. Then re-enter the routine, with the E (Edit) or P (Parameter) command, and fix the mistake. If this doesn't work, delete the device with the DELETE command and add it again with the ADD command.

If you enter the wrong VSGEN command, press 1 when VSGEN asks for a device name. VSGEN will then return to the ENTER A COMMAND: prompt. For example,

*Enter a command:*      D 1

*Name of device to be deleted:*      1

*Enter a command:*

The 1 answer works only for the first question in any VSGEN routine. If you are beyond the first question, finish the routine as described above.

If you want to abandon the VSGEN session and start over, use the Q command. Or, if you're desperate to stop, you can type CTRL-C CTRL-B to abort VSGEN. (CTRL-C CTRL-B aborts *any* program running under AOS/VS, but it's extreme; use it only when you must.)



## VSGEN Switches

A *switch* modifies the meaning of a command or the action taken on its arguments. It is a slash followed by a value. If this is your first system, omit switches. If it is not your first system, you have a spec file and will probably want to use the /**BATCH=** or /**DEFAULT=** switch.

You can include the following switches in the X VSGEN command.

**/BATCH=sys** Do not run an interactive session: build a system from the specification in file sys.SSF, which must already exist. Omit the suffix .SSF from the system name.

This switch is useful when you have received a new revision of AOS/VS and want to build a tailored system with all the specifications of the old system. You cannot use this switch for your first system because there is no valid .SSF file. But you can use it for later systems.

**/DEFAULT=sys** Run an interactive session, but use specs in file sys.SSF for default values (displayed in brackets). File sys.SSF must already exist. This switch is handy when you have a tailored system and want to generate another one; often you need to add or edit only one or two devices.

**/SAVE** Save temporary files. When you use the /**BATCH** switch, VSGEN will delete the temporary files — unless you also use this switch.

If you use a switch, put it next to the VSGEN command, without a space — for example

```
) X VSGEN/DEFAULT=OLD_SYSTEM )
```

Note that if you omit switches, VSGEN uses its default spec of a DPF disk controller (not 6214), MTB tape controller, CRT3 system console, and battery backup (BBU). If you have different controllers, edit the default controllers or delete and replace them. Or, if you don't have battery backup or don't have or want auto restart, delete or edit that option.

## Using an Old VSGEN Spec File

You can use any AOS/VS Revision 6.00 spec file as a default base for a Revision 7.00 system. For example, Revision 7.00 supports big PIDs (PIDs above 255). To take advantage of these new features, you must tell VSGEN about them. To do this, start VSGEN using the /DEFAULT switch to specify the old spec file. In the VSGEN session, update all devices and parameters as desired, give a new spec filename (like SYS\_7.00), and generate a system with the new values. You can also use the new spec file as a default base for other systems if needed.

## Spec Files Supplied with AOS/VS

If you have an MV/4000 DC, MV/4000 SC, MV/2000 DC, or a DS/7000-series system, DG supplied a spec file to use as a basis for your tailored system. (You can also use one the MV/4000 spec files as a basis for a DS/4000-series system — just delete the IAC or MCP1 and any other devices you don't have from the spec file.)

The spec filenames and the devices they define are as follows:

### File MV2000DC.CSF

MV/2000 DC (and DS/7000 series) computers  
DPJ disk controller on device code 24  
DPJ1 diskette controller on device code 64  
MTJ tape controller on device code 23  
LPJ printer on device code 17  
IAC-12, 12 console lines, on device code 65

### File MV4000SC.CSF

MV/4000 model computer  
DPJ disk controller on device code 24  
DPJ1 diskette controller on device code 64  
MTC tape controller on device code 22  
LPE printer on device code 17 (IOC)  
MCP1, 8 console lines (specified as IAC-8) device code 65  
Parameters: defaults except for dump device (DPJ1)

### File MV4000DC\_MCP1.MCF

MV/4000 model computer  
DPJ disk controller on device code 24  
DPJ1 diskette controller on device code 64  
MTC tape controller on device code 22  
LPE printer on on device code 17 (IOC)  
LPB1 printer on device code 57 (MCP1)  
MCP1, 8 console lines (specified as IAC-8) device code 65  
Parameters: defaults except for swap file truncation (Yes) and dump device (DPJ1)

### File MV4000DC\_IAC.CSF

MV/4000 model computer  
DPJ disk controller on device code 24  
DPJ1 diskette controller on device code 64  
MTC tape controller on device code 22  
LPE printer on device code 17 (IOC)  
IAC, 16 console lines, device code 65  
Parameters: defaults except for swap file truncation (Yes) and dump device (DPJ1)

To use a supplied spec file, start VSGEN with /DEFAULT=name switch, where name is the spec filename without suffix. For example

\*) X VSGEN/DEFAULT=MV4000DC\_MCP1

Then list the current system (C command), edit any specification that's wrong (E command), and build a system with the B command. Of all devices in the supplied spec file, the most likely

to need editing is the MCP1 or IAC console lines description — and this needs changing only for things like data flow control (Table 4-3) or if there is a letter-quality printer attached to a line (identify the console line as console type TTY).

## VSGEN Session

This section leads you through a VSGEN session in which you create a system tailored for your

- model of CPU
- disks
- tapes
- system console
- user consoles
- line printers
- card readers and plotters
- communications hardware
- battery backup unit
- software parameter requirements

Simple session summaries are shown in Figures 4-6 and 4-7, later in the chapter.

If you are working with an existing tailored system (/DEFAULT= switch), simply list the current specs with **CURRENT** or **LIST**, and edit or add the ones you want.

First, type

```
) SEARCHLIST :UTIL )  
) SUPERUSER ON )  
) DIR :SYSGEN )  
)
```

The **SEARCHLIST** command makes directory :UTIL your search list. (A search list is a list of directories the system scans when it can't find a file in the working directory.) The **DIR** (DIRECTORY) command makes :SYSGEN the working directory. **SUPERUSER** is needed to allow VSGEN to create files in this directory.

Execute VSGEN as follows for your first system, or with the switches of your choice for subsequent systems:

```
) X VSGEN )
```

*Welcome to VSGEN -- Type H for help*

*Enter a command:*

### Getting Help

Type

```
H )
```

VSGEN says

*The following are legal commands to VSGEN:*

|                                       |                                         |
|---------------------------------------|-----------------------------------------|
| <i>A — Add a system device</i>        | <i>M — Change system model</i>          |
| <i>B — Build a system</i>             | <i>N — Change system name</i>           |
| <i>C — List current configuration</i> | <i>P — Change system parameters</i>     |
| <i>D — Delete a system device</i>     | <i>Q — Quit this session</i>            |
| <i>E — Edit a system device</i>       | <i>S — Create a spec file</i>           |
| <i>L — List a system device</i>       | <i>V — Verify current configuration</i> |

*( To receive further information about any of these commands, type  
H <SPACE> X, where X is any of the above commands. )*

*Note —*

*Typing “?” in response to any question will list possible responses. ...*

*Enter a command:*

Get help on Add:

H A )

*A - Add a controller to the current system*

*Routine asks for the name of the controller...*

Give the ADD command and ask for help again:

*Enter a command:* A )

*Name of device to be added?* ? )

```
*  ATI   CPI   CPI1  CPI2  CPI3  CPI4  CPI5  CPI6  CPI7
|  CPI8  CPI9  CPI10  CPI11  CPI12  CPI13  CPI14  CPI15  CRA
   CRA1  DKB   DKB1  DKB2  DKB3  DKB4  DKB5  DKB6  DKB7
   DPD   DPD1  DPF1  DPF2  DPF3  DPF4  DPF5  DPF6  DPF7
   DPG   DPG1  DPI    DPI1  DPJ   DPJ1  DPJ2  DPJ3  DPJ4
   DPJ5  DPJ6  DPJ7  DPM   DPM1  DRT   IAC   IAC1  IAC2
|  IAC3  IAC4  IAC5  IAC6  IAC7  IAC8  IAC9  IAC10  IAC11
   IAC12  IAC13  IAC14  IAC15  IAC16  IAC17  IAC18  IAC19  IAC20
   IAC21  IAC22  IAC23  IAC24  IAC25  IAC26  IAC27  IAC28  IAC29
   IAC30  IAC31  IAC32  IAC33  IAC34  IAC35  IAC36  IAC37  IAC38
   IAC39  IAC40  IAC41  IAC42  IAC43  IAC44  IAC45  IAC46  IAC47
   IAC48  IAC49  IAC50  IAC51  IAC52  IAC53  IAC54  IAC55  IAC56
|  IAC57  IAC58  IAC59  IAC60  IAC61  IAC62  IAC63  LPB   LPB1
   LPB2  LPB3  LPB4  LPB5  LPB6  LPB7  LPD   LPD1  LPE
|  LPE1  LPE2  LPE3  LPE4  LPE5  LPE6  LPE7  LPJ   LPJ1
   LPJ2  LPJ3  MCA   MCA1  MTB1  MTC   MTC1  MTC2  MTC3
   MTD   MTD1  MTJ   MTJ1  MTJ2  MTJ3  MTJ4  MTJ5  MTJ6
|  MTJ7  PLA   PLA1
```

Typing ? ) in response to any VSGEN question gives you a list of legal answers.

The peripheral names used by VSGEN are *controller* names. For example, if you have two disk units on the first DPJ controller, their unit names are DPJ0 and DPJ1 — but the controller name is DPJ. This list of devices reflects the VSGEN default system, which includes a DPF and MTB controller, a system console (CON0), and battery backup (BBU). Since the system already includes these controllers, they can't be added, so their names are not shown in this ADD list. The controller names and meanings are explained in each section.

For a description of any device, type the LIST command, then the device name; e.g., L ↵, BBU ↵. VSGEN will display the current (or default) device specifications. It will also show how many data channel slots on the A or B map the device is using (these are used by tapes, line printers, DPI disk units, and some other disk units). Get out of the ADD command by pressing

↵

*Enter a command:*

## Model of CPU

To specify the Model of CPU, use the M command:

M ↵

*Enter new model [MV/8000]:*

Type the model of the computer on which the new system will run. Or, for an MV/8000 II, MV/8000 C, or MV/8000, press ↵ to select the default. For an MV/20000 Model 2, MV/20000 Model 1, or MV/20000 C, type MV/20000 ↵. For an MV/10000 SX or MV/10000, type MV/10000 ↵. For an MV/4000, MV/4000 DC, MV/4000 SC, or Data General DS/4000-series, type MV/4000 ↵. For an MV/2000 DC, type MV/2000 ↵. For a DS/7700 or DS/7500, type DS/7700 ↵ and DS/7500 ↵ respectively. For example,

MV/4000 ↵

*Enter a command:*

Having described the computer, you can add or edit devices. The minimum default system has one DPF disk and one MTB type controller, and the system console (CON0). You may have this disk and this tape controller, and/or other device controllers.

Most systems also have *user* consoles, attached to their own device. There may be one or more line printers, communications devices, and a backup battery. Each of these is described in its own section.

You can add or edit devices in any order, but let's do the disks first.

## Disks

An AOS/VS system can support up to eight DPF controllers, eight DPJ controllers, and up to two of any other model disk controller. All the controller types and models are shown in Table 4-2.

The original DG default system supports a DPF disk controller on device code 27. Disk unit names on the first DPF controller are DPF0, DPF1, DPF2, and DPF3. But if you are using a spec file (/DEFAULT= switch), the controllers named in the spec file are the defaults. If you're using one of the DG-supplied spec files described earlier (for example, MV/4000DC\_IAC, it already describes the correct controllers for your system.

If you want DPF disk controller support, you need not add a DPF to the original default system. Check the DPF definition by typing **E** **]** and **DPF** **]**; then run through the dialog. If the device code and number of 6214 controllers are correct for your DPF, press **]** for the default; otherwise, type the correct answer. When done, if you want the new system to support other controllers, add them by typing **A** **]** and the controller name from Table 4-2. Take the default device code unless you know that a controller is connected to a nonstandard code.

If you *don't* want the new system to support a DPF controller, delete the DPF (type **D** **]**, then **DPF** **]**). Then add your primary disk controller (DPJ or DPI) by typing **A** **]**, then **DPJ** **]** or **DPI** **]**. A DPJ controller can support up to four units, named DPJ0, DPJ1, DPJ2, and DPJ3. The DPI controller supports up to two units, named DPI0 and DPI1. Take the default device code unless you are sure the controller is connected to a nonstandard device code. For example, if your primary controller is DPJ,

Enter a command: **D** **]**

Name of device to be deleted: **DPF** **]**

DPF has been deleted

Enter a command: **A** **]**

Name of device to be added: **DPJ** **]**

Device code [24]: **]**

Enter a command:

If you want the new system to run an additional controller, add it using the **A** **]** command and controller name from Table 4-2. Take the default device code, if any, unless you know the controller is connected to a nonstandard code. For a DPF controller, answer the question about 6214 units.

**Table 4-2. Disk Controller Names and Device Codes**

| <b>Disk Description</b>                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Controller Name</b>                                                                                                    | <b>Default Device Code</b>                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DPF-type. Free standing with removable packs (6060, 6061, 6067, 6122); or free standing and sealed (6214); or rack-mounted and sealed (6160, 6161). Capacity ranges from 50 to 277 Mbytes. A 6160, 6161, or 6214 supports two units; others support four units.                                                                                                                                                                                    | DPF (1st)<br>DPF1 (2nd)<br>DPF2 (3rd)<br>DPF3 (4th)<br>DPF4 (5th)<br>DPF5 (6th)<br>DPF6 (7th)<br>DPF7 (8th)               | 27<br>67<br>None; chosen at installation.<br>None; chosen at installation.<br>None; chosen at installation.<br>None; chosen at installation.<br>None; chosen at installation.<br>None; chosen at installation.                                  |
| DPJ, model 6236 or 6239, sealed, rack-mounted, with LED digit display. Capacity is 354 or 592 Mbytes. A controller supports four units. Model 6237 is three 6236 units in one cabinet on one controller. Model 6290 is two 6239 units in one cabinet on one controller; model 6240 is three 6239 units in one cabinet on one controller.                                                                                                           | DPJ (1st)<br>DPJ1 (2nd)<br>DPJ2 (3rd)<br>DPJ3 (4th)<br>DPJ4 (5th)<br>DPJ5 (6th)<br>DPJ6 (7th)<br>DPJ7 (8th)<br>DPJ7 (8th) | 24<br>64<br>None; chosen at installation.<br>None; chosen at installation.<br>None; chosen at installation.<br>None; chosen at installation.<br>None; chosen at installation.<br>None; chosen at installation.<br>None; chosen at installation. |
| DPJ, 5-1/4 inch disk controller, unit capacity 120, 71, or 38.6 Mbytes. DPJ1 is a 5-1/4 inch minidiskette controller, unit capacity 737,000 bytes. The disk and diskette controller — and one disk and diskette unit — are built into the cabinet of an MV/4000 DC, MV/4000 SC, MV/2000 DC, Data General DS/4000-series or DS/7000-series computer. Additional disk units model 6239, 6238, or 6310, and diskette unit, model 6309, are available. | DPJ (disk)<br>DPJ1 (diskette)                                                                                             | 24<br>64                                                                                                                                                                                                                                        |
| DPI-type, rack-mounted. Models 6234, 6227, 6225, 6098, 6099, 6100, or 6103. Each runs one hard, sealed disk, range 50 down to 5 Mbytes. Model 6097 runs one or two 1.26-Mbyte diskettes.                                                                                                                                                                                                                                                           | DPI (1st)<br>DPI1 (2nd)                                                                                                   | 33<br>73                                                                                                                                                                                                                                        |
| Fixed-head disk, models 6063, 6064, 6066.                                                                                                                                                                                                                                                                                                                                                                                                          | DKB0 (1st)<br>DKB1 (2nd)<br>DKB2-DKB7                                                                                     | 26<br>66<br>None; chosen at installation.                                                                                                                                                                                                       |
| Two-disk rack-mounted unit; top disk removable, bottom disk sealed, 5 Mbytes per disk; total 10 Mbytes. Controller can also run 0.3-Mbyte diskettes. Models 6045–6050.                                                                                                                                                                                                                                                                             | DPD (1st)<br>DPD1 (2nd)                                                                                                   | 33<br>73                                                                                                                                                                                                                                        |
| Two-disk unit as above but 10 Mbyte per disk; total 20 Mbyte; no diskettes. Model 6070.                                                                                                                                                                                                                                                                                                                                                            | DPG (1st)<br>DPG1 (2nd)                                                                                                   | 33<br>73                                                                                                                                                                                                                                        |
| Minidiskette unit, 5-1/4 inch, 368-Kbyte diskettes, Model 4514. This is used in DESKTOP GENERATION™ and other systems.                                                                                                                                                                                                                                                                                                                             | DPM (1st)<br>DPM1 (2nd)                                                                                                   | 20<br>60                                                                                                                                                                                                                                        |
| Diskette (0.3 Mbyte). Model 6030.                                                                                                                                                                                                                                                                                                                                                                                                                  | DPD (1st)<br>DPD1 (2nd)                                                                                                   | 33<br>73                                                                                                                                                                                                                                        |

## The Current (C) Command

The C command displays the current system configuration. You may want to use it to check after you add a controller. For example,

*Enter a command:* C ↓

*Current system:* none

*Default system:* name or  
<system defaults>

*System parameters:*

|                                                |                   |
|------------------------------------------------|-------------------|
| <i>Model:</i>                                  | <i>MV/nnnn</i>    |
| <i>Swap:</i>                                   | <i>2147483647</i> |
| <i>Page:</i>                                   | <i>2147483647</i> |
| <i>Cache size:</i>                             | <i>128</i>        |
| <i>Minimum number system pageable pages:</i>   | <i>10</i>         |
| <i>Default file element size:</i>              | <i>4</i>          |
| <i>Frequency:</i>                              | <i>10</i>         |
| <i>Access enabled:</i>                         | <i>YES</i>        |
| <i>Initial program for PID 2:</i>              | <i>CLI.PR</i>     |
| <i>Initial IPC message for PID 2:</i>          |                   |
| <i>Max program load pages -noncontention:</i>  | <i>0</i>          |
| <i>Max program load pages -contention:</i>     | <i>0</i>          |
| <i>Fault time prepaging maximum:</i>           | <i>0</i>          |
| <i>Variable swapfiles enabled:</i>             | <i>N</i>          |
| <i>Maximum swapfile size:</i>                  | <i>126</i>        |
| <i>Default swapfile size:</i>                  | <i>126</i>        |
| <i>Truncate swap files after use:</i>          | <i>N</i>          |
| <i>Truncate page files after use:</i>          | <i>Y</i>          |
| <i>Size above which truncation will occur:</i> | <i>2048</i>       |
| <i>Lowest priority for group 1 processes:</i>  | <i>255</i>        |
| <i>Lowest priority for group 2 processes:</i>  | <i>258</i>        |
| <i>Soft tape errors suppressed:</i>            | <i>N</i>          |
| <i>Default system dump device:</i>             | <i>MTB</i>        |
| <i>Maximum number of processes:</i>            | <i>255</i>        |

*Current system devices:*

... (all current devices) ...

*Optional system devices:*

... (all devices not part of configuration) ...

*Number of data channel A map slots available:* n

*Number of data channel B map slots available:* n

*Enter a command:*

The new system has no name yet, but its parameters and devices are shown. If, at any point, you want to change a device spec, use the EDIT command. You can verify the system — to see if it is valid — with the V command.

There are five data channel maps, but VSGEN describes only the A and B maps. The A and B maps have 32 1-Kbyte slots each. Usually, each line printer takes two slots on the A map. Each non-BMC disk controller (DPI, etc.) takes five slots on the A map. Each MTB or MTC tape controller takes five slots on the B map (but an MTB or MTC will use more B slots if it has a larger max byte transfer buffer than the VSGEN default).



## Tapes

The default system supports an MTB tape controller with default options. If the current spec according to the C command describes the tape controller(s) you want supported, don't change it; you may want to edit a controller to see if its options (described below) are the ones desired.

If you don't want the new system to support the current controller(s), delete it (them), then add the controller(s) and options desired.

There are several types of tape controller, as follows.

- MTB The MTB unit model number is 6026; its density can be 800 or 1600 bpi. A unit has a panel DENSITY switch. A controller can handle up to eight units. On the first controller, unit names are MTB0, MTB1, MTB2, ..., MTB7.
- MTC Type MTC includes unit model number 6125 (reels side by side) and cartridge models (6231 and 6311, the latter for MV/4000 DC, MV/4000 SC, and DS/4000-series only). MTC density is 1600 bpi (reels) or 6400 bpi (cartridge). A controller can handle up to four units. On the first controller, unit names are MTC0, MTC1, MTC2, MTC3.
- MTD Type MTD unit density can be 6250 or 1600 bpi. The model number is 4307 (switches at top) or 6300 (touch-sensitive switch panel). A controller can handle up to four units. On the first controller, names are MTD0, MTD1, ..., MTD3.
- MTJ There are three kinds of MTJ tape units. Model 6340 or 6341 (reels side by side) accepts up to 1000-foot tapes and writes at 1600 bpi. Model 6352 (cartridge tape) holds up to 120 Mbytes at 6400 bpi. Model 6351 (specially formatted cartridge tape) holds up to 20 Mbytes. (Model 6351 has one read/write head; consequently, you should verify writes by rewinding the tape and loading with the /N switch to the LOAD command to verify.) A controller can handle up to four units. On the first controller, the names are MTJ0, MTJ1, ..., MTJ3. On the second controller, the names are MTJ10, MTJ11, ..., MTJ13.

Be sure to type the correct controller name here. The starter system recognizes type MTC (includes MTB), MTD, or MTJ. But for a *tailored* system to support any type well, you must specify the proper type. For example,

MTB ) (Or MTC or MTD)  
Device code [22]: (Default code is 62 for MTD.)

Press ) to specify the default device code. And, for an MTC controller, skip to the next *Max byte transfer*: query.

)  
Default density [ADM]:

You can select ADM, a valid bpi number, or NC as the default density. The meanings are:

- ADM Automatic Density Matching. When a unit on this controller reads a tape, the new system will try to match controller density to tape density — regardless of the DENSITY switch setting (if any). When a unit writes to tape, an MTB will use the tape panel DENSITY switch setting (800 or 1600 bpi); an MTD will use the last density that it read or wrote. Users can override the write default by specifying a valid density with the /DENSITY = switch in CLI commands.
- n (1600, 800, or 6250 bpi). Use density n as default. This overrides the DENSITY switch, if any. Automatic density matching will not occur; but users can override the default n with the the /DENSITY = switch in CLI commands.

NC No change from current density. (The current density is the density last specified with the /DENSITY= switch in a CLI command. But if no density has been specified on an MTB, the current density is that selected with the DENSITY panel switch. If no density has been specified on an MTD, the current density is 6250 bpi.) On reads or writes, only the current density will be used. Users can override the current density with the /DENSITY= switch in CLI commands.

The default answer (ADM) is the most convenient choice. We recommend it unless you know that you want another choice. To take it, press

↓

*Max byte transfer [nK]:*

This selects the maximum size of the buffer used for tape I/O. Valid answers are 2K (2,048 bytes), 4K, 6K, and so on through 32K. For MTB or MTC types, the 8K default is a good general-purpose choice; it's big enough for efficient reads and writes, yet not so big that it may slow down the program doing the I/O. For a model 6231 cartridge tape, the default (8K) is required. For an MTD at 6250 bpi, 32K is also a good general-purpose choice. For an MTJ tape, 16K is required. For all tapes, the buffer size affects the amount of data a tape can hold.

A user can select any buffer size up to the maximum with a /BUFFERSIZE= switch on a LOAD or DUMP command; or he can take the default size by omitting this switch. The same buffer size used to write a tape must be used to read it back.

Unless you have a good reason for doing otherwise, take the default transfer size by pressing

↓

*Enter a command:*

If you want the new system to support another magnetic tape controller, type A ↓, then the controller name: MTB1 ↓, MTC1 ↓, MTD1 ↓, or MTJ1 ↓; in most cases, default the device code. Unit names on the second controller are MTx10, MTx11, MTx12, and so on.

After adding the last tape controller, you might review the current system again (CURRENT command); or you might want to proceed.

## System Console

The system console name is CON0. It is included in the default system as a CRT3 (DASHER D2, D200, D210, D211, or other D200 compatible CRT). If this is the kind of console you want supported, fine; skip to the next section.

If you want the the new system to support a *different type* of system console, then you need to edit the CON0 spec. The other types of console are hardcopy, type TTY ↓; and CRT6 (graphics terminal, DASHER® D400, D450, D460). For example, to specify a hard copy system console:

*Enter a command:* E ↓

*Name of device to edit:* CON0 ↓

*Console type [CRT3]:* TTY ↓

*Input buffer byte length [128]:* ↓

*Output buffer byte length [128]:* ↓

*Characteristic word 0 [STANDARD]:* ↓

*Characteristic word 1 [STANDARD]:* ↓

*Characteristic word 2*

*Lines per page [STANDARD]:* ↓

*Chars per line [STANDARD]:* ↓

*Characteristic word 3 [STANDARD]:* ↓

*Enter a command:*

The *Buffer byte length* questions relate to buffers used by the system to communicate with the device; you can usually default them. *Characteristics word 0, 1, and 3* relate to things like echoing, lower-to-uppercase conversion, modem interfaces, and flow control. For the system console, you will usually want to take the defaults on these — as above. The same applies to *Lines per page* and *Chars per line*.

If you *do* want to select nondefault console values, Table 4-3, later on, describes the mnemonics you can use.

### **If the System Console is a Pixel-Mapped Terminal**

Some computers, like the DS/7000-Series, support pixel-mapped (graphics) terminals. If the system console is a pixel-mapped terminal, you don't have to edit the CON0 specification. The reason for this is that it is the peripheral manager, not the AOS/VS system, that contains the code for communicating with this kind of system console. Consequently, you can delete CON0 from the tailored system if your computer has a system console that is a bit-mapped terminal. See also "DRTs," later in this chapter.

### **User Consoles (IACs, MCP1s, CPI/24s, DRTs, and ATIs)**

You don't specify user consoles directly; instead, you describe the device that handles them. Then you describe the consoles connected to the *lines* of the device. User consoles are handled by one or more of the following devices:

- Intelligent Asynchronous Controllers (IACs);
- Multicomunications Processors (MCP1s);
- Computer-PBX-Interface controllers (CPIs);
- Dual Receiver/Transmitters (DRTs); or
- an Asynchronous Terminal Interface (ATI).

You'll tell VSGEN which device(s) you have, then describe the console lines attached to each device.

Note: If the consoles are not labeled, someone should label them — preferably with the console name, @CONn. You can use sticky-backed tape for this. If you don't know a console's name, you can figure it out from the line number, as described in each section below. Labeling the consoles will make things a lot easier later on.

## Ranges of Lines

You can describe console lines individually or in groups. VSGEN will ask questions about each entry — so, if you choose a group of lines, all consoles in the group will be treated the same way, even if the consoles are different. After you describe one or more groups of lines, VSGEN asks if you want to describe more lines — so you can proceed sequentially to describe them all. You need not specify groups sequentially, but we do so here for clarity.

To specify individual lines, separate the entries with one or more spaces. To specify a range of lines, separate the first and last number with a space-dash-space. For example,

0      12              Specifies lines 0 and 12

0 - 12              Specifies lines 0 through 12

MV/Family computers can have different console-handling devices, as follows:

### Computer

### Console-Handling Devices

MV/20000 Model 2,  
MV/20000 Model 1, or  
MV/20000 C

IAC, MCP1, and/or CPI/24.

MV/10000 SX or MV/10000

IAC, MCP1, and/or CPI/24.

MV/8000

IAC (model numbers beginning with 96) or  
ATI (model numbers beginning with 93).

MV/8000 II or MV/8000 C

IAC, MCP1, and/or CPI/24.

MV/6000

IAC only.

MV/4000

IAC, MCP1, and/or CPI/24.

MV/4000 DC

MCP1 or IAC.

MV/4000 SC or Data  
General DS/4000-series

MCP1.

MV/2000 DC

IAC-12 or DRT.

DS/7000-series

IAC-12 or DRT.

## Letter-Quality Printer

If your system has one or more letter-quality printers, you must identify these to VSGEN as user consoles, type TTY. For each line connected to a letter-quality printer, specify TTY and default all characteristic words. In the initialization word, specify a small input buffer and about a 256-byte output buffer, data rate of 1200, eight data bits, and one stop bit. An example of a letter-quality printer spec appears in Figures 4-1 and 4-2, console line 13.

## Mouse

If your system has a mouse, do not identify it to VSGEN. Software support for the mouse is provided by the GKS (Graphics Kernel System) software; GKS defines and handles the mouse device.

## IACs

Each IAC is one circuit board and has its own device code. The sequence of lines from board to board is established during VSGEN. You specify a base-line number for each board; then describe the lines from 0 to n, where n is the number of lines attached to consoles (up to a maximum of 15, 11, or 7, depending on whether the IAC has 16, 12, or 8 lines). At a small price in memory, you can specify *all lines* attached to an IAC, even if all lines aren't currently attached to consoles. An IAC-16 can handle up to 16 local lines; an IAC-8 can handle a total of 8 *local and modem* lines. An IAC-12 can handle 10 local lines and 2 modem lines.

Note that you must specify your IAC types and their sequence correctly — the new system may fail if you don't.

## IAC Dialog

To add an IAC, Add a device, then specify IAC:

A )

*Name of device to be added:* IAC )  
*Device code[65]:*

The default device code for IAC is 65; for IAC1 it is 50; for IAC2 it is 51, and so on. Unless you know that this IAC is connected to a nonstandard device code, type ) to select the default

)

*Base line number [0]:*

You can select any valid base line number for this IAC. The number must be 0 or a multiple of 2. The names of its consoles will depend on the number, as described below. For the first IAC, you might choose the default:

)

and go on to the next question.

For the second IAC and each subsequent IAC, you could type the number

**base-line-of-preceding-IAC**

+

**total-number-of-lines-on-preceding IAC (8, 12, or 16)**

For example, if the base line of the preceding IAC is 0 and if it can support 16 lines, you'd type 16 ). The base line for the next IAC could be 16.

You need not make the base lines sequential. For example, you might choose to make your modem base line 80. But each base line must be larger than the preceding IAC's base line and each must be divisible by 2. (VSGEN imposes this to ensure unique console names, so that your multiuser system will work properly.)

*IAC device type [??]:*

If this is a 16-line IAC, type 16 ); if it is a 12-line IAC, type 12 ); if it is an 8-line IAC, type 8 ). If you say 8 ), VSGEN asks about split baud rates; generally answer ) for the default unless the console on this line has an attached slave printer. Then VSGEN will say

*Console lines [??]:*

Now you need to describe the lines on this IAC — individually, or in groups. The line numbers you enter are specific to this IAC — ranging from 0 through 15, 0 through 11, or 0 through 7, depending on the IAC.

## **IAC Console Names**

When the new system runs, each console on an IAC will have the console name of  
 $\text{CON}(\text{base-line-number} + \text{line-number-on-this-IAC} + 2)$

For example, assume that the first IAC is an IAC-16, for which you have specified base line number 0 and lines 0–12. The console names on these lines will be CON2 through CON14. The second IAC, IAC1, is an IAC-8. You give IAC1 the base line number of 16; then you describe line 1 of IAC1. The console on line 1 (second line) of IAC1 will be  $\text{CON}(16+1+2)$ , or

CON19

## **IAC Console Lines Example**

The following example, Figure 4-1, shows you how to handle all common line-console configurations. It assumes that your first IAC is an IAC-16 and your second IAC (IAC1) is an IAC-8.

And it assumes that the lines are arranged as follows:

- IAC lines 0–2 are attached to local CRTs;
- IAC line 3 is attached to a local TTY;
- IAC lines 4–12 are attached to local graphics CRTs;
- IAC line 13 is attached to a letter-quality printer;
- IAC lines 14–15 are not used;
- IAC1 lines 0 and 1 are attached to modems.

```

Enter a command:  A ↓
Name of device to be added:  IAC ↓
Device code [65]:  ↓
Base line number [0]:  ↓
IAC device type [??]:  16 ↓
Console lines [??]:  0 - 2 ↓
Console type [CRT3]:  ↓
Input buffer byte length [128]:  ↓
Output buffer byte length [128]:  ↓
Characteristic word 0 [STANDARD]:  ↓
Characteristic word 1 [STANDARD]:  ↓
Characteristic word 2
    Lines per page [STANDARD]:  ↓
    Characters per line [STANDARD]:  ↓
Characteristic word 3 [STANDARD]:  ↓
Initialization word [STANDARD]:  ↓
Do you want to add another group of lines? [N]  Y ↓
Console lines [??]:  3 ↓
Console type [CRT3]:  TTY ↓
Input buffer ...
(Default the buffer and characteristic questions)
Initialization word [STANDARD]:  ↓
Do you want to add another group of lines? [N]  Y ↓
Console lines [??]:  4 - 12 ↓
Console type [CRT3]:  CRT6 ↓
Input buffer ...  ↓
(Default the buffer and characteristic questions)
Initialization word [STANDARD]:  ↓
Do you want to add another group of lines? [Y]  Y ↓
Console lines [??]:  13 ↓
Console type [CRT3]:  TTY ↓
Input buffer byte length [128]:  32 ↓
Output buffer byte length [128]:  256 ↓
Characteristic word 0 [STANDARD]:  ↓
Characteristic word 1 [STANDARD]:  ↓
Characteristic word 2
    Lines per page [STANDARD]:  ↓
    Characters per line [STANDARD]:  ↓
Characteristic word 3 [STANDARD]:  ↓
Initialization word [STANDARD]:  ?CLN8  ?CR12H  ?CS10 ?CSBDS ↓
Do you want to add another group of lines? [N]  ↓

```

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Figure 4-1. Sample IAC Dialog, with an IAC-16 and IAC-8 (continues)

```

Enter a command:  A )
    Name of device to be added:  IAC1 )
    Device code [50]:  )
    Base line number [0]:  16 )
    IAC device type [??]:  8 )
    IAC split baud rate [NONE]:  )
    Console lines [??]:  0 1 )
    Console type [CRT3]:  )
    Input buffer ...  )
    Output buffer ...  )
    Characteristic word 0 [STANDARD]:  ? )
    ?M<ST SFF 8BT RAF RAT RAC NAS EOL UCO MRI...>
    Characteristic word 0 [STANDARD]:  ?MMRI ?MST ?MEOC )
    Characteristic word 1 [STANDARD]:  ? )
    ?TTY, ?CRT<3,6>, ?M<ULC PM NRM MOD DT<0-3> TO ....>
    Characteristic word 1 [STANDARD]:  ?CRT3 ?MMOD ?MULC ?MWRP )
    Characteristic word 2
        Lines per page [STANDARD]:  )
        Chars per line [STANDARD]:  )
    Characteristic word 3 [STANDARD]:  )
    Initialization word [STANDARD]:  ?CPR0 ?CR12H ?CS10 ?CLN8 ?CSBDS )
    Do you want to add another group of lines? [N]  )
Enter a command:

```

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Figure 4-1. Sample IAC Dialog, with an IAC-16 and IAC-8 (concluded)

In Figure 4-1, for IAC, we defaulted the device code and base line number; and we described it as a 16-line IAC. Then we described lines 0-2, hardcopy line 3, graphics lines 4-12, and specified the letter-quality printer on line 13. We had then finished with this IAC.

Next we then added IAC1, with default device code and base line number of 16, and described it as an 8-line IAC. We specified the modem lines, 0 and 1. Then we checked legal responses to *Characteristic word 0* and specified ?MMRI for the modems followed by other desired characteristics. All these mnemonics are described in Table 4-3. When you specify one nondefault characteristic, you must specify *all* the ones you want. The angle brackets, <>, are notation abbreviations; interpret them as if they were parentheses in an arithmetic expression.

NOTE: If a console is uppercase only, be sure to specify lower-to-uppercase conversion (?MUCO from Table 4-3) for its line. If you don't, the console may drop all lowercase letters sent to it.

Proceeding to *Characteristic word 1*, we checked and found the characteristic we wanted: ?MMOD for the modem lines; and we typed this and the other standard characteristics.

We defaulted *Characteristic word 2* and 3.

For the initialization word, we set the clock (baud rate) of 12H (1200) for the modem lines, and gave the standard other characteristics. Then we chose not to add more lines; and we were finished with the IACs.

When the new system runs, the console names on lines 0-2 will be CON2-CON4; on line 3 the name will be CON5; on lines 4-12 CON6-CON14; on line 13 the letter-quality printer will be CON15 and on IAC1 lines 0-1 will be CON18-CON19.



The line-specifying procedure would have been much simpler without the modem lines; we'd have simply defaulted all the characteristics and initialization words on IAC1.

### **Multicommunications Processors (MCP1s)**

A Multicommunications Processor (MCP1) resembles an eight-line IAC, with some differences. An MCP1 has the following features:

- An MCP1 supports eight asynchronous lines, like an IAC-8, but only the first two lines can be connected to modems. Split baud rate is not available. You specify the asynchronous controller and its lines to VSGEN as if they were an IAC-8. The default device codes are the same as for IACs (first 65, second 50, etc.)

Console lines on an MCP1 are numbered the same way as for the first IAC — the device on line 0 is @CON2; the device on line 1 is @CON2, ..., and the device on line 7 is @CON9.

- An MCP1 also supports two synchronous lines. If you want to use these, you must identify them to BSCGEN (later in the chapter) as an ISC-2.
- An MCP1 supports an LPB data channel printer. If a line printer is connected to the MCP1 printer controller, you must identify this as an LPB (data channel printer) device on device code 57. Identifying line printers to VSGEN is described later in the chapter.

### **MCP1 Console Lines Example**

The following example, Figure 4-2, shows you how to handle all common line-console configurations. It assumes that the lines are connected as follows:

- lines 0–1 are attached to modems;
- lines 2–4 are attached to local nongraphics CRTs;
- lines 5–6 are attached to local graphics CRTs;
- line 7 is not used.

It also assumes that a printer is connected to the MCP1 printer controller.

In Figure 4-2, for the MCP1, we identified it as an IAC, took the default for the device code, and described it as an eight-line IAC. We identified the modem lines, 0 and 1. Then we checked legal responses to characteristic word 0 and specified ?MMR1 for the modems, followed by other desired characteristics. All these mnemonics are described in Table 4-3, later on. When you specify one nondefault characteristic, you must specify *all* the ones you want. The angle brackets, < >, are notation abbreviations; interpret them as if they were parentheses in an arithmetic expression.

At characteristic word 1, we checked Table 4-3 and found the characteristic we wanted: ?MMOD, for the modem lines; and we typed this and the other standard characteristics.

We defaulted characteristic word 2 and 3.

For the initialization word, we set the clock (baud rate) of CR 12H (1200) for the modem lines, and we typed the other standard characteristics. This ended the description of the modem lines.

For lines 2 through 4, connected to standard consoles, we took all the defaults. For lines 5 and 6, we specified CTR6, then took defaults on all other questions. We had then finished with the MCP1.

```

Enter a command:  A \
Name of device to be added:  IAC \      (Specify it as IAC)
Device code [65]:  \
Base line number [0]:  \
IAC device type [??]:  8 \
Console lines [??]:  0 1 \
Console type [CRT3]:  \
Input buffer ...  \
Output buffer ...  \
Characteristic word 0 [STANDARD]:  ? \
?M<ST SFF 8BT RAF RAT RAC NAS EOL UCO MRI...>

Characteristic word 0 [STANDARD]:  ?MMRI ?MST ?MEOC \
Characteristic word 1 [STANDARD]:  ? \
?TTY, ?CRT<3,6>, ?M<ULC PM NRM MOD DT<0-3> TO ...>

Characteristic word 1 [STANDARD]:  ?CRT3 ?MMOD ?MULC ?MWRP \
Characteristic word 2
  Lines per page [STANDARD]:  \
  Chars per line [STANDARD]:  \
Initialization word [STANDARD]:  ?CPR0 ?CR12H ?CS10 ?CLN8 ?CSBDS \
Characteristic word 3 [STANDARD]:  \

Do you want to add another group of lines? [N]  Y \
Console lines [??]:  2 - 4 \
Console type [CRT3]:  \
Input buffer ...  \
Output buffer ...  \
Characteristic word 0 [STANDARD]:  \
Characteristic word 1 [STANDARD]:  \
Characteristic word 2
  Lines per page [STANDARD]:  \
  Chars per line [STANDARD]:  \
Initialization word [STANDARD]:  \
Characteristic word 3 [STANDARD]:  \

Do you want to add another group of lines? [N]  Y \
Console lines [??]:  5 6 \
Console type [CRT3]:  CRT6 \
Input buffer ...  \
Output buffer ...  \
Characteristic word 0 [STANDARD]:  \
Characteristic word 1 [STANDARD]:  \
Characteristic word 2
  Lines per page [STANDARD]:  \
  Chars per line [STANDARD]:  \
Initialization word [STANDARD]:  \
Characteristic word 3 [STANDARD]:  \

Do you want to add another group of lines? [N]  \
Enter a command:  A \
Name of device to be added:  LPB \
Device code [17]:  57 \

Enter a command:

```

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Figure 4-2. Sample Multicommunications Processor Dialog, Asynchronous Lines and Printer

## **CPI/24s**

A CPI/24 (Computer-PBX-Interface controller) is a board that connects an MV/Family computer to a PBX (Private Branch Exchange) telephone switch. Phone lines from the PBX, instead of CPU-to-console cables, can then connect to user consoles. The CPI/24 device is named for the CPI software interface, T1/DS-1 version.

PBX line configurations are arranged by the PBX manufacturer — a telecommunications manufacturer like Northern Telecom. Each line is set up for dialing in (users make the connection) or direct outward calling (the computer makes the connection).

Most PBX lines connected to a computer are dial-in. After EXEC has enabled the console (like any console), a user dials the computer's number, the connection is made, and the user logs on. (A device called a DAM, (data-access module), is needed at the user's phone set.) To VSGEN, you specify a PBX dial-in line as a standard console line.

Direct outward calling is useful for a line without human dialer — for example, a line connected to a printer. (A DAM is also needed for outward calling.) If a printer/DAM is attached to a PBX line set up for outward calling and this line has been specified to VSGEN, the printer can be enabled by EXEC just as if it were on cables — users can access it through QPRINT commands just like any other printer. To VSGEN, you specify a PBX direct outward line as standard, except that you must specify ?CALLOUT (and any other desired settings) in characteristics word 3.

For a PBX dial-in or direct-outward line to work, the DAM, console, and VSGEN line specifications should match. (The host computer will try to match the baud rate, number of data bits, and the number of stop bits set in the DAM if these settings differ from the VSGEN settings.)

You specify CPIs to VSGEN the same way you do IACs, with the following exceptions:

- Each CPI/24 requires two sequential device codes. VSGEN asks for only one — the even numbered code. It then tries to assign the device code you type, and the next one, to the CPI/24. For example, if you type 30 1, VSGEN tries to assign code 30 and 31 to the CPI.
- A CPI can support up to 24 PBX lines — dial-in or call-out, in any combination.
- CPIs don't offer modem support.
- For a call-out line, you must specify ?CALLOUT (and any other characteristics desired) in characteristics word 3.

### **CPI/24 Lines Example**

The following example, Figure 4-3, shows how to handle all common CPI/24 line-console configurations. It assumes that there are 40 PBX lines, arranged as follows:

- CPI lines 0–15 are attached to dial-in lines for local CRTs;
- CPI lines 16 and 17 are attached dial-in lines for local graphics CRTs;
- CPI lines 18–21 are attached to lines for outward calling, for local letter-quality printers;
- CPI lines 22 and 23 are unused;
- CPI lines 0 through 15 are attached to local CRTs.

In Figure 4-3, for CPI, we specified the device code 30 (also including code 31). Then we defaulted the base-line number, and described the CRTs connected via the PBX to CPI lines 0–15 and graphics consoles connected via lines 16 and 17. Then we described lines 18–21, configured as direct call out lines; these will be connected to printers, so we specified them as TTY. In characteristic word 3, we indicated ?CALLOUT and output flow control. In the initialization word, we selected a baud rate of 1200 and other pertinent characteristics (all described in Table 4-4). We had then finished with this CPI.

Enter a command: A ↓

Name of device to be added: CPI ↓  
Device code [??]: 30 ↓  
Base line number [0]: ↓  
Console lines [??]: 0 - 15 ↓  
Console type [CRT3]: ↓  
Input buffer byte length [128]: ↓  
Output buffer byte length [128]: ↓  
Characteristic word 0 [STANDARD]: ↓  
Characteristic word 1 [STANDARD]: ↓  
Characteristic word 2  
Lines per page [STANDARD]: ↓  
Characters per line [STANDARD]: ↓  
Characteristic word 3 [STANDARD]: ↓  
Initialization word [STANDARD]: ↓

Do you want to add another group of lines? [N] Y ↓

Console lines [??]: 16 17 ↓

Console type [CRT3]: CRT6 ↓

Input buffer ...

(Default the buffer and characteristic questions)

Initialization word [STANDARD]: ↓

Do you want to add another group of lines? [N] Y ↓

Console lines [??]: 18 - 21 ↓

Console type [CRT3]: TTY ↓

Input buffer byte length [128]: 32 ↓

Output buffer byte length [128]: 256 ↓

Characteristic word 0 [STANDARD]: ↓

Characteristic word 1 [STANDARD]: ↓

Characteristic word 2

Lines per page [STANDARD]: ↓

Characters per line [STANDARD]: ↓

Characteristic word 3 [STANDARD]: ?CALLOUT ?MOFC ↓

Initialization word [STANDARD]: ?CLN8 ?CR12H ?CS10 ?CSBDS ↓

Do you want to add another group of lines? [N] ↓

Enter a command: A ↓

Name of device to be added: CPI1 ↓

Device code [??]: 34 ↓

Base line number [0]: 24 ↓

Console lines [??]: 0 - 15 ↓

Console type [CRT3]: ↓

Input buffer ... ↓

(Default the buffer and characteristic questions)

Initialization word [STANDARD]: ↓

Do you want to add another group of lines? [N] ↓

Enter a command:

Figure 4-3. Sample CPI/24 Dialog, with Two CPI/24s

Next we added CPI1, with device code 34 (and 35). The base-line number is 24. We specified that CPI lines 0–15 will be connected through the PBX to standard CRTs. Since the CRTs were standard, and the lines are dial-in lines, we could default all questions about this group of lines. Then we chose not to add more lines; and we were finished with the CPIs.

NOTE: If a console is uppercase only, be sure to specify lower- to uppercase conversion (?MUCO, from Table 4-3) for its line. If you don't, the console may drop all lowercase letters sent to it.

When the new system runs, the console names on lines 0–15 will be CON2–CON17; on lines 16 and 17 the names will be CON18 and CON19; on lines 18–21, and the letter-quality printer names will be CON20–23. On the CPI1 lines, lines 0–15 will be CON26–CON41.

### **DRTs**

A DRT (Dual asynchronous Receiver/Transmitter) is part of each MV/4000 DC, MV/4000 SC, MV/2000 DC, DS/4000-series, and DS/7000-series computer, on the multifunction I/O controller board (IOC) or system bus. The DRT is on device code 34. On DS/4000-series computers, a DRT has one asynchronous line that can support an interactive console or modem. On DS/7000-series and MV/2000 DC computers, a DRT has four asynchronous lines; one can support a modem and three interactive consoles. In this case, the system treats the console connected to line 1 as the system console. You might want, therefore, to make an inexpensive asynchronous console the system console and attach more expensive pixel-mapped (graphics) consoles to lines 2, 3, or 4.

### **DRT Console Lines Example**

To add a DRT, add a device; then specify DRT and the lines. For example, Figure 4-4 shows how to add a DRT with modem support (line 0) and printer support (line 1).

In Figure 4-4, we specified a modem on DRT line 0. When the new system runs, the modem device name will be @CON2. The mnemonics used are described in Table 4-3, later on.

```

Enter a command:  A ↓

Name of device to be added:  DRT ↓
Base line number [0]:  ↓
Device code [34]:  ↓
Console lines [??]:  0 ↓
Console type [CRT3]:  ↓
Input buffer byte length [128]:  ↓
Output buffer byte length [128]:  ↓
Characteristic word 0 [STANDARD]:  ?MMRI ?MST ?MEOC ↓
Characteristic word 1 [STANDARD]:  ?CRT3 ?MMOD ?MULC ?MWRP ↓
Characteristic word 2
  Lines per page [STANDARD]:  ↓
  Chars per line [STANDARD]:  ↓
Initialization word [STANDARD]:  ?CPR0 ?CR12H ?CS10 ?CLN8 ?CSBDS ↓
Characteristic word 3 [STANDARD]:  ↓

Do you want to add another group of lines? [N]  Y ↓

Console lines [??]:  1 ↓
Console type [CRT3]:  ↓
Input buffer byte length [128]:  ↓
Output buffer byte length [128]:  ↓
Characteristic word 0 [STANDARD]:  ↓
Characteristic word 1 [STANDARD]:  ↓
Characteristic word 2
  Lines per page [STANDARD]:  ↓
  Characters per line [STANDARD]:  ↓
Characteristic word 3 [STANDARD]:  ↓
Initialization word [STANDARD]:  ↓

Do you want to add another group of lines? [N]  ↓
Enter a command:

```

DG-27025T

Figure 4-4. Sample DRT Dialog

## ATIs

An ATI is a two-board Input/Output Processor (IOP) and one or more 8- or 16-line asynchronous multiplexor boards. An ATI with an 8-line multiplexor called an AMI-8 (Asynchronous Modem Interface) is included with each MV/8000 that has an ATI. This AMI can handle either local or modem lines; it can be part (or all) of an ATI. The device code for the ATI is 65.

With eight 16-line multiplexors, an ATI can support console lines 0 through 127. Each multiplexor board is hardware strapped to the next, which may or may not provide a contiguous sequence of lines from one board to the next. The sequence is contiguous only if all lines in the preceding board are used. The supplied AMI, with only 8 lines, is often inserted as the last board in the ATI.

## ATI Dialog

To add an ATI, add a device, then specify ATI:

```
A ↓  
Name of device to be added:   ATI ↓  
Console lines [??]:
```

Now you need to describe the lines on this ATI — individually or in groups.

For lines attached to the first multiplexor board in the ATI, lines are numbered 0 through n, where n is the number of consoles up to a maximum of 15 or 7 (depending on the multiplexor board). For lines attached to the second and subsequent boards, lines are numbered from the total number of lines in preceding boards

For example, if the first multiplexor has 16 lines (even if only 12 are used), the number of the first line on the second multiplexor board is 16.

## ATI Console Names

When the new system runs, each console on the ATI will have the console name of

CON (line-number + 2)

For example, the name of the console on line 5 will be CON7, and the name of the console on line 17 will be CON19.

From multiplexor board to multiplexor board, the console names will not be contiguous unless you have consoles attached to all previous multiplexor lines. For example, even if you have only 12 consoles attached to the first multiplexor (producing the console names CON2 through CON14), the name of the console attached to the first line on the second multiplexor will be CON18.

## ATI Console Lines Example

The following example, Figure 4-5, shows you how to handle all common ATI line-console configurations. It assumes that your ATI has a 16-line multiplexor followed by an 8-line multiplexor.

It also assumes that the ATI lines are connected as follows:

- Lines 0–2 are attached to local CRTs;
- Line 3 is attached to a local TTY;
- Lines 4–12 are attached to local graphics CRTs;
- Line 13 is attached to a letter-quality printer
- Lines 16–17 (lines 0 and 1 on second multiplexor) are attached to modems.

Enter a command: A ↓

Name of device to be added: ATI ↓

Console lines [??]: 0 - 2 ↓

Console type [CRT3]: ↓

Input buffer byte length [128]: ↓

Output buffer byte length [128]: ↓

Characteristic word 0 [STANDARD]: ↓

Characteristic word 1 [STANDARD]: ↓

Characteristic word 2

Lines per page [STANDARD]: ↓

Chars per line [STANDARD]: ↓

Characteristic word 3 [STANDARD]: ↓

Initialization word [STANDARD]: ↓

Do you want to add another group of lines? [N] Y ↓

Console lines [??]: 3 ↓

Console type [CRT3]: TTY ↓

Input buffer ... ↓

(default the buffer and characteristic questions)

Initialization word [STANDARD]: ↓

Do you want to add another group of lines? [N] Y ↓

Console lines [??]: 4 - 12 ↓

Console type [CRT3]: CRT6 ↓

Input buffer ... ↓

(default the buffer and characteristic questions)

Initialization word [STANDARD]: ↓

Do you want to add another group of lines? [N] Y ↓

Console lines [??]: 13 ↓

Console type [CRT3]: TTY ↓

Input buffer byte length [128]: 32 ↓

Output buffer byte length [128]: 256 ↓

Characteristic word 0 [STANDARD]: ↓

Characteristic word 1 [STANDARD]: ↓

Characteristic word 2

Lines per page [STANDARD]: ↓

Chars per line [STANDARD]: ↓

Characteristic word 3 [STANDARD]: ↓

Initialization word [STANDARD]: ?COD3 ?CLK1 ?STP0 ↓

Do you want to add another group of lines? [N] Y ↓

Console lines [??]: 16 17 ↓

Console type [CRT3]: ↓

Input buffer ... ↓

Output buffer ... ↓

Characteristic word 0 [STANDARD]: ? ↓

?M<ST SFF 8BT RAF RAT RAC NAS EOL UCO MRI...>

Characteristic word 0 [STANDARD]: ?MMRI ?MST ?MEOC ↓

Characteristic word 1 [STANDARD]: ? ↓

?TTY, ?CRT<3,6>, ?M<ULC PM NRM MOD DT<0-3> TO ...>

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Figure 4-5. Sample ATI Dialog, with AMI-16 and AMI-8 (continues)



```

Characteristic word 1 [STANDARD]:  ?CRT3 ?MMOD ?MULC ?MWRP )
Characteristic word 2
  Lines per page [STANDARD]:  )
  Chars per line [STANDARD]:  )
Characteristic word 3 [STANDARD]:  )
Initialization word [STANDARD]:  ?PAR0 ?COD3 ?STP0 ?CLK3 )
Do you want to add another group of lines? [N]  )
Enter a command:

```

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*Figure 4-5. Sample ATI Dialog, with AMI-16 and AMI-8 (concluded)*

In Figure 4-5, for the ATI, we described the CRTs connected to lines 0-2, the hardcopy on line 3, the graphics consoles on lines 4-12, and the letter-quality printer on line 13 (with 1200 baud; on our system, CLK1 is jumpered to 1200 baud).

Next we specified the modem lines: lines 16 and 17 (0 and 1 on the second ATI multiplexor). We checked legal responses to characteristic word 0 and specified ?MMRI for the modems followed by other desired characteristics. All these characteristics are described in Table 4-3. When you specify one nondefault characteristic, you must specify *all* the ones you want. The angle brackets, <>, are notation abbreviations; interpret them as if they were parentheses in an arithmetic expression.

Proceeding to characteristic word 1, we checked and found the characteristics we wanted: ?MMOD, for the modem lines; and we typed this and the other standard characteristics. We defaulted characteristic word 2 and 3.

For the initialization word, we specified clock 3 (which, in our system, is jumpered to 300 baud) for the modem lines; and we gave the standard other characteristics. Then we chose not to add more lines; and we were finished with the ATI.

When the new system runs, the console names on lines 0-2 will be CON2-CON4; on line 3 the name will be CON5; on lines 4-12 CON6-CON14; the letter-quality printer will be CON15; and on lines 16 and 17 they will be CON18-CON19.

The line-specifying procedure would have been much simpler without the modem lines; we'd have simply defaulted all the characteristics and initialization words.

## Console Line Characteristics

The characteristics that you specify to VSGEN are not cast in bronze. You can always edit them through VSGEN. Or, more conveniently, you can change any console's characteristics from PID 2 on the system console. To do this, use the CHARACTERISTICS command and /DEFAULT switch before the console is enabled (perhaps in the UP macro). For example, the command CHARACTERISTICS/DEFAULT/ON/PM @CON3 ) sets page mode on at CON3. Another way is to have user log-on macros (Chapter 5) set characteristics as users log on. Or, users can set characteristics on their own consoles.

All characteristics that you can default or specify during VSGEN are included in Tables 4-3, 4-4, and 4-5. Table 4-3 shows the line characteristics: an S within a column means that the characteristic is standard; an A means that it is available. Tables 4-4 and 4-5 show line initialization characteristics for IACs/MCP1s/CPI/24s and ATIs, respectively.

If you specify one nondefault characteristic, you must specify all the ones you want for the line(s). VSGEN includes only those you actually specify.

## About 8-Bit Character Handling

DG DASHER model D211, D220, D410, and D460 consoles can send and display 8-bit characters. The main advantage of 8-bit character handling is the ability to read and display characters with values above 177 octal — which includes many characters in the international character sets (like the UK currency symbol) and other special characters. In 7-bit mode, the high bit is ignored — which means the console can't see codes above 177 octal.

One disadvantage of 8-bit character handling is that CLI macros that use the `!ASCII` pseudo-macro may display garbled messages. People often add 200 (octal) to the ASCII value of a character to conceal it from the CLI. For example, to display a comma in a CLI macro, you must use the string `!ASCII 254` (`!ASCII 54` will produce a comma, which the CLI will display as a space). But if 8-bit character handling is enabled on a console and someone runs a macro with `!ASCII 254`, the system will see the value of code 254, which is *not* a comma. Note that also, on a console with a non-U.S. keyboard, some keys send *different codes* in 7-bit mode from 8-bit mode. For example, on a French keyboard the C cedilla key will produce C with a cedilla in 7-bit mode, but will produce `^\  
(ASCII 34)` in 8-bit mode.

If you want 8-bit character handling, a versatile way to get it is to generate your consoles with 7-bit handling (the default), then use the `CHARACTERISTICS` command with `8BT/ON` switch to enable 8-bit handling. To *print* 8-bit characters on an 8-bit printer, start the printer with the `/8BIT` switch to the `EXEC START` command. To restore 7-bit handling (on U.S. keyboards), the person at the terminal can type `CHARACTERISTICS/RESET`, or log off and on again.

The character *mode* is controlled by small dual in-line package (DIP) switches on the back of the console (HOST group), as follows.

- For 8-bit mode, which you can enable or disable via software, set the bit mode DIP switch to 8-bit mode; and then set the parity DIP switches to no parity (parity none). For U.S. terminals, 7-bit handling works normally — when set via software — with the DIP switches in these positions.
- For 7-bit mode, which cannot provide 8-bit characters but does allow certain non-U.S. characters to display as desired, set the bit mode DIP switch to 7-bit mode and set the parity DIP switches to mark parity.

The master CLI (PID 2) can change the default characteristics (but not the mode) of a console, with the /DEFAULT switch and console name, *before* the console is enabled by EXEC. For example, the command CHARACTERISTICS/DEFAULT/ON/8BT@CON22 ↓ sets /8BT on at console 22. If need be, you can put such commands in the system UP macro.

## Output Flow Control

Some programs (notably CEO, and also programs your site may choose to write) use binary mode to handle data on most consoles — including DASHER D210, D211, D220, D400, D410, D450, D460, and G300). If a program that uses binary mode will write to any of these consoles, the output flow control characteristic must be selected on the console line. You can do this during VSGEN by specifying the mnemonic ?MOFC (software flow control) or ?HOFC (hardware flow control - available on IAC-12s and MCP1s) in word characteristic 3 (add other mnemonics desired). Or, you can do it via the characteristics command switches /ON/OFC, in the UP macro, or via a user log-on macro (Chapter 5).

## Break Sequence Handling on User Consoles

On the system console, a break sequence gives control to the SCP-CLI. On *user consoles*, you can define a break to do *one* of the following things:

- A break sequence can break binary mode (used by certain programs when they write to the console) and restore normal CTRL character handling. In binary mode, the console ignores CTRL sequences like CTRL-C CTRL-A. The VSGEN mnemonic for this (in word 3) is ?MBBM; the CHARACTERISTICS switch for it is /BREAK=BMOB. Break binary mode is the default effect of a break sequence.
- A break sequence can terminate the user process on the console, and log the user off, and cause a modem disconnect. You might use this if you want users to be able to log off quickly and simply, regardless of the process running on their consoles. The VSGEN mnemonic for this (in word 3) is ?MBDS; the CHARACTERISTICS switch for it is /BREAK=DCOB.
- A break sequence can generate a CTRL-C CTRL-A or CTRL-C CTRL-B sequence. You might use this if you want users to be able to use the break sequence to produce the pertinent kind of interrupt. For CTRL-C CTRL-A, the VSGEN mnemonic in (word 3) is ?MBCA; the CHARACTERISTICS switch is /BREAK=CAOB. For CTRL-C CTRL-B (which aborts the issuing process), the VSGEN mnemonic (word 3) is ?MBCB and the CHARACTERISTICS switch /BREAK=CBOB.
- A break sequence can generate a CTRL-C CTRL-F sequence. This sequence has no meaning to AOS/VS, but your site can use it in application programs to redirect control or do anything you like. The program must issue a ?KWAIT system call (or higher level language equivalent) to receive notice that CTRL-C CTRL-F was entered. The VSGEN mnemonic (word 3) is ?MBCF; the CHARACTERISTIC switch is /BREAK=CFOB.

**Table 4-3. AOS/VS Console Line Characteristics**

| Word | Characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Bit Mnemonic                                                                                                                                        | CRT3 and CRT6                                                                                                             | TTY                                                                                          |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| 0    | <p>Simulate Tabs: tab key moves cursor right 8 columns.</p> <p>Simulate Form Feeds: new screen (CRT) or form feed (TTY).</p> <p>8 data bits per character.</p> <p>Non-ANSI Standard console. Such consoles have a small LF key and large RETURN key (ANSI standard consoles have a large NEW LINE key and small CR key).</p> <p>Enforce End Of Line: truncate any line longer than that given in word 2. The alternative is ?MWRP (word 1).</p> <p>Uppercase Only: convert lowercase to uppercase. The alternative (word 2) is ?MULC.</p> <p>Monitor Ring Indicator on modem control line.</p> <p>Form Feed: send form feed to console when it is opened for I/O.</p> <p>Echo control. If you specify ?MEB0 and omit ?MEB1, all characters will echo as typed except CTRL will echo as ↑ and ESC as \$. This is the default. If you specify both, CTRL and ESC won't echo.</p> <p>Echo control. ?MEOC is equivalent to ?MEB0; ?MEOS is equivalent to ?MEB1.</p> | <p>?MST</p> <p>?MSFF</p> <p>?M8BT</p> <p>?MNAS</p> <p>?MEOL</p> <p>?MUOC</p> <p>?MMRI</p> <p>?MFF</p> <p>?MEB0<br/>?MEB1</p> <p>?MEOC<br/>?MEOS</p> | <p>S</p> <p>A</p> <p>A</p> <p>A</p> <p>A</p> <p>A</p> <p>A</p> <p>A</p> <p>A</p> <p>S<br/>A</p> <p>S<br/>A</p>            | <p>S</p> <p>A</p> <p>A</p> <p>S</p> <p>A</p> <p>A</p> <p>A</p> <p>S<br/>A</p> <p>S<br/>A</p> |
| 1    | <p>Teletypewriter: line is attached to a TTY.</p> <p>CRT3: line is attached to a D200-compatible console. D200-compatible consoles include D2, D200, D210, D211, and G300.</p> <p>CRT6: line is attached to a model D400, D450, or D460 graphics CRT. This enhances screen editing, over ?CRT3, on graphics CRTs.</p> <p>Upper- and Lowercase: accept both upper- and lowercase characters as input. If you default word 1, ?MULC is the default. But if you specify characteristics for this word and omit ?MULC, the system converts lowercase to uppercase.</p> <p>Page Mode: console will display LPP (Lines Per Page) lines, then wait for CTRL-Q before displaying next sequence of LPP lines.</p> <p>Do Not Receive Messages; prevents console from receiving SEND messages. (Messages from PID2 override this.)</p> <p>Modem: line is attached to a modem interface.</p> <p>Type of Device is n: ignore this characteristic; omit it.</p>               | <p>?TTY</p> <p>?CRT3</p> <p>?CRT6</p> <p>?MULC</p> <p>?MPM</p> <p>?MNRM</p> <p>?MMOD</p> <p>?MTD0-3</p>                                             | <p>—</p> <p>S<br/>(CRT3)<br/>A<br/>(CRT6)</p> <p>S<br/>(CRT6)</p> <p>S</p> <p>A</p> <p>A</p> <p>A</p> <p>A</p> <p>n/a</p> | <p>S</p> <p>—</p> <p>—</p> <p>A</p> <p>A</p> <p>A</p> <p>A</p> <p>n/a</p>                    |

**Table 4-3. AOS/VS Console Line Characteristics**

| Word         | Characteristic                                                                                                                                                                                    | Bit Mnemonic | CRT3 and CRT6 | TTY |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------|-----|
| 1<br>(cont.) | Time Out: enable time-out on console line(s).                                                                                                                                                     | ?MTO         | A             | A   |
|              | ESC character has same interrupt effect as CTRL-C CTRL-A.                                                                                                                                         | ?MESC        | A             | A   |
|              | Wrap line onto next line if line is too long (done in hardware).                                                                                                                                  | ?MWRP        | S             | A   |
|              | Function Keys Terminate text input.                                                                                                                                                               | ?MFKT        | A             | A   |
| 2            | Values are taken from VSGEN query. The ones shown here are the defaults.                                                                                                                          |              |               |     |
|              | Lines per page.                                                                                                                                                                                   |              | 24            | 30  |
|              | Characters per line.                                                                                                                                                                              |              | 80            | 72  |
| 3            | Break sequence breaks binary mode.                                                                                                                                                                | ?MBBM        | S             | S   |
|              | Break sequence breaks modem connection.                                                                                                                                                           | ?MBDS        | A             | A   |
|              | Break sequence does CTRL-C CTRL-A.                                                                                                                                                                | ?MBCA        | A             | A   |
|              | Break sequence does CTRL-C CTRL-B.                                                                                                                                                                | ?MBCB        | A             | A   |
|              | Break sequence does CTRL-C CTRL-F.                                                                                                                                                                | ?MBCF        | A             | A   |
|              | Data flow control over console lines (X-OFF, X-ON). During binary I/O can prevent character loss when the host computer or device input buffer is full.                                           |              |               |     |
|              | Input flow control. CTRL-S interrupts from host computer. Instructs the console to stop sending data until the host issues CTRL-Q.                                                                | ?MIFC        | A             | A   |
|              | Output flow control. CTRL-S interrupts to host computer. Instructs host to stop sending data until the console issues CTRL-Q. Needed on D210, D211, D220, D400, D410, and G300 graphics consoles. | ?MOFC        | A             | A   |
|              | PBX call-out line, for CPI/24 lines only. Specifies that the line is for call-out; calls will be initiated by the computer, not a user. Generally used for lines connected to printers.           | ?CALLOUT     | A             | A   |
|              |                                                                                                                                                                                                   |              |               |     |

**Table 4-4. Line Initialization Word Characteristics for IACs, MCP1s, and CPI/24s**

| Mnemonic | Meaning                                                                                                                                                                                                                                    |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ?CLNn    | Select the number of data bits per character, excluding the parity bit (if any):                                                                                                                                                           |
| ?CLN5    | 5 bits per character.                                                                                                                                                                                                                      |
| ?CLN6    | 6 bits per character.                                                                                                                                                                                                                      |
| ?CLN7    | 7 bits per character.                                                                                                                                                                                                                      |
| ?CLN8    | 8 bits per character. The IAC, MCP1, or CPI/24 may generate or ignore hardware parity as specified via the CPR mnemonic (this is standard).                                                                                                |
| ?CS10    | Transmit 1 stop bit per character (standard).                                                                                                                                                                                              |
| ?CS15    | Transmit 1.5 stop bits per character.                                                                                                                                                                                                      |
| ?CS20    | Transmit 2 stop bits per character.                                                                                                                                                                                                        |
| ?CPR0    | Disable parity checking; ignore parity bit (standard).                                                                                                                                                                                     |
| ?CPR1    | Odd parity.                                                                                                                                                                                                                                |
| ?CPR2    | Even parity.                                                                                                                                                                                                                               |
| ?CSBEN   | Enable split baud rate (IAC-8s only). Receive rate is that given to VSGEN question <i>IAC split baud rate</i> . Useful for a console with attached printer.                                                                                |
| ?CSBDS   | Disable split baud rate (standard). You <i>must</i> include ?CSBDS with any nondefault characteristics you specify for any IAC-8 line.                                                                                                     |
| ?CRn     | Select the data (baud) rate for this group of lines. n can be: 45, 50, 75, 110, 134, 150, 300, 600, 12H (1200), 18H, 20H, 24H, 36H, 48H, 72H, 96H, 19K (19,400), or 38K (38,800). The standard for CRTs is 96H (9600); for TTYs it is 300. |
| ?HOFC    | Enable hardware flow control (on IAC-12s and MCP1s only). Stops the data transmission from the host when CTS (clear to send) is low. Use it for modems and some printers. Turn it on for RS 232 protocol, off for RS 422 protocol.         |

**Table 4-5. Line Initialization Word Characteristics for ATIs**

| Mnemonic | Meaning                                                                                                                                   |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------|
| ?PARn    | Select parity:                                                                                                                            |
| ?PAR0    | Disable parity checking; ignore parity bit (standard).                                                                                    |
| ?PAR1    | Odd parity.                                                                                                                               |
| ?PAR2    | Even parity.                                                                                                                              |
| ?CODn    | Select the number of data bits per character, excluding the parity bit (if any).                                                          |
| ?COD0    | 5 bits per character.                                                                                                                     |
| ?COD1    | 6 bits per character.                                                                                                                     |
| ?COD2    | 7 bits per character.                                                                                                                     |
| ?COD3    | 8 bits per character; the ATI may generate or ignore hardware parity as specified via the PAR mnemonic (standard).                        |
| ?STP0    | Transmit 1 stop bit per character (standard).                                                                                             |
| ?STP1    | Transmit 2 stop bits per character.                                                                                                       |
| ?CLKn    | Each ATI has four clocks with jumper-selectable baud rates. Choose the clock that provides the desired baud rate for this group of lines: |
| ?CLK0    | Select clock 0 rate (standard).                                                                                                           |
| ?CLK1    | Select clock 1 rate.                                                                                                                      |
| ?CLK2    | Select clock 2 rate.                                                                                                                      |
| ?CLK3    | Select clock 3 rate.                                                                                                                      |

## Proceeding

When you have described the lines for an IAC, MCP1, DRT, or ATI, you might want to examine the spec file with the Current command. If there is another IAC or MCP1 to describe, return to “IAC Dialog,” or “MCP1s”, above. If you have finished describing your console handling devices, continue to the next section.

## Line Printers

If a letter-quality printer is attached to a multiplexor line (IAC or MCP1 asynchronous line), identify it to VSGEN as a user console, as described earlier in this chapter.

There are several types of data channel printers that you specify:

- LPB** An LPB is a commercial I/O printer, with a vertical forms unit. AOS/VS supports up to eight LPB printers, device names LPB, LPB1, LPB2, ..., LPB7.
- LPD** An LPD is a DASHER model 4325 - 4328 printer. AOS/VS supports up to two LPD type printers, device names LPD and LPD1.
- LPE** Type LPE includes laser document printers (model 4225) and *any* data channel printer that doesn't need system initialization (LPB and LPD do need initialization). AOS/VS can run up to 8 LPE printers, device names LPE, LPE1,...,LPE7.
- LPJ** An LPJ printer on MV/2000 DC and DS/7700 computers. AOS/VS supports four controllers (LPJ, LPJ1, ..., LPJ3), and each controller can support up to four printers. On the first controller, device names are LPJ0, LPJ1, ..., LPJ3. On the second controller, device names are LPJ10, LPJ11, ..., LPJ13.

For 4000-class integrated systems: If a printer is connected to the MIOC printer controller, specify it as LPE, with device code 17 (default).

If a printer is connected to an MCP1 printer controller, you can specify it as either LPB or LPB1, but must specify its device code as 57. The name you specify (LPB or LPB1) will become the printer device name needed to start and stop queues on the printer via EXEC.

Determine which type your primary printer is. Then — when VSGEN asks for a COMMAND — add it:

```
      A )
Name of device to be added:    LPB )      (Or LPE, or LPD, or LPJ)
Device code [17]:
```

Generally, take the default unless you know the printer is on a different device code, or the printer is an MCP1 printer controller (explained above).

```
      )
Enter a command:
```

For 8-bit character handling though EXEC, you will need to specify 8-bit handling when you start the printer (described in Chapter 8, START command).

If you have a second line printer, type A ) and specify the name. If the second printer is the same type as the first, its name is name1 — e.g., LPB1. For example

```
      A )
Name of device to be added:    LPB1 )
Device code [57]:
```

```
Enter a command:
```

If the type of the second printer *differs* from the first (for example, the first printer is an LPB and the second an LPE), you can enter the name of the second printer as primary (e.g., LPE). But if you do this, be sure to specify the correct device code for the secondary printer. The default secondary printer device code is 57. For example,

```
      A )
Name of device to be added:    LPE )
Device code [17]:            57 )
```

Enter a command:

If you want any printer device to handle 8-bit characters, arrange this through EXEC (Chapter 8, EXEC's START command). VSGEN does not configure AOS/VS for 8-bit character handling on printers.

## Plotters

AOS/VS supports up to two digital plotters, device names PLA and PLA1. Only MV/8000 systems of the 9300 series can run a plotter as an individual device. Thus you should specify a plotter *only* for a system that will run on an original MV/8000, 9300 series. A different computer *may* be able to handle a plotter (like the model 4435) connected via asynchronous line to an IAC or MCP1; if so, specify the plotter to VSGEN as a console line, like a letter-quality printer (earlier). A slave printer attached to a console is treated as part of the console by the system; do not tell VSGEN that a slave printer is a plotter. To have the new system support a plotter, add a device, then specify the name, and, unless the plotter is connected to a nonstandard device code, default the device code. For example

```
      A )
Name of device to be added:    PLA )
Device code [15]:             )
Output buffer byte length [64]: )
Characteristic word 0 [STANDARD]: )
Characteristic word 1 [STANDARD]: )
```

Enter a command:

There are no standard characteristics for plotters. The nonstandard characteristics you can specify are shown in Table 4-6.

## Card Readers

AOS/VS supports up to 2 model 4016 card readers, device names CRA and CRA1. To have the new system support a card reader, add a device, then specify the name, and, unless the reader is connected to a nonstandard device code, default the device code. For example

```
      A )
Name of device to be added:    CRA )
Device code: [16]:             )
Input buffer byte length [164]: )
Characteristic word 0 [STANDARD]: )
Characteristic word 1 [STANDARD]: )
```

Enter a command:

The default buffer holds the images of two cards. There are no standard characteristics for card readers. The nonstandard characteristics you can specify are shown in Table 4-6.



**Table 4-6. AOS/VS Plotter and Card Reader Characteristics**

| Word | Characteristic                                                                                                                                                                                                                               | Bit Mnemonic | PLA, PLA1 | CRA CRA1 |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|----------|
| 0    | None.                                                                                                                                                                                                                                        | —            | —         | —        |
| 1    | Upper- and Lowercase: accept both upper- and lowercase characters as input. By default, lowercase characters are converted to uppercase.                                                                                                     | ?MULC        | n/a       | A        |
|      | Retain trailing blanks in text mode. By default, the system inserts a NEW LINE after the last nonblank characters and drops trailing blanks.                                                                                                 | ?MTSP        | n/a       | A        |
|      | Use packed format for binary mode. This format consists of 4 12-bit columns packed into 3 memory words. By default, the system puts each 12-bit column, right justified, in each memory word and uses the leftmost 4 bits for reader status. | ?MPBN        | n/a       | A        |
|      | Time out: enable time-outs on device.                                                                                                                                                                                                        | ?MTO         | A         | A        |
|      | Wrap line onto next line if line is too long (done in hardware).                                                                                                                                                                             | ?MWRP        | A         | A        |
|      | No New Line: do not append NEW LINE character to end of card image. By default, the system appends a NEW LINE to allow for data sensitive reads later.                                                                                       | ?MNNL        | n/a       | A        |

## MCA's and Local Area Networks (LANs)

An MCA is a small processor, used in compressed Local Area Networks (LANs) with DG systems that are no more than 150 feet apart. Each MCA can handle up to 16 asynchronous lines (nodes).

(For compressed LAN operations, MV/4000 DC, MV/4000 SC, and Data General DS/4000-series and DS/7000-series computers have a device called a LAN controller. And, for LAN communications with systems up to 1 mile apart, there's a device called a Network Bus Adapter (NBA), also called an NBS. A LAN variation called a Local Bus LAN controller is available on DS/7500 and MV/2000 DC systems. A LAN can be very useful — for both intersystem communication, distributed data processing, and transport of software from one system to another. For more on the latter use, see the XODIAC™ (networking) X.25 Release Notice. If you want to use an NBA or MV/4000 DC or MV/4000 SC LAN controller, you must configure it using the XODIAC networking NETGEN program, not VSGEN. Since you configure and run NBAs and LAN controllers using the XODIAC or Internet system (not AOS/VS), we don't describe them further in this book.)

Each MCA, however, must be identified to VSGEN.

AOS/VS supports up to two MCAs — device names MCA and MCA1. Internally, an MCA is two devices: the transmitter, MCAT(1), and the receiver, MCAR(1). MCAT must be on device code 6 and MCAR on device code 7; MCAT1 must be on device code 46, and MCAR1 on device code 47.

VSGEN sees the transmitter and receiver as one device, so the MCA dialog is the shortest of all. Simply add a device and type the name. For example,

```

A )
Name of device to be added:    MCA )

```

Enter a command:

If you have a second MCA, add MCA1 as you did MCA.

## DCUs, ISCs, and LSCs

If your system has a Data Control Unit (DCU), Intelligent Synchronous Controller (ISC), or Local Bus Synchronous Controller (LSC), you must configure it using the BSCGEN program. You must also use BSCGEN to configure synchronous lines on an MCP1. BSCGEN is described in “Supporting Synchronous Devices”, near the end of this chapter.

## Battery Backup (BBU) and Auto Restart

Your MV/Family computer may have a battery for full backup or partial backup. Battery backup is part of the default system. If your system has no battery, you can delete BBU. If you do have full backup but don't want auto restart, edit this choice.

If your computer has either battery, tell VSGEN about it, adding the device named BBU:

```
Enter a command:  A )
Name of device to be added:  BBU )
Full or partial backup [F]:
```

If your battery is model 8746, it provides full backup; press **Y** for the default. If the battery provides partial backup, type **P** **Y**; this ends the BBU dialog.

If you specify full, VSGEN asks

```
Enable auto restart after powerfail [Y]:
```

An answer of yes allows AOS/VS to continue normally when power returns after a power failure. We recommend that you answer yes by pressing **Y**.

For full backup to work, all of the following must be true:

- The battery must provide full backup;
- power must return before the battery is exhausted;
- BBU with full backup and auto restart must have been specified to VSGEN; and
- the computer LOCK switch (if any) must have been in the ON or LOCK position when power went down.

Handling power failures is described near the end of Chapter 6.

## Proceeding

Having dealt with the backup battery issue, you're done with the hardware specifications for the new system. The next section explains system software parameters that you can default or specify.

As always, you can display all current system specifications with the Current command, list device specs with the List command, or respecify one or more specs with the Edit command.

## Parameters for the System

Certain software parameters can be changed to optimize system performance. VSGEN supplies defaults for these. But — even for your first system — you may want to pick values other than the defaults to truncate page and swap files. In any case, you should at least examine this section before deciding to default the parameters. To display parameters, type **C** **Y**.

To change one or more system parameters, type **P** **Y**. VSGEN then asks about the following parameters. As usual, it displays the current defaults in brackets.

```
Enter a command:  P )
```

| Parameter                                                | What it Specifies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Swap [default]</i>                                    | Swap directory size in 512-byte disk blocks. The default is 2,147,483,647, larger than AOS/VS can ever use. We recommend the default. Details are below.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>Page [default]</i>                                    | Page directory size in blocks. The default is the same as for SWAP. We recommend the default. Details are below.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <i>Cache [128]</i>                                       | Number of 512-byte buffers allotted for the system to do its I/O. The default is okay. Details are below.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <i>Minimum number<br/>system pageable<br/>pages [10]</i> | Number of 2,048-byte pages that the system will attempt to retain in memory during operation. The default is okay. Details are below.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>Default file element size [4]</i>                     | <p>Size of the default file element. A file element is a set of contiguous 512-byte disk blocks. This parameter sets the minimum element size for every file created. The default of 4 blocks is a good general-purpose choice.</p> <p>Any user can choose an element size other than the default when he creates a file via the CLI command CREATE. So, in most cases, you will not want to change the default size. Valid responses are <i>1</i>, <i>1 1</i>, or a multiple of 4 between 4 and 65,532.</p>                                                                                                                            |
| <i>Frequency [10]</i>                                    | <p>The frequency, in cycles per second (Hz), of the CPU real-time clock. The default is 10 Hz. Other choices are 50, 60, 100, or 1000 Hz. Several higher level languages — like AOS/VS BASIC — expect the default frequency for their time-oriented statements.</p> <p>However, if the new system <i>must</i> synchronize with ac line frequency, you might select <i>50 1</i> or <i>60 1</i>, depending on your ac power. If the new system <i>must</i> check something often — as in a some kind of process control situation — you might choose <i>1000 1</i> (despite the overhead involved in 1000 RTC interrupts per second).</p> |
| <i>Access [Yes]</i>                                      | This parameter enables ( <i>1</i> ) or disables ( <i>N 1</i> ) the AOS/VS file access control mechanism. All file security — very important in a multiuser system — depends on access control. If you disable control ( <i>N 1</i> ), the multiuser environment will work, but every user will be able to access, modify, and delete every file in the system. So you will probably want to take the default on this.                                                                                                                                                                                                                   |

| Parameter                                             | What it Specifies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Initial program for PID 2<br/>[CLI.PR]</i>         | <p>Normally, when AOS/VS starts up, it runs a CLI process (called the master CLI process) as PID 2 on the system console. This question allows you to specify another program for PID 2. If this AOS/VS system will support multiple users, the CLI is your best choice, since it can create the multiuser environment (EXEC) easily. But for a special application, you might want to specify one of your own programs, perhaps one that creates other processes. Or, on a single-user system, where PID 2 needn't create any processes, you can choose any program you want (for example, CEO). For any program other than the default, you must specify the full pathname, with the .PR suffix, from the root directory. The file you specify must exist when you try to start up this system; if not, the system won't run.</p> <p>Whenever you shut down the PID 2 process, and confirm, the whole system will shut down.</p> |
| <i>Initial IPC message<br/>for PID 2 [ ]</i>          | <p>This allows you to specify a file of commands to be executed by the PID 2 (master) process when it comes up. If the master is CLI.PR (default), you might want to choose :UP.CLI, to bring up the multiuser environment automatically. (If not, someone must type UP ) when the master comes up.) The default is no IPC message. If you specify an IPC file, type the full pathname from the root directory.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>Max program load pages -<br/>noncontention [0]</i> | <p>This question, and the next one, can enable loading of multiple memory pages when a process is created. A nondefault answer doesn't <i>do</i> anything. It just enables multiple page loading for a program if specified by the SPRED utility. Details follow, in the section "Program Load Pages".</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <i>Max program load pages -<br/>contention [0]</i>    | <p>This question, and the previous one, can enable loading of multiple memory pages when a process is created while processes are competing for memory. Details follow, in the section "Program Load Pages".</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>Fault time prepaging<br/>maximum [0]</i>           | <p>This allows you to specify the maximum number of pages a process can read when it needs data or code that isn't in memory. If you take the default, a process can read (fault in) only one page at a time. Details follow, in the section "Multiple Pages on Faults."</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## Parameter

*Do you wish to use  
variable swapfiles [N]*

*Do you wish to  
truncate swap  
files after use [N]*

*Do you wish to  
truncate page  
files after use [Y]*

*Size above which  
page files will  
be truncated  
[2048]*

## What it Specifies

This question can enable variable swap files, which may shorten swapping time for large processes. If you say Y, it asks about the maximum and default sizes. Details follow in "Variable Swap Files."

Truncating swap files can (temporarily) save disk space by reducing each process's swap file to 0 bytes when the process terminates. However, the swap file will grow to its standard size when any process that's using it swaps. Generally, if you have more than 100 Mbytes of disk storage, take the default (N). If you have less than 100 Mbytes, type Y.

Truncating page files can save disk space by reducing a process's page file to 0 bytes when the process terminates — if the page file has grown larger than a specific size (next question). The space saved by truncating page files may last for hours or even days, since page files grow only as needed by the process using them. You should answer N only if you have ample disk space, *and* if paging performance is critical. With less than 100 Mbytes of disk space, always take the default with Y.

VSGEN asks this only if you wish to truncate page files. The answer sets the upper limit of page file size. If, when a process terminates, its page file exceeds the specified size, the system will truncate the page file to 0 bytes. The default size (2048 blocks), is a good general-purpose answer.

If you have less than 100 Mbytes of disk storage, type O.

With more than 100 Mbytes of disk, if disk space is not a critical issue, take the default (2048 blocks) by pressing N.

If you want to fine-tune page file size, or if disk space is a critical issue, try the following. Run the system for a while, then check the page file size in :PAGE (F/AS :PAGE: + N). Take the average page file size, divide by 512 to convert bytes to disk blocks, and run VSGEN again to specify this average number.

(Although the default page file limit, 2048 blocks, appears very large, it's deceiving. The F/AS command shows byte length to the *end of file mark*, in the highest block number in the file. Many disk blocks before the end of file are not occupied. A page file that appears to use — say — a Mbyte, is actually using much less space.)

| Parameter                                          | What it Specifies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Lowest priority for group 1 processes [255]</i> | Process types are independent of process priority. There are three process groups: group 1, high priority; group 2, medium priority (includes user processes); and group 3, low priority. Your answer to this question, and the next one, determine the group in which a process of a given priority falls. The details of all this are fairly complex (described in Chapter 15). In most cases, you don't need to know the details. Things will be simpler if you take the default on both of these <i>lowest priority</i> questions.                                                                                                                                                                                                                                                                                  |
| <i>Lowest priority for group 2 processes [258]</i> | This question sets the range for group 2 processes (between the number in the previous question and this number). We suggest the default.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <i>Suppress soft tape error reporting [N]</i>      | <p>A soft tape error is an I/O inconsistency that disappeared in fewer than 13 retries. (If it persisted for 13 retries, it would be a hard error.) Normally, soft errors are reported to the system console and AOS/VS error log (:ERROR_LOG). Certain brands of magnetic tape can produce many soft error messages. On a hard copy console, printing these messages can slow system response. And the messages can be quite annoying if you're trying to use this console.</p> <p>To disable soft tape error reporting on the system console, type Y ; otherwise press J. A Y J answer disables <i>only</i> soft tape error reporting on the system console. All disk errors will still be reported on the system console and error log. You can control soft tape error logging at runtime with SYSLOG commands.</p> |
| <i>Default system dump device [MTB]</i>            | If serious system errors recur, you may want to ask for help from DG. To get help, you might need to submit a dump of computer memory to DG. The default device for this dump is MTB — but, if you don't have an MTB tape unit, you can specify a different device now or when the system panics. You can specify any tape controller you have (for example, MTC, MTD, or MTJ). If you don't have tape or have both diskette and tape, and don't want to use a tape for memory dumps, specify a diskette controller (DPJ1 or DPI).                                                                                                                                                                                                                                                                                      |
| <i>Maximum number of processes [255]</i>           | On most systems, the default of 255 processes is enough. But, on an MV/20000 or MV/10000, you might want to specify more than 255. Details follow in the section "Maximum Number of Processes"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

### Swapping and Paging in AOS/VS

AOS/VS is a *virtual memory, demand-paged* system. Virtual memory means that memory is a composite of main memory and disk memory. Demand-paged means that it adds a page to each process's total memory allotment (called its *working set*) when the process demands another page. A page of memory is 2,048 bytes.

The SWAP and PAGE directories are the disk component of AOS/VS virtual memory. They are critical to its operation.

## Processes and Working Sets

AOS/VS runs each program as a *process*, with its own process ID (PID). A process starts with a certain number of pages of virtual memory — its initial working set. When it needs more pages (perhaps to execute a routine that isn't in memory), a *page fault* occurs; AOS/VS then allots an additional page to its working set. The theoretical limit on the number of pages in a process' working set exceeds 1,000,000 — providing a limit of 2 billion bytes for a process' logical total size.

There can be many processes — up to 1,024 — all running simultaneously.

*Memory contention* occurs when all currently active processes (including the AOS/VS system and its peripheral manager) desire a working set larger than the computer's main (physical) memory. Memory contention can occur much of the time.

In “light” memory contention, AOS/VS resolves the situation by removing inactive pages from processes and keeping them on disk in directory PAGE. The processes' initial working sets remain in memory. Later, if demanded, the pages are restored to the processes' working sets. Because the number of pages involved varies, the files used to keep the pages vary in size. In directory PAGE, AOS/VS creates a page file for each new process ID as the process is created. Later, it attempts to reuse these files — matching the file's size to the number of pages it expects the process to use.

In “heavy” memory contention, AOS/VS removes whole *processes* (selecting blocked processes first), and keeps them in directory SWAP. Later it restores them to main memory. The file in which it keeps each process is a contiguous file of 512 disk blocks (each disk block is 512 bytes). As with PAGE, AOS/VS creates a swap file for each new process ID as the process is created. But the file size is constant unless you enable variable swap files (described below).

AOS/VS creates and manages the SWAP and PAGE directories automatically. They are really part of memory; AOS/VS relies on them and uses them extensively. If AOS/VS runs out of space in either one, it may fail (panic). The default maximum sizes have been made very large to prevent AOS/VS from running out of space. However, the large sizes won't prevent problems if the LDU that *holds* SWAP and PAGE fills up.

Only a small percentage of the disk space allowed for SWAP and PAGE will ever be used by these directories. The space not used is available for general data storage. But do not store user or system files in SWAP or PAGE. At system initialization files not in a specified format are deleted.

Files in SWAP and PAGE can be deleted by superusers to save space; but the system will recreate them if it needs them. After anyone deletes files in these directories, AOS/VS should be shut down and brought up again, so that it can reinitialize them.

Generally, you will not want to delete page files. But you might do so in a situation where a very large process (like a batch job) runs at night — requiring a large page file — and where interactive user processes, which generally need smaller page files, run during the day. You might delete the large page files after the batch runs to make more room for the smaller daytime page files.

## An LDU For SWAP, PAGE, or BOTH

If you can afford the disk space, you may want to designate an LDU for both SWAP and PAGE directories, or for each one.

To do this for both directories, use the Disk Formatter to format a DPJ or DPF disk with the logical disk name of BOTH, and give this LDU an access control list of +,E — as described in the Disk Formatter chapter. Then, to VSGEN, specify this disk unit name to both the SWAP and PAGE questions. For example, if your LDU named BOTH will be in unit DPF10, you'd say to VSGEN:

```
Swap [default]:    DPF10 ↵  
Page [default]:    DPF10 ↵
```

When the new AOS/VS system comes up, it will automatically create and maintain control point directories with pathnames :SWAP and :PAGE on the LDU named BOTH. LDU BOTH is not restricted to the SWAP and PAGE directories; you can put other material on it as well.

If you decide to have a separate LDU for either SWAP or PAGE, remember that each time you initialize the system all files not in a specified format will be deleted.

You can override the VSGEN specs for both SWAP and PAGE when you bring up an AOS/VS system.

Under some circumstances, you may want to give the SWAP or PAGE directory, or each, its own LDU. To do this, use the Disk Formatter to format a disk with the LDU name SWAP or PAGE, and give this LDU an access control list of +,E. Then, during VSGEN or when you initialize AOS/VS, specify the pertinent disk unit name to the SWAP and PAGE queries as above. As with BOTH, user directories and other files can be placed on the SWAP and/or PAGE LDU.

### Cache of Buffers

Your answer to the CACHE question sets the number of system buffers. These are 512-byte buffers that the system uses for internal I/O. The valid range is 58 through 1,024. If your system will have a lot of free memory (as it might if it will run only a few processes), a large number of buffers can help cut down on disk requests. But if there will be a lot of processes, and/or memory contention, swapping will occur anyway; and you might want to specify fewer buffers to free memory for active processes.

For your first system you will generally want to take the default. The ideal buffer figure will depend on your system load, the kind of things it does, and your hardware; you can time typical application programs to determine it.

As with the SWAP and PAGE specs, you can override the CACHE spec when you bootstrap the system. This makes it easy to alter the buffer cache for testing — simply reboot the system, override default specs, and enter the new cache size.

### System Pageable Pages

AOS/VS uses pages in its own operation. Your answer to the *Minimum number system pageable pages* question sets the number of pages AOS/VS will try to keep resident in main memory (its own working set). The valid range is 4 to 99 pages.

If memory contention will be light, you may want to specify a large number of pages here. This will keep less frequently used system code resident, which may allow processes to run faster. But specifying more than about 45 pages has little effect on system performance.

If memory contention will be moderate or heavy, you may want to take the default and free the memory for active processes. Ideally, system load will be set up to be consistent — and programs that use similar types of calls will be run simultaneously. But this requires a lot of experience to implement — and generally you can take the default. This specification can't be overridden when you bootstrap the system.

### Program Load Pages (Max program load pages)

Normally, when a process is created, its working set has only a few pages (nominally 0). Your answers to these questions set the *maximum* number of pages that can be loaded as the working set when a process is created. For program loading to occur, someone must run the SPRED (Selective Preamble Editor) utility and describe the page boundaries.

Even if you specify an answer (say 50), multiple pages won't be loaded before SPRED runs. If you take the default, multiple page loads can't occur even if SPRED specifies them. Regardless of your answer, and what is done with SPRED, existing programs will run. Using SPRED is described in Chapter 9.



Program loading of pages can be useful in situations where programs use many unshared pages — it's faster to load most (or all) of the needed pages when the process is created than to fault the pages in later.

The state of memory contention may influence your choice of maximums. For example, you might want to allow a fairly large maximum when memory is free (noncontention), and allow only a small (or 0) maximum in contention situations.

### Multiple Pages on Faults (Fault time prepagging maximum)

Normally, when a process needs information that isn't in memory, it takes a page fault; the system finds a page, adds it to the working set, and reads needed information into the page.

This question can enable the system to add multiple pages to a working set when a process takes a page fault. Having a process do this can be useful when you know the process will usually need more than one page when it takes a fault. Like the *max program load* question, this question only *enables* a feature; the actual number of pages to be added must be specified with the SPRED utility.

### Variable Swap Files

During memory contention, sometimes a process must be swapped to disk. If the process' working set has grown while the process was running, the swap file might not be large enough to hold the working set. If this happens, the system must strip pages from the working set until it fits in the swap file. Later, when the process swaps back in, it may need the stripped pages back, and take many page faults to get them.

These operations take a lot of time. You can shorten this time by setting up a large swap file for each process that you expect will acquire a large working set, then get swapped out. Like the two previous questions, this only sets a maximum. For a nondefault swap file size, someone must run SPRED on the program's .PR file.

Neither allowing variable swap files nor specifying a large swap file will prevent or inhibit a program from running. The only negative aspect is the loss of disk space.

The default maximum swap file size is 126 pages. The default swap file size for all processes not given a custom size (with SPRED) is also 126 pages.

### Maximum Number of Processes

The default maximum number of processes is 255. Your answer to the *Maximum number of processes* question sets the maximum number of processes the new system can run. As a general rule, CLI users who may also use CEO need an average of three and a half processes. CEO-only users need an average of two and a half processes. So — assuming twenty or so system processes — the default of 255 processes is enough for about 65 CLI users or 90 CEO-only users simultaneously.

On most computers, 255 processes is enough. But, on an MV/20000 or MV/10000, you may want to run more than 255. If so, type the number of processes you want. For example, you might type 500 ).

Specifying more than 255 processes doesn't mean you *must* run more than 255 — it just allows the system to do so. VSGEN lets you specify up to 1,024 processes.

To allow a process to run with a PID above 255, you will need to edit the pertinent program file(s) with the SPRED editor. Also, there are issues relating to PID size that you should understand. These issues are explained in Chapter 15, under "Running More than 255 Processes on Your System."

## Proceeding

When you have specified the parameters you want, you might want to review the whole system again with the **CURRENT** command. If any device is wrong, fix it with the **EDIT** command; or, in worst case, delete the device with **DELETE** and add it again.

Then continue.

## Naming the System (N Command)

Having specified the CPU and all your devices and parameters, name the system. The name can be any valid AOS/VS filename, 1 to 31 alphanumeric and special characters, **?**, **\_**, **\$**, and period (**.**). Try to create a descriptive and memorable name, because — until you install the system — you'll have to type its full pathname to bring it up.

To name it, use the **N** command:

**N** **↓**

*Enter new system name [none]:*

Type the new name, for example

**SYS\_7.00** **↓**

*Enter a command:*

## Creating the Spec File (S Command)

All your device specifications are still in memory. To write them to disk (files **sys.CSF** and **SYS.SSF**), use the **S** command (create a spec file):

**S** **↓**

*Creating specification file*

*Enter a command:*

If you have not specified a valid system, **VSGEN** will not create the spec file; instead it will type an error message and ask for a command. Fix the spec by adding or editing the appropriate controller; then try the **S** command again.

If a file named **sys.CSF** already exists in directory **:SYSGEN**, **VSGEN** will ask if you want to write over it (delete it and replace it with the new one). To overwrite, type **Y** **↓**; to save the old file, type **N** **↓**, use the **N** command to specify another name, and type the **SPEC** command again.

At this point, all your efforts are saved on disk. You could leave **VSGEN**, execute it again later with the command **X VSGEN/SAVE/BATCH=sys** **↓**, and have it build a system.

But let's assume you want to build a system.

## Building the System (B Command)

To build the current spec into a tailored AOS/VS system, use the **BUILD** command. **VSGEN** will verify the configuration, and notify you if it isn't valid. If valid, **VSGEN** will try to create a spec file, then build a system. If a file with the name **sys.CSF** already exists, **VSGEN** will ask if you want to write over it. Here, this will occur because you already created the specification file.

Type

**B** **↓**

*A spec file with this name already exists*

*Shall I write over it? [N]      Y* **↓**

*Creating specification file*

*Do you want to save TMP files? [Y]* **↓**

*System build in progress*

VSGEN invokes first the macroassembler (MASM), then the Link utility to build the system. This takes a several minutes. But soon, you'll see the message

*System build completed*

*Enter a command:*

The tailored system is ready. Go to the next section.

If the build doesn't work and you see an error message, leave VSGEN with Q ↵. Check the working directory with the CLI command DIRECTORY ↵; it should be :SYSGEN. Then check your search list with SEARCH ↵; it should include :UTIL. If the working directory and search list are not what they should be, set them as shown earlier under "VSGEN Session"; then type

\*) X VSGEN/SAVE/BATCH=sys ↵

to build another system from the spec file. If the search list is not the problem, type the SYS.KS\_OUT.pid.TMP file (described in Table 4-1) to check for other errors.

### Quitting VSGEN (Q Command)

The new system has been built, but is still waiting in the wings. To try it, you'll need to leave VSGEN, shut down the current system, and bootstrap the new tailored system. To leave VSGEN, type

Q ↵

\*)

If you try to quit VSGEN without typing a SPEC or BUILD command, VSGEN warns you that

*You have not created a spec file for the current system*

*Do you wish to create a spec file? [Y]:*

To save the work you've done (if any) during this VSGEN session, press ↵ for the default, then type a spec file name as described under "Creating the Spec File". To leave VSGEN without creating a spec file, type N ↵.

You're back in the CLI.

For a concise summary of a simple VSGEN session for an MV/4000 computer, see Figure 4-6. For a session for an MV/10000 SX with disks on the second IOC, see Figure 4-7.

```

) SEARCHLIST :UTIL )
) DIR :SYSGEN )
) SUPERUSER ON )
*) X VSGEN )

Welcome to VSGEN -- Type H for help
Enter a command:  H )

... (Text of HELP) ...
Enter a command:  M )

Enter new model [MV/8000]:  MV / 4000 )
Enter a command:  A )

Name of device to be added:  DPJ )
Device code [24]:  )

Enter a command:  C )

... (Text of current system description) ...
Enter a command:  E )

Name of device to edit:  DPF )
Device code [27]:
Number of 6214 units on this controller [0]:  )

Enter a command:  E )

Name of device to edit:  CON0 )
Console type [CRT3]:  TTY )
Input buffer byte length [128]:  )
Output buffer byte length [128]:  )
Characteristic word 0 [STANDARD]:  )
Characteristic word 1 [STANDARD]:  )
Characteristic word 2
Lines per page [STANDARD]:  )
Chars per line [STANDARD]:  )
Characteristic word 3 [STANDARD]:  )
Initialization word [STANDARD]:  )

Enter a command:  A )

Name of device to be added:  IAC )
Device code [65]:  )
Base line number [0]:  )
IAC device type [??]:  16 )
Console lines [??]:  0 - 15 )
Console type [CRT3]:  CRT6 )
Input buffer byte length [128]:  )
Output buffer byte length [128]:  )
Characteristic word 0 [STANDARD]:  )
Characteristic word 1 [STANDARD]:  )
Characteristic word 2
Lines per page [STANDARD]:  )
Chars per line [STANDARD]:  )
Characteristic word 3 [STANDARD]:  )
Initialization word [STANDARD]:  )

```

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Figure 4-6. A VSGEN Session for an MV/4000 Computer System (continues)

```

Do you want to add another group of lines? [N]
Enter a command:  A ↓

Name of device to be added:  LPB ↓
Device code [17]:  ↓
Enter a command:  P ↓

Swap [2147483647]:  ↓
Page [2147483647]:  ↓
Cache [128]:  ↓
Minimum number system pageable pages [10]: ↓
Default file element size [4]:  ↓
Frequency [10]:  ↓
Access [YES]:  ↓

Initial program for PID 2 [CLI.PR]:  ↓
Initial IPC message for PID 2 [:  UP.CLI ↓
Max program load pages -noncontention [0]: 40 ↓
Max program load pages -contention [0]:  ↓
Fault time prepaging maximum [0]: 20  ↓
Do you wish to use variable swapfiles [N]:  Y ↓
Maximum swapfile size [126]: 512 ↓
Default swapfile size [126]:  ↓
Do you wish to truncate swap files after use [N]:  ↓
Do you wish to truncate page files after use [Y]:  ↓
Size above which page files will be truncated [2048]:  ↓
Lowest priority for group 1 processes [255]:  ↓
Lowest priority for group 2 processes [258]:  ↓
Suppress soft tape error reporting [N]:  ↓
Default system dump device [MTB]:  ↓
Maximum number of processes [255]:  ↓
Enter a command:  N ↓

Enter new system name [none]:  SYS_7.00 ↓
Enter a command:  B ↓

Creating specification file
Do you want to save TMP files? [Y]  ↓
System build in progress
System build completed
Enter a command:  Q ↓

*)

```

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Figure 4-6. A VSGEN Session for an MV/4000 Computer System (concluded)

```

) SEARCHLIST :UTIL )
) DIR :SYSGEN )
) SUPERUSER ON )
*) X VSGEN )

```

*Welcome to VSGEN -- Type H for help*

```

Enter a command:  H )
... (Text of HELP) ...

```

```

Enter a command:  M )
Enter new model [MV/8000]:  MV/10000 )

```

```

Enter a command:  A )
Name of device to be added:  DPF1 )
Device code [67]:  )

```

```

Enter a command:  A )
Name of device to be added:  DPJ )
Device code [24]:  124 )    (On second IOC)

```

```

Enter a command:  A )
Name of device to be added:  BBU )
Full or partial backup [F]: )
Enable auto-restart after powerfail [Y]: )

```

```

Enter a command:  C )
... (Text of current system description) ...

```

```

Enter a command:  A )
Name of device to be added:  IAC )
Device code [65]:  )
Base line number [0]:  )
IAC device type [??]:  16 )
Console lines [??]:  0 - 15 )
Console type [CRT3]:  )
Input buffer byte length [128]: )
Output buffer byte length [128]: )
Characteristic word 0 [STANDARD]: )
Characteristic word 1 [STANDARD]: )
Characteristic word 2
Lines per page [STANDARD]:  )
Chars per line [STANDARD]:  )
Characteristic word 3 [STANDARD]:  ?MBBM  ?MOFC  )
Initialization word [STANDARD]:  )

```

*Do you want to add another group of lines? [N] )*

```

Enter a command:  A )

Name of device to be added:  IAC1 )
Device code? [50]:  )
Base line number [0]:  16 )
IAC device type [??]:  8 )
IAC split baud rate [NONE]:  )
Console lines [??]:  0  1 )

```

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Figure 4-7. A VSGEN Session for an MV/10000 with Disks on the Second IOC (continues)

```

Console type [CRT3]:  )
Input buffer byte length [128]:  )
Output buffer byte length [128]:  )
Characteristic word 0 [STANDARD]:  ?MMRI ?MST ?MEOC )

Characteristic word 1 [STANDARD]:  ?CRT3 ?MMOD ?MULC ?MWRP )
Characteristic word 2
    Lines per page [STANDARD]:  )
    Chars per line [STANDARD]:  )
Characteristic word 3 [STANDARD]:  ?MBBM MOFC )
Initialization word [STANDARD]:  ?CPR0 ?CR12H ?CS10 ?CLN8 ?CSBDS )

Do you want to add another group of lines? [N]  )

Enter a command:  A )

    Name of device to be added:  LPB )
    Device code [17]:  )

Enter a command:  P )

    Swap [2147483647]:  )
    Page [2147483647]:  )
    Cache [128]:  )
    Minimum number system pageable pages [10]:  )
    Default file element size [4]:  )
    Frequency [10]:  )
    Access [YES]:  )
    Initial program for PID 2 [CLI.PR]:  )
    Initial IPC message for PID 2 [:  )
    Max program load pages -noncontention [0]:  )
    Max program load pages -contention [0]:  )
    Fault time prepaging maximum [0]:  )
    Do you wish to use variable swapfiles [N]:  )
    Do you wish to truncate swap files after use [N]:  )
    Do you wish to truncate page files after use [Y]:  )
    Size above which page files will be truncated [2048]:  )
    Lowest priority for group 1 processes [255]:  )
    Lowest priority for group 2 processes [258]:  )
    Suppress soft tape error reporting [N]:  )
    Default system dump device [MTB]:  )
    Maximum number of processes [255]:  )

Enter a command:  N )

    Enter new system name [none]:  SYS_7.00 )

Enter a command:  B )

    Creating specification file
    Do you want to save TMP files? [Y]  )

    System build in progress

    System build completed

Enter a command:  Q )
*)

```

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Figure 4-7. A VSGEN Session for an MV/10000 with Disks on the Second IOC (concluded)

## Installing Patches

Patches are corrections to a program, made on its .PR or .OL file. AOS/VS revisions usually ship with an update that includes patches. Also, if you belong to DG's Software Subscription Service, you will periodically receive AOS/VS updates that include patches.

You should always install patches after generating a new AOS/VS system. You should also install patches after receiving each update — especially if there's a problem you want fixed. Even if AOS/VS software appears to run correctly, it is not complete until the current update's patches — if any — have been installed.

AOS/VS includes a set of macros (autopatch macros) that make patch installation easy. The autopatch macros patch all AOS/VS programs (like PMGR, CLI, EXEC, Agent, and the SED text editor) for which patches have been issued.

Before patching, be sure that you have loaded the latest AOS/VS update tape (supplied by DG with revision number n.nn, with nn not 00). For your first system, Chapter 2 or 3 had you load the latest update. But if you have generated a new AOS/VS system without loading the latest update, then you must load the update before patching.

If the latest update is already loaded, skip to "How to Install Patches."

### Loading an AOS/VS Update

If you received the update on tape, continue. If you received it on diskette, skip to step 2.

1. Get the latest AOS/VS update tape, mount it on a tape unit, and type

```
) SUPERUSER ON ↓
*) DIR : ↓
*) DELETE/2=IGNORE PATCH_FILES ↓      (List file of old patch filenames)
*) LOAD/V/DELETE/L=PATCH_FILES @MTxn:0 ↓ (x is B, C, or D; n
   is the unit number. With
   the starter system, type
   @MTC0:0 or, with an
   MTD unit, MTD0:0.)
```

```
... (CLI verifies old files deleted and new files loaded.) ...
*)
```

Skip to step 3.

2. Get the first (maybe the only) diskette in the update and insert it in unit 0. Then type

```
) OPERATOR ON ↓
) SUPERUSER ON ↓
*) DIR : ↓
*) DELETE/2=IGNORE PATCH_FILES ↓      (List file of old patch filenames)
*) LOAD/V/L=PATCH_FILES @LFD:VOL1:UPDATE ↓ (Volume ID is VOL1,
   filename is UPDATE)

PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED
UNIT [@DPJ10] VOLUME ID [VOL1]? ↓
... (CLI verifies old files deleted and new files loaded) ...
*)
```

Remove the update diskette from unit 0.



### 3. Type

\*) DIR PATCH )

\*) QPRINT AOSVS\_UPDATE\_NOTICE ) (Print update notice file. If EXEC is not running, type COPY @LPB (or @LPE or @LPD) instead of the QPRINT command. If you have no line printer, use TYPE instead of QPRINT or COPY.)

Read the update notice, to check for any warnings or cautions. If you're curious about the patches themselves, print or type file PATCH\_FILES. This file has the names of all patch files loaded. Each patch filename includes the AOS/VS revision number, the program filename if known, and "\_PATCHES". For example, file 7.00\_AGENT.PR\_PATCHES has patches for the revision 7.00 Agent. And file 7.00\_AOSVS\_PATCHES has patches for a tailored revision 7.00 AOS/VS system.

## How to Install Patches

The autopatch installation macros are easy to use. The rules for using them are as follows.

- You must install patches from PID 2 (the master CLI). This CLI must be at level 0 (check with LEVEL command; type POP ) as needed).
- The CLI's search list must include fewer than 40 characters. The contents of the search list don't matter for patching.
- The multiuser environment (EXEC and other sons of PID 2) must be shut down. There should be only two processes: PMGR and CLI.
- The working directory must be :PATCH. The patch program PATCH.PR and current patch files must be in this directory. (These files are put here by default.) During the patching process, the macros will copy PATCH.PR to :UTIL if needed.
- AOS/VS program files must be accessible from the directory where they were installed (e.g., EXEC.PR must be accessible from :UTIL and PMGR.PR must be accessible from the root). Also, each program symbol table (program-name.ST) must be accessible from the program's default directory. (Symbol table and program files are loaded into the same directory by default.)

If a program file should be patched, and the macros cannot find it or find its symbol table, they will skip it and it won't be patched on this patch run. A message to this effect will appear in the listing file and on the console.

The form of the command to start the autopatch macros is

```
INSTALL_rev_PATCHES[/L=listfile] [/ROOT=subtree] [system-pathname]
```

where

*rev* is the AOS/VS revision — for example, 6.00, 7.00, or 8.00.

*/L=listfile* specifies the listing file pathname, to store copies of console messages. These messages include comments in each patch that explain the reason for the patch. If you omit this switch, the listing filename will be `INSTALL_rev_LOG` in directory `PATCH`. If this file already exists, new messages will be appended to it.

*/ROOT=subtree* specifies an alternative root directory (useful for system programmers, or any site that has a separate tree structure beneath the root). If you omit this switch, the default root is `.`. Generally, omit this switch.

*system-pathname* is the pathname of the AOS/VS system you want to patch — for example, `:SYSGEN:SYS_7.00.PR`

If you omit the *system-pathname*, the autopatch macros will not patch the AOS/VS system. It's very important to patch the system. Always include the tailored system pathname, even if you think the system has already been patched.

A typical autopatch sequence takes 5 to 15 minutes. When you're ready to do it, type the `INSTALL` command. For example

```
) DIR :PATCH )  
) INSTALL_7.00_PATCHES :SYSGEN:SYS_7.00.PR )
```

... (Patch messages) ...

```
)
```

This command patches all AOS/VS files that need patching, including the system, `SYS_7.00.PR`. It records console messages in file `:PATCH:INSTALL_7.00_LOG`.

In addition to console messages, `PATCH` creates a patch history file (name ends in `.PH`) for every program patched. The patch history files are stored in directory `:PATCH:PATCH_HISTORY`. Patch history files can help you keep track of patching activity.

Whenever a program is patched, the patch updates its revision number, so you can get the last update level via the `REVISION` command. For example,

```
) REV :PMGR.PR ) (Check program revision.)  
07.00  
) INSTALL_7.00_PATCHES ) (Install patches.)  
... (Messages) ...  
) REV :PMGR.PR ) (Check revision again.)  
07.01 (Revision number shows update.)  
)
```

After you patch, the applied patches will not take effect until you shut the system down and bring it up again. So, to try your software, shut down, and start up again (skip to "Testing the New System").

## Autopatch Errors

The autopatch installation macros create files in a temporary directory, :UDD:OP:?PATCH.pid.TMP. Then, after patching is complete, they delete the temporary directory. If for any reason the macros do not finish normally, you might want to delete this directory before retrying the procedure.

Error messages have the form

*ERROR*  
(message)

The message text that follows the word *ERROR* should enable you to fix the problem and retry the installation. If not, make sure you're following the rules described above.

## Patching Specific Programs

The PATCH program — used by the autopatch installation macros — installs patches in individual program files. Generally, we recommend that you use the autopatch macros. Under some circumstances, however, you (and/or a DG system engineer) may want to install an individual patch using the PATCH program.

As with autopatch, the system won't let you patch an open file. And, if you patch a program that's already running, the patch won't take effect until the program is restarted from disk.

Before using the PATCH utility, make :PATCH the working directory. The PATCH command line has the form

**XEQ PATCH/Y/P=patch-pathname/T=program-pathname [/L=pathname]**

where

**/Y** specifies Yes (tells PATCH to install the patch).

**/P=patch-pathname** gives the pathname to the patch file. This patch file must be written according to PATCH rules, as in the PATCH help file (HELP \*PATCH ). Generally, we suggest that you keep all patches in the :PATCH directory.

**/T=program-pathname** specifies the target program to patch. You must include the .PR suffix, if the program has one.

**/L=pathname** selects a disk file to store console messages from PATCH. These messages will be sent to your console screen in any case.

It's a good idea to copy a program to a backup file before patching it. An example of a manual patch sequence is

```
... (Copy program to a backup file) ...
*) DIR :PATCH )
... (Load the patch file into :PATCH) ...
*) XEQ PATCH/Y/P=DG_UTILITY.PATCHFILE/T=:UTIL:DG_UTILITY )
... (PATCH applies patches) ...
*)
```

If the patch you want to apply uses symbolic addresses, then the program symbol table file (program-name.ST) must be in the same directory as the program file. The two files are placed in the same directory by default when you create a program with Link or load an AOS/VS revision.

For every program it patches, PATCH creates a patch history file, program-name.PH, in directory :PATCH.

If the PATCH program reports an error, make sure that your command line syntax is correct, and that the symbol table file (.ST) exists in the program's directory. If a patched program does not work properly, you can retry with a new copy of the backup version. (Don't patch the backup version itself.)

## Testing the New System

First, shut down the current system. (If the multiuser environment is up, make sure all users are logged off first). Type

**\*) BYE )**

*Do you really want to shut the system down? Y )*

*Starting system shutdown date*

*System shutdown*

Boot the new system:

**SCP-CLI> RESET )**

**SCP-CLI> BOOT 27 )** (Or **BOOT 24** for models 6236, 6239, 6301)

### *Operating System Load Menu*

*1 Continue immediately with operating system load*

*2 Enter the Technical Maintenance Menu*

...

*Enter choice [1]: 2 )* (Choose option 2)

### *Technical Maintenance Menu*

...

*6 Run a specified program*

...

*Enter choice [1]: 6 )* (Choose option 6)

*Pathname? :SYSGEN:sys.PR )* (e.g., :SYSGEN:SYS\_7.00.PR )

*sys* is your system name. As shown, you must type the full pathname from the root directory; shown as :SYSGEN:SYS\_7.00.PR ).

*Date (MM/DD/YY)?* (Enter date; e.g., 5 23 86 )

*Time (HH:MM:SS)?* (Enter time; e.g., 16 30 )

*Override default specs [N]?*

The system is asking about specs you gave to VSGEN for the new system. You don't want to override, so press )

A pause occurs here, then

*AOS/VS CLI REV n date time*  
)

The new, tailored system is running. Skip the next section.

## If the New System Doesn't Come Up or Work Properly

If the new system doesn't come up, there will usually be an error message that describes the problem. The solution may simply be a matter of editing a device in the spec file. If the message is *FATAL AOS/VS ERROR*, note the figures displayed; then run ESD (Emergency Shutdown) by typing **RESET )**, **START 50 )**, and **)**. Then boot the starter system.

To bring up the starter system, choose option 1 from the Operating System Load Menu or wait for the time-out delay. (The starter system is the installed system.) Then, if you think the problem is in the VSGEN spec, execute VSGEN with the /DEFAULT=sys switch; fix the offending device spec(s); give the original name in the NAME command; use the SPEC command to overwrite the old spec file; then use the BUILD command again and repeat "Testing", above.

If the new system fails again, or if the problem isn't the VSGEN spec, perhaps you haven't installed patches. Install patches (described earlier); then try again. If the new system fails again, type the panics file via `COPY @LPB :UTIL:AOSVS.PANICS.SR`; then interpret the panic values as explained in Chapter 6.

## A Fast Checkout for the Tailored System

If you know that your VSGEN spec file is okay (perhaps because it has been used before to build a system that works), you can skip this section.

If your VSGEN spec file is new, you may want to check a few basic things. (You won't really know that the system works until you've brought up the multiuser environment, as described in the next chapter.) As a basic test, try a few CLI commands:

```
) SEARCH      :UTIL )
FILES/AS/S    :PAGE:+ )
ERROR: FILE ACCESS DENIED, ...
) SUPERUSER   ON )
*) FILES/AS/S :PAGE:+ )
    ... (Sorted list of files in directory :PAGE) ...
```

This sequence of commands sets the search list to :UTIL, then checks file access controls and shows you the FILESTATUS /S (SORT) and /AS (Assortment) switches.

Now, if you have any other LDUs (formatted with the Disk Formatter), try to initialize and release them. For example, assume you have an LDU with disk unit name DPJ1 that you named UDD1. With unit DPJ1 ready, type

```
*) INITIALIZE DPJ1 )      (Initialize using unit name)
UDD1              (System displays LDU name)
*) RELEASE    UDD1 )      (Release using LDU name)
```

Try this with all your LDUs. If the commands work, your disk controllers were correctly identified to VSGEN. If a command doesn't work, you forgot or entered an incorrect controller specification; the VSGEN spec file may need editing.

Turn your line printer on; make sure paper in it is aligned; put it on line; and type

```
*) COPY @LPB :UTIL:AOSVS.PANICS.SR )      (Or @LPD, or @LPE instead of @LPB)
*)
```

This shows that the line printer works and also gives you a copy of the Panics file — useful for describing fatal AOS/VS errors.

Type

```
*) CHAR/DEFAULT )
... (characteristics) ...
*)
```

This shows you the default console characteristics VSGEN set up for the system console.

Type

```
*) PROCESS/DEF/IOC=@CON2 :CLI )
*)
```

This creates a CLI process to run on console CON2. The @ is shorthand for the peripherals directory. Go over to the console connected as CON2 (line 0 of IAC, MCP1, or ATI) and verify the baud rate and parity settings on the back (if it's a CRT). Make sure it is on line.

Wait a few moments, then press `]` a few times. If the CLI prompt appears, this means that you have at least one user console line connected and identified to VSGEN correctly. It's very good news. But if nothing happens on CON2, the hardware may be wrong, or you may have made a mistake in VSGEN.

To terminate the process on CON2, type **BYE** on CON2's keyboard.

Next, try some magnetic tape I/O with the tailored system (if it has tape). Get a blank tape, ring in, and mount it on unit 0. Put the unit on line. Type

\*) **DIR** :)

\*) **DUMP/V @MTx0** (x is B, C, or D, depending on tape unit model)

... (System verifies files dumped)...

**CTRL-C CTRL-A** (Press CTRL-C, then CTRL-A)

**ERROR: CONSOLE INTERRUPT**

\*) **REWIND @MTx0** (x is B, C, or D, as above)

This shows that the tape driver for unit 0 is okay; it also shows how to interrupt CLI commands with **CTRL-C CTRL-A**. You can dismount the tape.

You've done nearly all the testing it's practical to do without bringing up the multiuser environment.

## Making a Tailored System Tape

After testing the system, you should make a system tape or diskette of your tailored system. This can save many steps if you ever need to rebuild your system LDU. To make a tailored system tape, follow these steps.

- Get a blank tape, with the write ring in. Mount and thread it on tape drive 0, the one you used for the initial AOS/VS load. Make sure the unit is on, and on line.
- Type

) **SUPERUSER ON** )

\*) **DIR :SYSGEN** )

\*) **SYSTAPE @MTx0 sys.PR** (x is B, C, D, or J depending on the unit type.  
sys is your tailored system name)

Commands in the SYSTAPE.CLI macro make you a tailored system tape.

- When the CLI SUPERUSER prompt returns, rewind the tape:

\*) **REWIND @MTx0** )

\*)

Remove the tape from the unit, remove the write ring from the tape, and clip the cover on the tape.

Any system tape you make using the SYSTAPE macro has the same format as the AOS/VS system tape supplied by DG. However, it has your tailored, patched system in file 5 instead of the starter system. And, it has all files and programs currently in your root (:), :UTIL, :HELP, and :SYSGEN directories — including the ones your site created, *and* (except on an MV/8000) a copy of the microcode/SCP-OS file (MVnnnn.MCF).

If you ever need to rebuild a blank LDU using this tape, you can abbreviate the procedures given in Chapter 2 or 3. You won't need to load microcode from a separate tape, or run VSGEN again; in fact, after you load tape file 7, you'll come up in AOS/VS with the root, :UTIL, :HELP, and :SYSGEN directories restored as of the time the system tape was made.

## Making a Tailored System Diskette

To make a tailored system diskette, follow these steps.

- Get a new, blank diskette and insert it in unit 0.

- Type

```
) SUPERUSER ON )
```

```
*) DIR :SYSGEN )
```

```
*) COPY @DPJ10 sys.PR )
```

(sys is your tailored system name;  
e.g., SYS\_7.00.PR. If the disk and diskette share a  
controller, the diskette name is DPJ1.)

... (Delay while it copies to diskette) ...

```
*)
```

- Remove the diskette from the unit, and return it to an outer envelope.

This copy diskette has the same format as the starter system diskette supplied by DG. If you ever need to rebuild a blank LDU (Chapter 2), you can load your tailored system from this diskette and skip VSGEN.

## Making the Tailored System the Default System

By default, SYSBOOT brings up the default system. The first time you bring up a new revision of AOS/VS, this is the installed starter system. If you've named another system as the default system, SYSBOOT will bring up that system instead of the starter system. Now that you have tested your tailored system, you can tell SYSBOOT the name of your tailored system so that in the future SYSBOOT will bring it up. To make the tailored system the default system, follow these steps.

1. Shut down the current system, if one is running, with the command **BYE** ; then type **Y** .  
If the multiuser environment is running, make sure all users are logged off first.

2. Boot the starter system:

```
SCP-CLI> RESET )
```

```
SCP-CLI> BOOT 24 ) (Or 27)
```

3. From the Operating System Load Menu, type **2** .

### *Operating System Load Menu*

*1 Continue immediately with operating system load*

*2 Enter the Technical Maintenance Menu*

...

*The default system pathname is xxx*

*Enter choice [1]: 2*

4. Choose option 8 from the Technical Maintenance Menu:

### *Technical Maintenance Menu*

...

*8 View or change the default operating system filename*

...

*Enter choice [1]: 8*

5. SYSBOOT prompts you for the pathname of the tailored system:

*Default operating system [xxx]:*

If the system named in *pathname* is the one you want, press ↵. If not, type the pathname of your tailored system, starting from the root. For example, type

*:SYSGEN:SYS\_7.00.PR ↵*

6. Now bring up the tailored system by choosing option 1, "Load and start the default operating system."

*Enter choice [1]: ↵*

... (pause) ...

7. The date and time questions are skipped on computers with a working boot clock.

7a. *Date (MM/DD/YY)? 5 23 86 ↵* (Type current date)

7b. *Time (HH/MM/SS)? 17 24 ↵* (Type current time)

8. *Override default specs [N]? ↵*

... (pause) ...

9. *AOS/VS CLI REV n date time*

Congratulations. Your tailored system is running and SYSBOOT knows it is the default system. The next time you start your system, SYSBOOT will start your tailored system as the default system.

## Generating Other AOS/VS Systems

After you generate an AOS/VS system that you like, you can use the sys.CSF spec file as a base for all future systems.

There are two main reasons for generating a new AOS/VS system. The first is to change a specification (as when you acquire a new device) or change parameters for performance tuning. The second is to install a new AOS/VS revision.

You can generate a new system for either case using the /DEFAULT switch; for example

**\*) X VSGEN/DEFAULT=SYS\_7.00 ↵**

VSGEN will warn you if any interrevision changes may cause problems.

When you name a new AOS/VS system, you determine whether the old system will be deleted. If you give the new system the same name as an old one, the old system will be deleted (after VSGEN gets confirmation). If you give the new system a different name, the old system will continue to exist in directory :SYSGEN.

If an old system is defective, or its specs are obsolete, you will probably want to delete it. You can use the CLI DELETE command for this, or run VSGEN and give the new system the same name as the old — whichever is most convenient. If you include the AOS/VS revision in the system name, all names may differ, therefore old systems may persist — and you will have to use the DELETE command to remove them. But don't delete the original spec files (with .CSF and .SSF suffix) that you will use as a base for new systems.

Loading new revisions of AOS/VS is described in Chapter 15, "How to Handle Updates and New Revisions from DG".



## Supporting Synchronous Devices (DCUs, ISCs, MCP1s, LSCs)

Synchronous devices supported directly by AOS/VS include one or more Data Control Units (DCUs), Intelligent Synchronous Controllers (ISCs), and Multicommunications Processor (MCP1) synchronous lines, and, on DS/7500 or MV/2000 DC systems, Local Bus Synchronous Controllers (LSCs). A DCU is a small processor with one or more synchronous communications multiplexors (SLMs); it can handle up to eight sync lines. An ISC has a small processor and sync multiplexors on one circuit board; it can handle up to two sync lines. An MCP1's sync controller or LSC is just like an ISC, and you identify it the same way as an ISC.

A DCU, ISC, MCP1 or an LSC is required if your system is to use sync lines. Sync lines are needed for communication with IBM systems or IBM software emulators (HASP II, RCX70, DG/SNA).

If your system has a DCU or ISC, you *may* need to run the DG-supplied program BSCGEN. If the sync lines will be used *exclusively* by XODIAC or Internet networking software or DG/SNA, then the generation program supplied with XODIAC, Internet, or DG/SNA should be run; you need not run BSCGEN. But if your site wants to use RJE80, HASP II, RCX70, or make system calls that use the sync lines, then you must run BSCGEN.

You need not run BSCGEN *every time* you run VSGEN. However, you must run it when your sync line configuration changes or when the AOS/VS Release Notice recommends running it.

### The BSCGEN Program

BSCGEN creates a spec file with information about sync lines. A program called GSMGR uses this information to manage the lines. GSMGR allows another program (like RJE80 or a user program) to use the lines. GSMGR is described in Chapter 5.

To create the sync spec file that GSMGR needs, you must run BSCGEN.

### BSCGEN Dialog

BSCGEN — like VSGEN — in is directory :SYSGEN. To execute it, type

```
) SUPERUSER ON )
*) DIR :SYSGEN )
*) XEQ BSCGEN )
```

BSCGEN executes and asks the following questions. Legal answers are in parentheses. Default answers (that BSCGEN will use if you answer with *)*) are brackets, as usual.

*Do you wish to:*

*A Create a spec file.*

*B Edit a spec file.*

*C Update a pre rev 2.00 spec file.*

*Enter your selection:*

Before AOS/VS revision 2.00, sync spec files were created by VSGEN, with the name `sys.SYNC` where `sys` was the name given to the new AOS/VS system. If there is an old spec file that you want to update, type *C* *)*. If there is a BSCGEN-created spec file that you want to check or edit, type *B* *)*. To create a new spec file, type *A* *)*.

*Enter name of spec file:*

Type the name of the spec file you want to create or edit. For a new file, we suggest the name `sys.BSC`. For example, use `SYS_7.00.BSC` for an AOS/VS system named `SYS_7.00`. If you want to edit or update a file, and the name you type is not a valid spec file name, BSCGEN repeats this question.

*What type of CPU (MV20000,MV10000,MV8000,MV6000)  
(MV4000,MV2000DC,DS7700,DS7500) [MV8000]*

Answer with the model of CPU that will run the synchronous device. For an MV/20000 Model 2, MV/20000 Model 1, or MV/20000 C, answer MV20000 ↵. For an MV/8000 II, MV/8000 C, or MV/8000, press ↵ for the default. For an MV/10000 SX or MV/10000, answer MV10000 ↵. For an MV/4000, MV/4000 DC, MV/4000 SC, or DS/4000, answer MV4000 ↵. For an MV/2000 DC, answer MV2000DC ↵. For a DS/7700, answer DS7700 ↵. For a DS/7500, answer DS7500 ↵.

*Do you want to set/change bisync buffer area size (4)? [N]*

The default buffer size is 8 Kbytes. This size suits HASP II, RJE80, and RCX70. For the default size, press ↵ and skip the next question.

To specify a nondefault size, type Y ↵. BSCGEN then asks the size:

*Bisync buffer area size in 2 kbyte pages [4]*

The valid range of buffer sizes is 1 to 26 (pages). The program that owns this buffer will run resident, so the buffer will always occupy memory when the program runs. Decide on the buffer area size you want, and type it. For example, for RCX70 on two consoles, 4 ↵.

*What type is bisync controller n (DCU200, ISC/2, LSC) ? [DCU200]*

BSCGEN asks this question for each controller you have. If this device is a DCU, press ↵ for the default; otherwise, type ISC/2 ↵ or LSC ↵.

*Enter device code for controller n [m]:*

The default device code (m) for the first ISC or MCP1 sync controller is 25. The default code for the first DCU is 40. For your first ISC/MCP1 or DCU, unless you know it is connected to a nonstandard device code, press ↵ for the default. If you know the device is connected to a nonstandard code, or if no default code is displayed, type the correct device code and ↵.

*Enter lines to be genned on controller n: [0,1]*

On a DCU, each SLM usually manages two lines; there can be up to four SLMs, hence eight lines, usually numbered 0 through 7. For a DCU, type the range of lines handled (for example, 0,3 ↵); or with two lines, press ↵ for the default. With an ISC or MCP1, press ↵ for the default.

*Enter logical line number for physical line m: [n]*

Generally, for the first DCU, ISC, MCP1, and LSC, the logical line number should be the same as the physical line number, so press ↵ for the default.

For the second DCU (if any), you may want the logical line numbers to follow those of the first (not required). BSCGEN displays as default the lowest available line number. If you want the default, press ↵; otherwise type the desired line number and ↵.

For the second and subsequent ISC or MCP1, the logical line number should be (2 \* number-of-previous-devices), then (2 \* number-of-previous-devices) + 1. For example, for the second ISC, the first line would be 2 ↵ and the second line 3 ↵.

For either device, the name of the sync line will be @SLNn, where n is the number you specify or default, when this spec file is being used.

*Is this line switched or dedicated (SWT or DED)? [SWT]*

If this sync line will use a dedicated (leased) phone line, type DED ↵. If it uses a switched (standard) phone line, press ↵ for the default.

*Is this line half- or full-duplex (H or F)? [H]  
(Full duplex lines will have RTS high always.)*

Half-duplex sync lines are more common than full-duplex sync lines. The bisync protocol is a half-duplex protocol. So, generally, you should take the half-duplex default by pressing ↵. This

will work with either a half- or full-duplex modem. However, if you *know* that this line will be on a full-duplex modem, *and* that the modem takes a while to switch from transmit to receive, you should answer F ). The *RTS* message tells you that the GSMGR process will keep RTS high always on full-duplex lines.

For a DCU, BSCGEN skips the next two questions.

*Is the clock for this line external? [Y]*

Each ISC, MCP1, and LSC has an internal clock, with a frequency that you can select (next). But, most modems have and depend on their own clocks. So, generally, if this is a modem line, or if you want the line on an external clock, press ) for the default. If you specify an external clock, BSCGEN skips the next question.

To use the ISC or MCP1 clock, type N ). BSCGEN then asks

*Specify internal clock frequency in baud*  
(300,600,1200,2400,4800,9600,19200,38400) [2400]

Type the desired baud (data) rate. The device on the other end of the sync line must match this baud rate. The default, 2400, is the highest rate that works reliably over an ordinary modem and switched phone line. For the default, press ); for a different baud rate, type the desired number and press ).

Now, for every line on this device, BSCGEN returns to the *Enter logical line number* question. When you have described all the lines, it asks

*Do you have additional bisync controllers? [N]*

If you have another DCU, ISC, or MCP1 to describe, type Y ); BSCGEN then returns to the *What type is bisync controller...* question.

If this was the last DCU, ISC, or MCP1 press ). BSCGEN then asks

*Do you wish to display current configuration? [Y]*

BSCGEN gives you this chance to review the specs entered. To review the specs, press ); BSCGEN then displays them. To skip the specs, type N ); BSCGEN then terminates.

Next, BSCGEN asks

*Do you wish to save this spec file? [Y]*

If the spec file has many errors, you may want to answer N ) and rerun BSCGEN from scratch. But you can always rerun BSCGEN to edit the file and correct errors. So, generally, you should answer ). BSCGEN now terminates.

The sync spec file is done (along with a display file, name spec.DSP, that you can print). Both files are in directory :SYSGEN. Later, the spec filename will be passed to the GSMGR process when GSMGR is started up (described in Chapter 5).

## BSCGEN Example

A sample BSCGEN dialog for an ISC might go like the following.

\*) XEQ BSCGEN ↓

Do you wish to:

A Create a spec file.

B Edit a spec file.

C Update a pre rev 2.00 spec file.

Enter your selection: A ↓

Enter name of spec file: SYS\_7.00.BSC ↓

What type of CPU (MV20000,MV10000,MV8000,MV6000)

(MV4000,MV2000DC,DS7700,DS7500) [MV8000] MV4000 ↓

Do you want to set/change bisync buffer size [N]? ↓

What type is bisync controller n (DCU200, ISC/2, LSC) ? [DCU200] ISC/2 ↓

Enter device code for controller 1: [def] ↓

Enter lines to be genned on controller 1: [0,1] ↓

Enter logical line number for physical line 0: [0] ↓

Is this line switched or dedicated (SWT or DED)? [SWT] ↓

Is this line half- or full-duplex (H or F)? [H] ↓

Is the clock for this line external? [Y] ↓

Enter logical line number for physical line 1: [1] ↓

Is this line switched or dedicated (SWT or DED)? [SWT] ↓

Is this line half- or full-duplex (H or F)? [H] ↓

Is the clock for this line external? [Y] ↓

Do you have additional bisync controllers? [N] ↓

Do you wish to display current configuration? [Y] ↓

... (Display) ...

Do you wish to save this spec file? [Y] ↓

...

\*)

## What Next?

If this was your first system, you will want to create the multiuser environment, which will be easier than what you've done thus far.

If this wasn't your first system, you might want to bring up EXEC and user processes, and perhaps run a few applications to see how they do.

End of Chapter

# Chapter 5

## Creating the Multiuser Environment

Read this chapter

- when you have generated and tested your first tailored AOS/VS operating system and want to create an environment where many people can use it;
- whenever you want to create a brand-new multiuser environment, or some useful macros.

This chapter leads you through the steps needed to create a multiuser environment. It assumes that a tailored AOS/VS operating system has been generated, tested, and is running.

The AOS/VS multiuser environment is based on two utility programs:

PREDITOR, the user profile editor, which creates individual *profiles* for each user;

EXEC, the executive program that supervises user logon and logoff according to PREDITOR profiles, and manages printing and batch queues. Even if your system doesn't have user terminals, you need EXEC to manage printer and batch queues, and perhaps for labeled tape backup.

Using PREDITOR, you create a profile for each person that will use the system. Next you initialize EXEC, and try it. Then, you edit some macros with a text editor so that you can bring the multiuser environment up or down with one command.

Next you consider other DG software — like compilers — that you acquired with AOS/VS, and you create a tailored error message file for these. Finally — to make life easier for users — you create log-on messages and perhaps help messages.

This chapter explains how to do all these things. The major sections are

- Creating the Initial Profiles
- Initializing EXEC and Its Queues
- Editing the UP and DOWN Macros
- Other DG Software
- Making Life Easier for Users
- Your Finished System and Its File Structure

### Creating the Initial Profiles

This section leads you through a session in which you create two classes of profiles:

The operator profile, which provides all privileges and powers needed to control the system.

User profiles, which provide only those privileges that users actually need.

Later, as your system evolves, you may want to edit individual profiles according to user needs.

## Username, Passwords, and Network Access

The username you specify for each user is important. The username is the only trace to the person who's responsible for the account. Usernames persist over long periods of time; they are not often changed (although PREDITOR does have a command to rename a profile).

Generally, your system should have a unique username for every person; more than one user should not use a single account. If, for any reason, you want to place a set of users in a group, think up a special identifier (like a suffix) for the usernames and make the identifier part of each username. Username groups are further explained in Chapter 16.

If your system will be part of a XODIAC network, your choice of username, password, and password encryption will affect each user's ability to access other network hosts. At some point, you'll need to coordinate names and passwords with other systems. (If you won't be using networking, skip the rest of this section and the next section.)

There are several parts of XODIAC (called agents) that provide different services. The resource management agent (RMA) allows users on one host to access devices and files on another host. The file transfer agent (FTA) can transfer files from one host to another. For access to occur, RMA and FTA require that

- the user have a valid profile on both systems, *with the same username and the same password* on both systems;
- the user have the privilege *Access local devices from remote machines* on the remote host;
- the user have appropriate access (ACL) to the file or device.

Another XODIAC agent, the Virtual Terminal agent (VTA) requires that

- the user have a valid profile (but not necessarily the same username and password) on both systems;
- the user have the privilege *Use virtual console* on the remote system;
- the user have appropriate access (ACL) to the file or device.

Without the first two items, the user will receive an *invalid username-password pair* message on attempted access.

If you will be using DG's CEO system over a network, be aware that CEO Mail allows different OP passwords on different systems (it doesn't use RMA or FTA). However, if the user wants to use a remote printer from CEO, the OP passwords must be the same on both systems (for remote printing, CEO depends on RMA).

## Password Encryption

With AOS/VS Revision 7.00, PREDITOR can encrypt a password before storing it. From a security standpoint, this is very desirable.

But, if the user will rely on XODIAC, encrypting the password may prevent RMA and FTA access to remote hosts (because, unless both passwords are encrypted, the two password strings won't be identical). If any remote host runs a revision of XODIAC that doesn't support encryption, encrypting the password locally will prevent RMA access to that host. (Unless your XODIAC Release Notice says that your revision supports encryption, assume it is not supported.) Also, if any remote host runs AOS or AOS/VS Revision 6.00 or earlier, encrypting the password locally will prevent RMA access to that host. (These restrictions exist because both the operating system and XODIAC agent must handle encryption so they can compare encrypted and unencrypted passwords.)

For a CEO user on a network, encrypting the password won't prevent the user from accessing other hosts via CEO Mail. It may prevent a user from using remote printers, since CEO relies on the RMA agent to control access to remote printers.

Once encrypted, a password can't be decrypted. If a password is encrypted and you later decide to have it stored unencrypted, you must edit the profile, think up a new password and type it, and say No to the *Encrypt* question. Then, tell the user the new password. (He or she can change it if desired.)

For a network user, you may decide against encryption, or you may decide to encrypt in the user's profile on all systems (for the latter, all systems must be running AOS/VS Revision 7.00 or later). Or, you might maintain two accounts for the user: one secure local account, with password encrypted, and one general-purpose account, with password unencrypted, to serve for network access. For users who store highly sensitive material, the two-account approach is a good idea, although it involves extra work.

## The Operator Profile

You — and the person who routinely operates the system (if any) — need a profile that gives you the super powers needed to control the AOS/VS system.

The master CLI (PID 2) that runs on the system console already has all these powers. But having a profile and user directory will allow you to issue Q-series commands to the CLI, allow you to log on as the operator from any console (instead of using the system console), and also provide a directory for your own files. So you should create an operator profile first. Type

```
) DIR :UTIL )  
) SUPERUSER ON )  
) XEQ PREDITOR )
```

*AOS/VS User Profile Editor REV n date time*

*Command:*

PREDITOR has commands to create a profile (C), list a profile's specifications (L), and edit an existing profile (E), among others. Each command has its own dialog. If you make a mistake when you answer a PREDITOR question, you can "back up" by pressing ^ (SHIFT and 6 keys) until you reach the bad entry, then type the desired answer and proceed.

You want to create a profile. So type

```
C )
```

*Username:*

The operator profile must have a username of OP, so type

```
OP )
```

*Password change? (Y or NL)*

The values displayed in parentheses are valid answers to the question. For a new profile, you must type

```
Y )
```

*New (6-15 chars):*

On the system console, the master CLI is always available and a username and password aren't required to use it. But on any other console, you will need to type in the username and password to log on to the system. A password can be any combination of 6 to 15 of the following characters: upper- or lowercase letters (treated as uppercase), numbers 0 through 9, and all printing characters except for uparrow. You will be able to change the password when you log on — so, for simplicity, choose something simple like

```
OPERAND )
```

*Encrypt password [No]*

PREDITOR can encrypt a password before storing it. From a security standpoint, this is desirable because no one — not even a superuser — can find out an encrypted password.

Generally, it's a good idea to have the operator's password encrypted — since the operator account is privileged. But if the operator using this profile will rely on XODIAC networking (if your site runs XODIAC), encrypting the password may prevent certain kinds of access to remote hosts. (Encryption will *not* affect access via CEO Mail to remote hosts.) Username, password, and network issues are described earlier in this chapter.

Having considered network issues, decide whether to choose password encryption. If you want the password encrypted, type Y ). Otherwise press ).

*Initial IPC file [] change? (Y or NL)*



The IPC file is a file that the system will execute when this user logs on. It usually contains a sequence of CLI commands, which set the default ACL, search list, prompt, and so on. The file is not required, but it can be very useful in terms of user friendliness and system control. The empty brackets mean that the default is null (no initial IPC file). You want one, so type

Y ↵

*New (0-63 chars):*

PREDITOR wants the IPC file pathname.

The most flexible way to handle the log-on issue is to use one macro file (perhaps in :UTIL) for all users. This central macro can impose certain system-wide defaults for default ACL, search list, and so on. The last line of the central macro can execute a log-on macro in each user's directory. The user can then edit his/her own log-on macro with a text editor to change the defaults imposed by the central macro, if desired. The central macro can be changed easily if you want to change the defaults; for example, if you want to tighten security on the system.

You (or a user) can create the central and user log-on macros with a text editor, described later in this chapter.

The central macro pathname might be something like :UTIL:LOGON\_CENTRAL.CLI. (Each user log-on macro might be something like LOGON.CLI.) But the central macro pathname is the one to specify here — for example

:UTIL:LOGON\_CENTRAL.CLI ↵

*Program [:CLI.PR] change? (Y or NL)*

Default this question; then answer the following questions, as follows.

↵

*Create without block [No]? (Y, N, or NL)*      Y ↵

*Use IPC [No]? (Y, N, or NL)*      Y ↵

*Use console [Yes]? (Y, N, or NL)*      ↵

*Use batch [Yes]? (Y, N, or NL)*      ↵

*Use virtual console [Yes]? (Y, N, or NL)*      ↵

*Access local resources from remote machines [Yes]? (Y, N, or NL)*      ↵

*Change password [Yes]? (Y, N, or NL)*      ↵

*Unlimited sons [No]? (Y, N, or NL)*      Y ↵

*Change priority [No]? (Y, N, or NL)*      Y ↵

*Change type [No]? (Y, N, or NL)*      Y ↵

*Change username [No]? (Y, N, or NL)*      Y ↵

*Access devices [No]? (Y, N, or NL)*      ↵

*Superuser [No]? (Y, N, or NL)*      Y ↵

*Superprocess [No]? (Y, N, or NL)*      Y ↵

*System manager privilege [default]?*

This privilege allows the user to initialize and release job processors (relevant only with a computer that has more than one job processor), and to create and delete process classes and logical processors. System Manager privilege also allows a user process to issue AOS/VS system calls that change the system date, time, ID (SYSID), and bias factor. Also, the user can start or stop the system log (SYSLOG) and issue EXEC commands. These privileges have significant impact on security (although some expertise is needed to write a program that exploits them).

Use of classes and privileged system calls can affect the performance and security of your system. Generally, the master CLI issues all the commands that require the System Manager privilege. However, the operator may need System Manager privilege to initialize job processors *outside* the UP macro. Also, if your system will run classes using the optional Class Assignment and Scheduling Package (CLASP), the operator will need this privilege. If you want the operator to have System Manager privilege, type **Yes** ↵. To say No, press ↵.

*Modem [No]? (Y, N, or NL)*

You may not want to give the operator profile the privilege to use a modem. If you do give this privilege, and an unauthorized user somehow learns the operator password, he or she can access and use the system at will from outside the installation.

If you will want to use a modem yourself, you can create another profile later, with modem privileges. For now, say No by typing

↵

*Change address space type [No]? (Y, N, or NL)*

Type Y to this; then default the following questions:

Y ↵

*Change working set limit [No]? (Y, N, or NL)* ↵

*Priority [2] change? (Y or NL)* ↵

*Max qpriority [0] change? (Y or NL)* ↵

*Disk quota [500] change? (Y or NL)*

500 512-byte blocks is not much disk space. For now, change the quota to something like 15000. You can always change it again later with the PREDITOR's EDIT command. Type

Y ↵

*New (0-2147483647):* 15000 ↵

*Logical address space* - batch [-1 system default] change? (Y or NL)

Accept the default answers to this Logical address space question and the next questions as follows:

```

    }
Logical address space - non-batch [-1 system default] change? (Y or NL) }
Minimum working set size - batch [-1 system default] change? (Y or NL) }
Maximum working set size - batch [-1 system default] change? (Y or NL) }
Minimum working set size - non-batch [-1 system default] change? (Y or NL) }
Maximum working set size - non-batch [-1 system default] change? (Y or NL) }
Default user locality [0]?
```

This question is important only if you plan to use class scheduling on your system. You can create and implement classes with the optional Class Assignment and Scheduling Package (CLASP), described in *Using the Class Assignment and Scheduling Package (CLASP)* manual; or you can write a program to do it via AOS/VS system calls.

For the operator profile, we recommend the default, 0. For the default, press *↓*. (There's more information on this question and the next in Chapter 7.)

*Use other localities [No]?*

The locality issue is meaningful only after you've built an application and created classes. For initial profiles, we recommend the default; press *↓* and skip the next question.

If you answer Yes, PREDITOR asks

*Localities [ ]?*

The operator will be able to change locality to any locality you specify here. Respond with the numbers of *all* localities you want the user to have, or press *↓* to prevent the operator from changing locality. Separate numbers with spaces. For example, 1 3 5 6 *↓*.

*User comment [ ] change? (Y or NL)*

User comments are simply text strings placed in the profile file; they are purely informational. They are handy for users' full names and/or dates. To enter one for the OP profile, type Y *↓* and enter a useful comment; for example,

```

                                Y ↓
New (0-79 chars):             OP  PROFILE,  30  MAY 86 ↓
```

*Command:*

You've finished the Operator profile. As with any existing profile, you can list its specs by typing L *↓*, then the username *↓*. You can edit its specs one by one by typing E *↓*, then username *↓*.

The first time you run it on an LDU, PREDITOR creates the user directory directory, :UDD. For every profile you create, PREDITOR creates a user directory (with the disk space limit specified) in :UDD, and the system creates a profile in :UPD (the User Profile Directory). Each user directory and profile is named username; e.g., :UDD:OP for username OP.

## Standard User Profiles

Users' needs vary. Some may need large working set sizes and large amounts of disk space. After all, you bought your computer system to run programs — perhaps very large programs — and the process that will run these programs will need a user profile (unless you plan to run all large programs interactively from the master CLI, which has the Superuser privilege and can do anything it wants).

Given these variables, we suggest general-purpose default values for all users. You can then tailor these for individual users. To set up the default profile, edit PREDITOR's internal default profile (!DEFAULT!) as in the following dialog. But, for CEO® user profiles, see *Managing the CEO® System* or Chapter 7.

```
Command:      E ↵
Username:     !DEFAULT! ↵
Password change? (Y or NL)      Y ↵
New (6-15 chars): GENERAL      ↵
Encrypt password [No]?          Y ↵
Initial IPC file [ ] change? (Y or NL)      Y ↵
New (0-63 chars):      :UTIL:LOGON_CENTRAL.CLI ↵      (Type central macro name)
Program [:CLI.PR] change? (Y or NL)      ↵
Create without block [No]? (Y, N, or NL)      ↵
Use IPC [No]? (Y, N, or NL)      ↵
Use console [Yes]? (Y, N, or NL)      ↵
Use batch [Yes]? (Y, N, or NL)      ↵
Use virtual console [Yes]? (Y, N, or NL)      ↵
Access local resources from remote machines [Yes]? (Y, N, or NL)      ↵
Change password [Yes]? (Y, N, or NL)      ↵
Unlimited sons [No]? (Y, N, or NL)      ↵
Sons [1] change? (Y or NL)      Y ↵
New (0-1023):      3 ↵
Change priority [No]? (Y, N, or NL)      ↵
Change type [No]? (Y, N, or NL)      ↵
Change username [No]? (Y, N, or NL)      ↵
Access devices [No]? (Y, N, or NL)      ↵
Superuser [No]? (Y, N, or NL)      ↵
Superprocess [No]? (Y, N, or NL)      ↵
System manager privilege [No]?      ↵
Modem [No]? (Y, N, or NL)      ↵
Change address space type [No]? (Y, N, or NL)      Y ↵
Change working set limit [No]? (Y, N, or NL)      ↵
Priority [2] change? (Y or NL)      ↵
Max qpriority [0] change? (Y or NL)      ↵
Disk quota [500] change? (Y or NL)      Y ↵
New (0-2147483647):      15000 ↵
Logical address space - batch [-1 ... default] change? (Y or NL)      ↵
Logical address space - non-batch [-1 ... default] change? (Y or NL)      ↵
Minimum working set size - batch [-1 ... default] change? (Y or NL)      ↵
Maximum working set size - batch [-1 ... default] change? (Y or NL)      ↵
Minimum working set size - non-batch [-1 ... default] change? (Y or NL)      ↵
Maximum working set size - non-batch [-1 ... default] change? (Y or NL)      ↵
Default user locality [0]?      ↵
Use other localities [No]?      ↵
User comment [ ] change? (Y or NL)      Y ↵
New (0-79 chars):      GENERAL USER ↵
Command:
```

This tailors PREDITOR's !DEFAULT! profile for general use. Now, when you create each profile, the new defaults you gave will appear; this allows you to default more questions and

saves time. The original [default] values will return when PREDITOR terminates — so you should do all the profiles you need during this session.

## Creating the Profiles

For each profile, the only values you *must* enter (and cannot default) are username and password.

Each username must be unique among usernames. As a username, you might use a person's first name and initial (if needed) (If a user doesn't like his/her username, you can rename the profile via PREDITOR later). For the password, you can specify the username and tell the user to change it when he or she logs on (described later).

If anyone on your system uses other DG systems (or vice versa) over a network, and his/her password is renamed, it may also need to be renamed on other systems. If he/she changes the password, have him/her log on to remote system(s) and change it there also. Username, password, and network issues are explained near the beginning of this chapter.

The following dialog shows how you might set up a profile for someone named Jack. It also explains some of the issues involved.

```
Command:      C ↓
Username:     JACK ↓                               (Type username)
Password change? (Y or NL)      Y ↓
New (6-15 chars):    JACQUERIE ↓                   (Type password)
```

*Encrypt password [No]*

PREDITOR can encrypt a user's password before storing it. From a security standpoint, this is desirable because no one — not even a superuser — can figure out an encrypted password.

But if the user will rely on XODIAC networking (if your site runs XODIAC), encrypting the password may prevent certain kinds of access to remote hosts. (Encryption will *not* affect access via CEO Mail to remote hosts.) Username, password, and network issues are described earlier in this chapter.

Having considered network issues, decide whether to choose password encryption. If you want the password encrypted, type Y ↓. Otherwise, press ↓.

*Initial IPC file [:UTIL:LOGON\_CENTRAL.CLI] change? (Y or NL)*

For IPC, accept the default central macro name you specified earlier:

↓

*Program [:CLI.PR] change? (Y or NL)*

For *Program*, default to CLI.PR unless you want this user to come up in BASIC or some other program — in which case, type Y ↓ and the full pathname, with .PR suffix, of the program you want. For BASIC, there is often a BASIC directory off the root or :UTIL. If this will be true, you'd answer Y ↓, then :BASIC.PR ↓ or :UTIL:BASIC.PR ↓ to have the user come up in BASIC. For DG's window management program DG/VIEW (DS/7000-series systems only), the pathname is :DGVIEW\_UTIL:SYSTEM:DGVIEW.PR. Windowing is further described in "Windowing with DG/VIEW" in Chapter 15.

The CLI is a good general-purpose choice because it allows users to access text editors and write programs in *all* DG languages; it also allows users to execute other programs like BASIC. Unless you know that you want this user to come up in a program other than the CLI, select the default by pressing

↓

*Create without block [No]? (Y, N, or NL)*

*Create without block* means that the user can have at least two processes running concurrently. By default, the creating (father) process is blocked when it executes the son; this means that the father is eligible to be swapped, which may speed up the system. But if the user will run DG's SWAT® debugger (for FORTRAN 77, PL/I, or COBOL programs), he or she must have the *Create without block* privilege. So, for such users, you must answer Y ↓. Otherwise, take the default, which is No:

↓

Use IPC [No]? (Y, N, or NL)     ↓

IPC means InterProcess Communications calls, available in assembly language and some higher-level languages. IPC privileges are needed wherever two or more active processes must communicate. For IPC usage to work, a user must also have *Create without block*, because at least two of his/her processes must remain active if they are to use IPC. For most users, take the default:

↓

Use console [Yes]? (Y, N, or NL)     ↓

Use batch [Yes]? (Y, N, or NL)     ↓

Use virtual console [Yes]? (Y, N, or NL)

This question, and the next, are meaningful only if your system will run DG's XODIAC networking software. The default answer allows this user to log on to your system from a remote host system or use the XODIAC loopback feature. A value of N (no) prevents the user from logging on to your system via a virtual terminal.

If you plan to give Superuser privilege to this user, don't give this (virtual console) privilege, or the next privilege. Superuser with either network privilege allows a user to explore the entire system from a terminal on a remote system.

If you don't plan to give Superuser, and do want the user to be able to log on to your system from a remote, press

↓

*Access local resources from remote machines [Yes]? (Y, N, or NL)* ↓

The default answer allows a remote user to access files and devices like tapes and printers on your system. This is different from being able to log on, as covered in the previous question. If you want the user to be able to do this (and he or she won't have Superuser), press

↓

*Change password [Yes]? (Y, N, or NL)*

In general, users should be able to change their own passwords, per the default. But if you are setting up a GUEST profile, to allow guests to use your system, the password must be public; and you should answer N ↓ to prevent a guest from changing the password and barring other guests from the system. Generally, press

↓

*Unlimited sons [No]? (Y, N, or NL)*

A user who can create unlimited son processes has the potential for hobbling the system. Each process requires some CPU time, and disk I/O to the SWAP and/or PAGE directories. So far as possible, it's a good idea to minimize the number of processes. So, in most cases, press

↓

*Sons [3] change? (Y or NL)*

BASIC and clerical data entry users can get along with fewer sons: 1 or 2. CLI users who want to execute a non-CLI son process from within a son (instead of going back to the CLI to do it), need more sons: at least 5. For these people, you might want to say Y ↓. PREDITOR will say *New(0-1023)* and you will type the new number and ↓.

For other users, 3 sons is a good general-purpose number. This will allow a user to develop programs and use the SWAT debugger; it's a minimum for serious application programmers who will use FORTRAN 77, PL/I, or COBOL. So, for this group, take the default by pressing

↓

*Change priority [No]? (Y, N, or NL)*

Processes compete for CPU time, and processes of the same type with higher priority (closer to 0) get preference. But a user process that can change priority can monopolize the system. Also, changing priority may change group status (explained in Chapter 15). So, unless you know a process *must* be able to change its priority, press

↓

*Change type [No]? (Y, N, or NL)*

Processes can run as one of three types: resident (always in main memory), pre-emptible (generally in main memory, but swappable if blocked) and swappable. Swappable is the most common type and is the default type for user and other processes. Resident is quite rare — used primarily for the AOS/VS peripheral manager and the system itself. If a process can change type, it can become resident, and perhaps hobble the system. So, unless you know that a process must be able to change its type, say No by pressing

↓

*Change username [No]? (Y, N, or NL)*

A process that can change its username can assume the name of OP or another superuser — giving it access to the entire system. Again, unless you know that the process must be able to change its username, say No by pressing

↓

*Access devices [No]? (Y, N, or NL)*

This privilege allows a process to bypass operating system safeguards, and access devices directly in machine language. You should never give it unless the user is a systems programmer who needs it to write or debug device drivers. Network and DG/SNA processes need it, but they can be given it from the master CLI. So, in nearly all cases, press

↓

*Superuser [No]? (Y, N, or NL)*

This privilege allows a user process to bypass all file access controls and *execute, read, modify, or delete any file on the system*. Superusers can run PREDITOR to change their own profiles; and, unless you choose to encrypt passwords, they can find other users' usernames and passwords in their profile files. The master CLI needs Superuser to control the system; but most other users do not need it, and they shouldn't have it. Say No by pressing

↓

*Superprocess [No]? (Y, N, or NL)*

This privilege allows a user process to terminate any process — including the master CLI, which would bring down the entire system. Unless you know that a process needs Superprocess, say No by pressing

↓

*System manager privilege [default]?*

This privilege allows the user to initialize and release job processors (relevant only with a computer that has more than one job processor), and to create and delete process classes and logical processors. System Manager privilege also allows a user process to issue AOS/VS system calls that change the system date, time, ID (SYSID), and bias factor. Also, the user can start or stop the system log (SYSLOG) and issue EXEC commands. These privileges have significant impact on security (although some expertise is needed to write a program that exploits them).

Use of classes and privileged system calls can affect the performance and security of your system. Generally, the master CLI issues all the commands that require System Manager privilege. Possibly, a system operator may need this privilege. Users — as a rule — *don't* need it. So, generally, say No by pressing

↓

*Modem [No]? (Y, N, or NL)*

If you want this user to be able to log on via a modem, type Y ↓. Generally, superusers should not be able to use a modem, because the two privileges allow the user to explore the entire system from his or her own home or wherever a remote console is placed. In most cases, press

↓

*Change address space type [Yes]? (Y, N, or NL)*

The privilege allows the user to execute 16-bit programs. There are a lot of 16-bit programs around — including some text editors. So, generally, press

↓

*Change working set limit [No]? (Y, N, or NL)*

This privilege allows the user to run programs that change the system default working set limit. The system default works best for nearly all programs. For the exceptions, this question is further described in the PREDITOR chapter. Generally, press

↓

*Priority [2] Change? (Y or NL)*



Generally, user processes should be created equal. For equality and simplicity, we suggest the default. (Details on priority numbers appear in Chapter 15). Press

}

*Max qpriority [0] change? (Y or NL)*

When the multiuser environment is up and running, users will use Q-series commands to print files and submit batch jobs. Priority 0 is the default and highest priority. If you give the default to all users, they will receive equal treatment on their Q-series jobs. Generally — unless you want to favor or discourage a user's Q-series requests — press

}

*Disk quota [15000] change? (Y or NL)*

This sets the limit on the size of the user directory that PREDITOR will create and the system maintain for this user process.

The default you put in !DEFAULT! is 15,000 blocks — a good general-purpose amount of disk space. If this user process is for guests or other casual users, then you might want to specify less space (perhaps the original default, 500). If this user process will be used by many people (perhaps data entry clerks or students), you might want to specify a larger figure (e.g., 100,000). If this user process will deal with a large database and its directory will contain the database(s), you might want to allot an entire single- or multiple-disk LDU to it. A model 6061 disk contains about 370,000 blocks; a model 6122 disk contains about 540,000 blocks; a model 6236 disk contains about 690,000 blocks. If you want to change the space quota, type Y. PREDITOR will then say *New(0-2147483647):* and you will type the new quota. Don't include a comma in the number.

To accept the default, press

}

*Logical address space - batch [-1 system default] change? (Y or NL)*

This series of questions gets more detail in Chapter 7. For now, default them.

}

*Logical address space - non-batch [-1 system default] change? (Y or NL)* }

*Minimum working set size - batch [-1 system default] change? (Y or NL)* }

*Maximum working set size - batch [-1 system default] change? (Y or NL)* }

*Minimum working set size - non-batch [-1 system default] change? (Y or NL)* }

*Maximum working set size - non-batch [-1 system default] change? (Y or NL)* }

*Default user locality [0]?*

This has meaning only if you plan to use class scheduling on your system, as mentioned earlier.

For initial user profiles, we recommend the default, 0. For the default, press }. (There's more information on this question and the next in Chapter 7.)

*Use other localities [No]?*

The locality issue is meaningful only after you've built your application and created classes. For initial profiles, we recommend the default; press } and skip the next question.

If you answer Yes, PREDITOR asks

*Localities [ ]?*

The user will be able to change locality to any locality you specify here. Respond with the numbers of *all* localities you want the user to have, or press } to prevent the user from changing locality. Separate numbers with spaces.

*User comment [GENERAL USER] change? (Y or NL)?*

As described earlier, you can use this for text comment about the user: full name, date, etc. Type Y ), then the desired command. For example,

```
Y)
New (0-79 chars):      JACK  ARMSTRONG  30  MAY  86 )
```

*Command:*

You have finished this profile. PREDITOR has written it into its profile directory :UPD, as a file with the filename of the username; e.g., JACK for a username of Jack. The profile is ready for use.

To do another profile, type C ) and run through this section again. (Remember that a user must have a profile to log on to the system. Many people can have a common profile — usable through a common username and password — but, aside from using the system console, a person who doesn't know a valid username and password cannot use the system.)

When you have finished all the profiles you want, PREDITOR will be asking for a command. Leave PREDITOR and return to the CLI by typing

```
BYE )
)
```

Continue to the next section.

## Initializing EXEC and Its Queues

With the user profiles done, you can initialize the EXEC process. This involves executing EXEC and creating and opening EXEC queues; generally you need to do it only once.

Via your primary tool, the master CLI, set your search list and turn on SUPERUSER:

```
) SEARCH  :UTIL )
) SUPERUSER  ON )
*)
```

Now start up EXEC:

```
*) PROCESS/DIR=@/DEF/NAME=EXEC EXEC )
```

*Pid 3*

*From Pid 3 : (EXEC) EXEC REV n READY*

*From Pid 3 : (EXEC) time*

\*)

The PROCESS command creates a new process — just as XEQ does — but it is more versatile. The switches make the EXEC process home directory :PER (@ means :PER), give it default privileges (/DEF), and make its process name EXEC.

The PID messages indicate that EXEC is running as a process with Process ID 3 (PID 3); and give its revision and the time.

Now create the batch and spool queues via the following commands to EXEC.

```
*) CONTROL @EXEC CREATE PRINT LPT )  
From Pid 3 : (EXEC) ...  
*) CONTROL @EXEC OPEN BATCH_INPUT )  
From Pid 3 : (EXEC) ...  
*) CONTROL @EXEC OPEN BATCH_OUTPUT )  
From Pid 3 : (EXEC) ...  
*) CONTROL @EXEC OPEN BATCH_LIST )  
From Pid 3 : (EXEC) ...  
*) CONTROL @EXEC OPEN LPT )  
From Pid 3 : (EXEC) ...  
*)
```

The CONTROL @EXEC directs the command through the CLI to EXEC. The commands created EXEC's permanent spool queues in a file named :QUEUE:Q. As long as this file exists, you'll never need to repeat these commands.

Now, go to the line printer and make sure power is on, paper is aligned, and that it is on line. The printer must be on line for EXEC to start it.

Associate the batch output and batch list file with the line printer queue, and start the queue, by typing

```
*) CONTROL @EXEC CONTINUE 1 )  
From Pid 3 : (EXEC) STREAM 1 CONTINUING  
From Pid 3 : (EXEC) STREAM 1 IDLE  
*) CONTROL @EXEC START BATCH_OUTPUT @LPB )  
From Pid 3 : (EXEC) @LPB CO-OPERATIVE INITIATED  
From Pid 3 : (EXEC) @LPB PAUSED  
*) CONTROL @EXEC START BATCH_LIST @LPB [UPPER] )  
From Pid 3 : (EXEC) ...  
*) CONTROL @EXEC START LPT @LPB )  
From Pid 3 : (EXEC) ...  
*) CONTROL @EXEC CONTINUE @LPB )  
From Pid 3 : (EXEC) @LPB CONTINUING
```

For an uppercase-only type LPB printer, include the argument UPPER in the EXEC START command; this tells EXEC to change lowercase characters to uppercase for printing.

For a type LPD printer, use device name LPD instead of LPB

For a type LPE laser printer, use device name LPE instead of LPB. And for a laser printer, use the following variation of the EXEC START command:

```
*) CONTROL @EXEC START/NL queuename @LPE )
```

This tells EXEC to correct each NEW LINE (J) character it prints as needed for the laser printer.

You have continued the batch streams, and started the batch queues and printer queue on the printer. Users can now issue Q-series commands. There are 4 batch streams, and we have activated (with CONTINUE) only number 1, but this is enough to start. These commands are part of a CLI macro named UP.CLI, so they will not need to be typed individually.

## Letter-Quality Printer Queues

If your system has one or more letter-quality printers (connected on console lines), create and open a letter-quality printer queue for each. For example, if you have two letter-quality printers:

```
*) CONTROL @EXEC CREATE PRINT LQP )
*) CONTROL @EXEC CREATE PRINT LQP1 )
*) CONTROL @EXEC OPEN LQP )
*) CONTROL @EXEC OPEN LQP1 )
```

## Second Line Printer and Plotter Queues

If you have a second line printer, initialize a queue for it.

```
*) CONTROL @EXEC CREATE PRINT LPT1 )
*) CONTROL @EXEC OPEN LPT1 )
*)
```

And if you have a digital plotter, initialize its queue.

```
*) CONTROL @EXEC CREATE PLOT PLT )
*) CONTROL @EXEC OPEN PLT )
*)
```

## Enabling a User Console

Now to enable a user console. The user console names were determined at VSGEN and — if the consoles haven't been labeled, now is a good time to label them. Using white tape or tape labels, label each with its name: @CON2, @CON3, etc.

Choose a CRT (for example, @CON2), turn it on, and place it on line. Then enable it via EXEC:

```
*) CONTROL @EXEC ENABLE @CON2 )
From Pid 3 : (EXEC) ENABLED CONSOLE: @CON2
```

@CON2 is ready for user logon. If you want to try enabling *all* consoles, type

```
CONTROL @EXEC ENABLE/ALL )
```

This tells EXEC to try and enable all consoles specified to VSGEN (files of type CON in directory :PER).

If EXEC does not report an error, skip the next section.

## If EXEC Fails to Enable a Console

If you get an error message from the EXEC ENABLE command, issue it again. If the error persists, type DIR @ ), then F/S ) to list the entries in directory @ (:PER, the peripherals directory). All the device and console names you specified during VSGEN should be in this directory. The console names here should match the names you pasted on the consoles. If not, you may have made a mistake during VSGEN, or the console line connections may be wrong.

Try reading another console whose name appears in directory @ (:PER); and issue the CONTROL @EXEC ENABLE command with the other console's name.

## Logging on as a User

Having enabled a console, walk over to it. The screen (or paper, on a hard-copy console) should display

\*\*\*\* AOS/VS REV n / Press NEW-LINE to begin logging on\*\*\*\*

If only part of this message shows, the console may be uppercase only. After you log on, you can correct this by typing CHAR/ON/UCO ↓ — but eventually lower to upper conversion should be specified via VSGEN.

Log on with the OP username and password you created for the operator with PREDITOR. Do it as follows:

↓

AOS/VS REV n / EXEC REV n date time @CONn

Username: OP ↓

Password: (Type the password, e.g., OPR ↓. It doesn't echo.)

AOS/VS CLI REV n date time

)

You have now logged on as a user (user OP) and your user process is running a CLI process for you. This is your own CLI, independent of the CLI on the system console.

Now you know that EXEC's log-on function works, and that the hardware and software configuration of your system are probably correct.

Try some QPRINT commands:

) QPRINT :UTIL:ERMES.SR ↓

QUEUED, SEQ = n

) QPRINT :UTIL:AOSVS.PANICS.SR ↓

QUEUED, SEQ = n

)

The line printer should now print the text of these files, each preceded by a header sheet that gives your username, file pathname, and date, among other things. You needn't read these files now — they served only to test the printer queue. Take the printed copy to the system console for later use.

Try a batch command:

) QBATCH Write Hello ↓

QUEUED, SEQ = n

)

The batch output file is the line printer, so the text string Hello should appear there, preceded by a printed header and logon information. If so, EXEC's batch function is okay.

To get a sense of the CLI's Help facility, type

) HELP ↓

... (CLI displays HELP topics) ...

)

The entire Help facility is available to any user from any CLI. Use it whenever you have doubts or questions on a topic or command.

Things look good for the multiuser environment. You can terminate the user process by typing  
)  
BYE )

*AOS/VS CLI TERMINATING  
PROCESS CONNECT TIME ...*

*\*\*\*\* AOS/VS REV n / Press NEW-LINE to begin logging on \*\*\*\**

and return to the system console.

### Changing a Password

By default, any user can change his or her password at log on time. The user types `username)` as usual, then types the password but hits the ERASE PAGE key instead of `)`.

EXEC will then ask for the new password, which must be 6 to 15 printable characters. When the user types it and `)`, EXEC logs the user on. From that point on, the new password will be in effect. Note that usernames are public information, but passwords — including the OP password — should be private.

### Bringing down EXEC

Back at the system console, pause the device queues, and bring down EXEC.

*\*) CONTROL @EXEC PAUSE 1 )*

*From Pid 3 : (EXEC) STREAM 1 WILL PAUSE...*

*From Pid 3 : (EXEC) STREAM 1 PAUSED*

*\*) CONT @EXEC PAUSE @LPB )*

*From Pid 3 : (EXEC) @LPB PAUSED*

*\*) TERM OP:EXEC )*

*)*

The CLI command TERMINATE (TERM) brings down a process and all its sons. Here, it terminated EXEC.

## Editing the UP and DOWN Macros

As you saw, there are a lot of commands involved in bringing EXEC up and down. To make this easier, DG supplied CLI macros named UP.CLI and DOWN.CLI in directory :UTIL. Because systems vary, these macros are not directly executable; you must edit them for *your* system before you can use them. When you've done this, you'll need only to type `UP )` to bring up EXEC and the multiuser environment, and `DOWN )` to bring them down.

To edit the macros, you'll need to know how to use a text editor — specifically, the text editor named SED.

## Using the SED Text Editor

SED is a good text editor, with informative error messages and its own Help facility. It has many commands and features. But to do the editing you need now, you'll require only a few commands:

|                         |                                                                                                                                                                |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HELP                    | Gives Help on SED commands or features.                                                                                                                        |
| APPEND                  | Adds text to the end of the file.                                                                                                                              |
| BREAK/ESC or<br>ESC key | Terminates an<br>APPEND or INSERT.                                                                                                                             |
| INSERT                  | Inserts lines of text before the current line.                                                                                                                 |
| MODIFY                  | Edits lines of text one by one.                                                                                                                                |
| →, ←<br>↑, ↓            | Moves cursor. These cursor control keys are on the keypad to the right of the main keypad. They move the cursor to the right, left, a line up, or a line down. |
| CTRL-E                  | Begins a character insert or ends a character insert, on a line.                                                                                               |
| DEL key                 | Deletes the previous character.                                                                                                                                |
| LIST                    | Displays a range of lines.                                                                                                                                     |
| FIND                    | Finds a text string.                                                                                                                                           |
| DELETE                  | Deletes one or more lines of text.                                                                                                                             |
| BYE                     | Leaves SED and returns to the CLI.                                                                                                                             |

The SED prompt is an asterisk (\*). As with CLI commands, you can abbreviate SED commands to their shortest unique parts; e.g., MOD for MODIFY.

SED is a line-oriented editor, dealing with text a line at a time. It is also screen-oriented, depending heavily on cursor control keys. Thus you should use it on a CRT console if you can. If the system console is a printing console, bring up EXEC again with the PROCESS command, do a CONTROL @EXEC ENABLE @CONn (where @CONn is a CRT), log on to the CRT as OP, type SUPERUSER ON ), and create/edit the macros. When you've finished editing the macros, go back to the system console and TERM OP:EXEC ); then test the macros from the system console.

The first steps are to get into directory :UTIL, where all the macros are, and turn Superuser on so you can create new files. Use the DIRECTORY and SUPERUSER commands for this.

```
) DIR :UTIL )  
) SUPERUSER ON )
```

Note that the following sections tell you to create a number of macros before you edit UP.CLI. If any of these macros exist, don't recreate them; simply try them to see if they work. You can see if a macro exists by typing F/AS name ), where name is the macro filename. If the CLI displays the name, the macro exists.

## Editing Macro CX.CLI

Now create a macro called CX.CLI. This will allow you to issue EXEC commands as simply "CX" command, instead of the tedious sequence "CONTROL @EXEC" command. Type

```
*) XEQ SED CX.CLI ;
```

*SED Rev n Input file - :UTIL:CX.CLI*

*Do you want CX.CLI to be created? YES ;*

```
* APPEND ;
```

```
1 CONTROL @EXEC %-%
```

```
2 ESC
```

```
* MOD 1 ;
```

```
1 CONTROL @EXEC %-%
```

(Append text to the new file.)

(Append CONTROL @EXEC %-%.)

(Press BREAK/ESC or ESC key)

(Modify line 1.)

(SED displays line 1.)

Press → 4 times, CTRL-E, type R,  
then ;, producing

(Use cursor control characters  
to correct typo.)

```
CONTROL @EXEC %-%
```

```
* BYE ;
```

*Output File - :UTIL:CX.CLI*

```
*)
```

This little macro will save anyone who needs to type EXEC commands a lot of time in the future. (The line numbers — 1 and 2 above — are displayed by SED for your editing convenience. They are not part of the file.)

## Editing Macro SED.CLI

Another useful macro which may not exist is SED.CLI. It allows you to skip the "XEQ" when you want to use SED. To create it, type

```
*) XEQ SED SED.CLI ;
```

*SED Rev n Input File :UTIL:SED.CLI*

*Do you want SED.CLI to be created? Y ;*

```
* APP ;
```

```
1 XEQSED%/% %-%
```

```
2 ESC
```

```
* MOD 1 ;
```

```
1 XEQSED%/% %-%
```

(Append text.)

(Append XEQSED%/% %-%.)

(Press BREAK/ESC or ESC key.)

(Modify line 1.)

(SED displays line 1.)

Press →, type E to correct the R,  
press →, press CTRL-E, press the  
space bar, then press ; — changing  
the bad line to XEQ SED%/% %-%

(Use control characters  
and space bar to correct  
the bad line.)

```
* BYE ;
```

*Output File - :UTIL:SED.CLI*

```
*)
```

Now you can run SED by simply typing SED filename ;.



## Editing Macro ?.CLI

A very useful macro which may not exist is ?.CLI. It tells you about all processes running on your system, and additionally identifies your computer, the current date and time, your own process, and space in your user directory. To create this macro, type

\*) X SED ?.CLI ↓

*Input file — :UTIL:?.CLI*

*Do you want ?.CLI to be created?      Y ↓*

\* AP ↓

```
1      host ↓
2      write Status at [!time],[!date] ↓
3      write ↓
4      who / 2=ignore% / % [!pids] ↓
5      write ↓
6      write You are the following process: ↓
7      who ↓
8      write ↓
9      write Current space in :UDD:[!USERNAME] is: ↓
10     space :udd:[!username] ↓
11     sysid ↓

12     ESC          (Press BREAK/ESC or ESC key.)
```

\* BYE ↓

*Output file — :UTIL:?.CLI*

\*)

This macro displays every process on the system. You can execute it by typing ? ↓.

To make macros SED.CLI and ?.CLI available to *users*, type the following CLI commands:

```
) ACL  SED.CLI  OP,OWARE  +,RE ↓
) ACL  ?.CLI   OP,OWARE  +,RE ↓
```

For the following few macros, we show only the text. Try the SED commands for yourself.

## Macro FF.CLI

In many sites, the fold on which line printer paper falls is important. If people use the line printer controls to output the last sheets of their printing jobs, and they press TOP OF FORM an odd number of times, then the paper fold will be reversed — which can be a nuisance. Even worse, people may forget to put the printer back on line, preventing print requests from being processed until someone puts it back on line.

Instead of having people operate the printer controls, you can create a form feed macro, perhaps named FF.CLI. People can then type FF ↓ after their QPRINT commands, and the printer will automatically output enough paper to allow them to tear off their jobs. You can cover the printer controls with a label that says “Use FF macro.”

There are two files involved. Get into the directory you want to hold the files — say :UTIL — and type

```
*) CREATE/I RECYCLE_ME ↓          (Or whatever header you want.)
*) ) ↓                          (Insert a NEW LINE.)
*) CTRL-L                      (Insert a form feed — or, with a paper puller,
                                3 form feeds.)
*) ) ↓                          (End text insert mode.)
```

Now create the form feed macro — let's say FF.CLI. The text is

```
QPRINT /QUEUE=LPT/DESTINATION=RECYCLE_ME RECYCLE_ME
```

After creating the two files, make them accessible to users by typing

```
*) ACL RECYCLE_ME OP,OWARE +,RE )
*) ACL FF.CLI OP,OWARE +,RE )
```

You can use whatever header text you want on the throw-away sheets, instead of RECYCLE\_ME. If you have a second line printer, you can create a second form feed macro with the name FF1.CLI. FF1.CLI would be the same as FF.CLI, but with the queue name LPT1.

## Macros BATCH.CLI and CHEK.CLI

By default, when users submit batch jobs (usually with the QBATCH command), the output and list files are the first line printer queue, LPT. To check the results of the batch jobs, users must walk to the line printer. This may discourage them from using batch. The following macros allow any user to do a whole batch job without leaving his or her console.

Macro BATCH.CLI queues a batch job with output and list files in a user's initial directory; macro CHEK.CLI types and deletes these files. (It's named CHEK.CLI to distinguish it from the CLI command CHECKTERMS.)

Macro BATCH.CLI is self-documenting. It explains itself if someone types its name without an argument (e.g., BATCH ). This is a good idea for your own user-oriented macros: if they explain themselves, then you don't have to explain them.

The text of BATCH.CLI is

```
[!EQUAL, %1% , ]
  WRITE CLI macro %0% queues a batch job, with multiple
  WRITE arguments. It writes the batch output file and batch
  WRITE list file to your initial working directory -- instead
  WRITE of the line printer queue -- so that you needn't go to
  WRITE the printer each time you use batch. Do not use it to
  WRITE stack multiple batch jobs -- wait for one job to complete
  WRITE before using it to queue the next job. The format for
  WRITE using this macro is ,, BATCH , normal-command-line , NEW-LINE
  WRITE ,, BATCH , normal-command-line , NEW-LINE ,,, For example,
  WRITE ,, BATCH , XEQ , MASM , PROG1 , PROG2 NEW-LINE
[!ELSE]
  DELETE /2=IGNORE :UDD:[!USERNAME]:(LAST_BATCH.<OUT,LIST>)
  CREATE :UDD:[!USERNAME]:(LAST_BATCH.<OUT,LIST>)
  QBATCH/NOTIFY/QOUTPUT=:UDD:[!USERNAME]:LAST_BATCH.OUT&
/QLIST=:UDD:[!USERNAME]:LAST_BATCH.LIST %-%%
  WRITE When this batch job is done your console will
  WRITE show 'STREAM COMPLETED' then beep. Type CHEK NEW-LINE.
  WRITE Macro CHEK types the batch output file -- allowing
  WRITE you to check for errors. Then it allows you to
  WRITE delete or save the batch output and list files.
[!END]
```

The text of CHEK.CLI is

[!EQ, comment,] This macro prints batch output file after a batch job created by macro BATCH.CLI completes -- [!end]

```
TYPE :UDD:[!USERNAME]:LAST_BATCH.OUT
WRITE To delete batch output and empty batch list files press NEW-LINE.
STRING [!READ To save them type S and press NEW-LINE. ]
[!EQUAL,[!STRING],S]
    WRITE Saving output and list files
    WRITE :UDD:[!USERNAME]:LAST_BATCH.<OUT LIST>
[!ELSE]
    DELETE /V :UDD:[!USERNAME]:LAST_BATCH.OUT
    [!EQUAL [!SIZE :UDD:[!USERNAME]:LAST_BATCH.LIST] ,0]
    DELETE /V :UDD:[!USERNAME]:LAST_BATCH.LIST
[!ELSE]
    WRITE List file - :UDD:[!USERNAME]:LAST_BATCH.LIST
    WRITE is NOT empty. Saving.
[!END]
[!END]
```

Make the macros accessible to users by typing

```
) ACL BATCH.CLI OP,OWARE +,RE )
) ACL CHEK.CLI OP,OWARE +,RE )
```

Now, to post a batch job, all a user needs to do is type BATCH command-line ; for example

```
) BATCH X MASM MYFILE )
```

The BATCH macro will tell the user what to do next; and the prompt will return to his console. When the job is done, the user types

```
) CHEK )
```

which displays the batch output file — showing all errors — with an option to delete both files. These macros offer a fast, simple, and effective way for users to post batch jobs.

## Macro REMEMBER.CLI

As people work on your system, they may want to post reminders to themselves — for example, about meetings or deadlines. You can make it easy for anyone to post one or more such personal reminders by creating macro REMEMBER.CLI (naturally, you can give it any name you want).

The text of REMEMBER.CLI is

```
[!eq, %2%, ]
  write This macro -- %0% -- reminds you of a future engagement.
  write It enqueues a batch job to run at the time you specify.
  write The batch job consists of SENDING the specified message
  write to your console.
  write
  write To execute the macro use the form
  write ,, %0% ,,, date:time ,,, message ,,, NEW-LINE
  write
  write "date:time" can be a specific date and/or time -- for example
  write "23-AUG-85:20" means "August 23 85 8pm". Or "date/time" can be
  write relative -- for example "+ 1" means "an hour from now". Try the
  write HELP *AFTER ,, topic for more information on "date/time".
[!else]
  string @![CONSOLE]
  qbatch% / % / after=%1% / qlist=@null / qoutput=@null &
  send [!STRING] [!asc 215] [!asc 207] [!asc 216] REMEMBER: [!asc 217] %2-%
[!end].
```

Make the REMEMBER macro available to users by typing

```
) ACL REMEMBER.CLI OP,OWARE +,RE )
```

Now, for example, if user Sally wants to be reminded of a meeting on August 22, 1986, at 4:00 pm (16:00 on a 24-hour clock), she would type

```
) REMEMBER 22-AUG-86:16 Meeting )
```

Then, when the system calendar and clock showed the specified time, Sally's REMEMBER batch job would run; her console would beep and display REMEMBER blinking with the message text. (A REMEMBER batch job would be delayed if all batch streams were busy throughout the delay interval.)

## Macros ON.CLI and OFF.CLI

You — and other people who run the system — will often need to turn Superuser on and off, and it's a nuisance to have to type the whole string to do it. Here is the text of macros ON.CLI and OFF.CLI — which turn Superuser or Superprocess on and off. We don't show the SED commands; try them for yourself.

Text of ON.CLI:

```
[!EQ,%0 / %, / P]
SUPERPROCESS  ON
[!ELSE]
SUPERUSER  ON
[!END]
```

Text of OFF.CLI:

```
[!EQ,%0 / %, / P]
SUPERPROCESS  OFF
[!ELSE]
SUPERUSER  OFF
[!END]
```

With these macros in :UTIL, you can turn Superuser on by typing ON ; and you can turn Superprocess on by typing ON/P ;. To turn them off, type OFF ; or OFF/P ;.

## Macro BROADCAST.CLI

In the multiuser environment, the person at the system console will often want to SEND messages to all users. The SEND @CON message command can be used for this, but it can provoke a lot of messy (but harmless) error messages. The text of a macro called BROADCAST.CLI follows; it sends a message with time and (beep) to each user terminal, *without* error messages.

Text of macro BROADCAST.CLI

```
SEND / 1=IGNORE / 2=IGNORE (@CON-\@CONSOLE @VCON-)&  
  [!ASCII 7][!USERNAME] at [!TIME] [!ASCII 276][!ASCII 240] % 1-%
```

The operator can use this macro to send messages to other users by typing

```
) BROADCAST message )
```

If you want *users* to be able to use BROADCAST, type the following CLI command:

```
) ACL BROADCAST.CLI OP,OWARE +,RE )
```

## Editing Macro UP.CLI

After writing some macros with SED, you're ready to tackle UP.CLI. To start, type

```
*) SED UP.CLI )  
SED Rev n - Input file :UTIL:UP.CLI  
*
```

Type LIST ALL to see the entire prototype macro. As you can see, there are instructions at the end on how to make it executable.

As time passes, and your system grows and changes, you'll be editing this macro to reflect the changes. In this session, we'll simply give some general-purpose answers that will make UP.CLI executable — without explaining the other lines in the macro. An example of a real UP.CLI macro appears in Chapter 15.

The first line to edit is line 1. Line 1 makes the macro nonexecutable — it says, "if 1 equals 2, execute all lines up to the next !ELSE or !END." So, using cursor controls, position on the line and make the two numbers equal. For example,

```
[!EQUAL,1,1] )
```

Now find the PROCESS command that starts EXEC:

```
* FIND "PROCESS/" )  
n PROCESS/DEFAULT/DIRECTORY=...
```

Insert the following lines to run the queue compacter program, QCMP:

```
WRITE Running QCMP now...  
XEQ QCMP/YES  
WRITE QCMP is done.
```

The QCMP program helps keep directory QUEUE neat by deleting unused files in it. QCMP must run before EXEC does. You have just made sure it will do so.

## Initializing a Second Processor in a Multiprocessor System

If you have an MV/20000 Model 2, it's a good idea to initialize the second processor in your system's UP.CLI macro. Add the following line to the UP.CLI macro before any process or execute commands:

```
) JPINITIALIZE n (n is 0 if 1 is the mother processor or 1 if 0 is the mother  
processor)
```

See Table 9-1 for switches to the CLI command JPINITIALIZE.

## If You Have Graphics Consoles

AOS/VS Revision 7.00 supports windowing on graphics (pixel-mapped) consoles on systems like the DS/7700 computer. On such systems, a user can create windows on a graphics console, but in order to do so, must first assign (get ownership of) the PMAP, an entry in :PER, for the device. Unauthorized access to PMAP entries represents a potential security risk. (See the section in Chapter 16 “Preventing Unauthorized Access to Windows” for an explanation of the security risk involved.)

To prevent unauthorized creation of windows — a security breach — add the following line to your system’s UP macro *before* the line that enables consoles:

```
ASSIGN ([!FILENAMES @PMAP+])
```

This assigns (gives ownership of) the PMAP device entries (specified by @PMAP+) to PID 2.

Likewise, if you have a program that creates additional windows, deletes default windows, or repositions or resizes windows, you can run that program from your UP macro — but run it *before* assigning the PMAPs.

## Enabling User Consoles

The UP.CLI macro contains an EXEC ENABLE/ALL command, so you do not need to insert ENABLE commands.

But, after EXEC enables a console, it “owns” that console. Some other DG programs need to “own” consoles to run on them. Among these are data entry programs (Idea, TPMS) and IBM emulator programs (RCX70, DG/SNA). If you plan to run one or more of these other programs, decide which consoles you want them to use. Then, in the UP macro, execute the other programs and have them take charge of the consoles they need *before* the CONTROL @EXEC ENABLE/ALL command. The other program(s) will get use of the consoles, and there will simply be a *DEVICE ALREADY IN USE* error message when EXEC tries to enable them. Also, if you want to change any console characteristics (CHARACTERISTICS/DEFAULT command), this must be done before the console is enabled.

To enable consoles selectively, you can replace the ENABLE/ALL command with specific enable lines of the form

```
CONTROL @EXEC ENABLE @CON(n,n,n ... )  
PAUSE 10
```

For example,

```
CONTROL @EXEC ENABLE @CON(2,3,4,5,6,7,8,9,10,11,12)  
PAUSE 10
```

This would allow you to specifically enable consoles and avoid the EXEC *DEVICE ALREADY...* error messages. You can deal with this issue later, when you know more about your applications software. But it’s important to know how to handle the console enabling issue. (The parentheses iterate the CONTROL @EXEC ENABLE @CON command on each number within them. Parentheses work the same way with other commands to the CLI.)

(If you’re wondering why we didn’t simply say “CX” instead of CONTROL @EXEC, you should know that it’s good practice to use full commands within a macro. This helps keeps macros simple, versatile, and independent of one another.)

After making sure that the consoles you want will be enabled, proceed.

## Starting the Second Line Printer and Plotter Queues

The UP macro already contains commands to start the first line printer queue and continue the printer. If your printer is an upper- and lowercase type LPB printer, you can leave these commands alone. But if your primary printer is an uppercase-only LPB, change the `CONTROL @EXEC START...` command to `CONTROL @EXEC START ... UPPER`. For a type LPD printer, change the name `@LPB` to `@LPD` in both the `CONTROL @EXEC START` and `CONTROL @EXEC CONTINUE` commands. For an LPE laser printer, change `@LPB` to `@LPE` in both `EXEC START` and `EXEC CONTINUE` commands; and change `CONTROL @EXEC START...` to `CONTROL @EXEC START/NL....`

The `EXEC START` and `CONTINUE` commands for batch stream 1 and the first printer are just before the command `POP` in the prototype UP macro.

If you have a second line printer and/or plotter, start and continue its queue *after* the `POP` command in the macro. Depending on the printer type (LPB, LPD, or LPE, uppercase only or laser document), insert the following commands after `POP`.

```
CONTROL @EXEC START [/NL] LPT1 @LPx [UPPER]
```

(Insert the `/NL` for a laser printer, type LPE. Insert the `UPPER` for an uppercase only printer. `x` is B1 for the second LPB printer, D for the first LPD printer, D1 for the second LPD printer, E for the first laser printer, E1 for the second laser printer, etc.

```
CONTROL @EXEC CONTINUE @LPx
```

For a digital plotter, insert the following commands:

```
CONTROL @EXEC START PLT @PLA
CONTROL @EXEC CONTINUE @PLA
```

This will allow users to post printing requests to the second printer via `QPRINT/QUEUE=LPT1...` commands; and/or post plotting requests via `QPLOT` commands.

With two or more line printers, label each printer (perhaps using a sticky-backed magnetic tape label) with its queue and device name; for example “Device LPB, queue LPT” for the first printer. Having the names clearly visible will make operations easier later on.

## Starting Letter-Quality Printer Queues

If you created one or more letter-quality printer queues earlier, insert commands to start and continue them. For example, if you have two letter-quality printers, connected to console lines 13 and 14, and you created queues named LQP and LQP1 for them, you’d insert the following commands:

```
CONTROL @EXEC START @CON15 LQP
CONTROL @EXEC START @CON16 LQP1
CONTROL @EXEC CONTINUE @CON15
CONTROL @EXEC CONTINUE @CON16
```

This will allow CLI users to post printing requests to the first letter-quality printer using `QPRINT/QUEUE=LQP ...` commands or to the second printer using `QPRINT/QUEUE=LQP1...` commands.

As with line printers, you may want to label your letter-quality printers — with queue name, device name, and if you have the CEO system, the CEO printer name.

## Finishing Up

Having made the macro executable, enabled user consoles, and (perhaps) started the second printer and plotter queues, you're done with the UP macro (for the time being).

Leave SED and save the old file as backup via the following commands:

```
* BYE )
Do you want to save the original file as a backup file?    YES )
Output file - :UTIL:UP.CLI
Backup file - :UTIL:UP.CLI.BU
*)
```

Copy the macro to the root directory with the MOVE command:

```
*) MOVE/V/R : UP.CLI )
UP.CLI
*)
```

The command lines in UP.CLI are all CLI commands and directives called *pseudomacros* (pseudomacros start with "[!"). You can see that UP.CLI's PROCESS and EXEC commands are similar to the CLI commands you typed earlier.

Later on, you might want UP.CLI to CONTINUE batch streams other than 1, initialize other LDUs (if any), create data management processes, use the SYSID command to create a custom banner for display on user consoles, etc. And, you might want it to start the system log, via macros described in Chapter 9.

## Editing DOWN.CLI

Bringing the multiuser environment down is simply a matter of bringing down EXEC. This will also bring down interactive user processes — so whoever uses the DOWN macro will need to make sure that all users are alerted to the impending shutdown so they won't lose work.

Type

```
*) SED DOWN.CLI )
```

As with UP.CLI, the two numbers in line 1 must be the same. For example you could edit line 1 to be

```
[!EQUAL,1,1]
```

After editing line 1, you might want to insert some text about pausing queues and warning users. To do so, type

```
* FI "TERM" )
n TERMINATE OP:EXEC
```

Insert the following lines before the TERMINATE command.

```
WRITE EXEC queues should be paused and users warned about
WRITE EXEC shutdown. If not: type CTRL-C CTRL-A; then PAUSE queues
WRITE [!READ and send warning to users. If so: press NEW LINE.]
WRITE Bringing down EXEC.
```



This gives information and allows the person to stop the macro if needed. For completeness, you might add some other information near the end of the macro.

```
* FIND  "ELSE" )
```

```
n    [ELSE]
```

Insert the following lines before this !ELSE.

WRITE EXEC and all its son processes are terminated.

WRITE To check for other processes use ? macro. To shut

WRITE down system: type BYE NEW LINE then Y NEW LINE.

Then leave SED:

```
* BYE )
```

*Do you want to save the original file as a backup file? YES )*

*Output file - :UTIL:DOWN.CLI*

*Backup file is - :UTIL:DOWN.CLI.BU*

```
*)
```

As with UP.CLI, copy DOWN.CLI to the root directory:

```
*) MOVE/V/R : DOWN.CLI )
```

```
DOWN.CLI
```

```
*)
```

## Testing UP and DOWN

Having edited the macros, try them in sequence. First, make sure all consoles you want to enable are turned on and are on line. Make sure the line printer(s) are on line.

Then try UP:

```
*) UP )
```

*Running QCMP now.*

*...(QCMP types messages)...*

*QCMP done.*

*Pid 3*

*From Pid 3 : EXEC REV n READY*

*From Pid 3 : ENABLING ALL CONSOLES*

*.*

*.*

*From Pid 3 : ALL CONSOLES ENABLED*

*... (EXEC types ENABLED messages for all enabled consoles) ...*

*From Pid 3 : (EXEC) STREAM 1 CONTINUING*

*From Pid 3 : (EXEC) @LPB CO-OPERATIVE STARTED*

*From Pid 3 : (EXEC) @LPB CO-OPERATIVE CONTINUING*

*.*

```
)
```

One of the last lines executed is EXECUTE CLI, which creates a son process under the master CLI. So the master CLI, PID 2, is no longer running on the system console. Check with WHO ) or ? ).

Go and check the consoles. Every console that is enabled for user logon will have a *Press NEW-LINE to begin logging on* message on it. If any consoles that you expected to be enabled do not show this message, note their numbers; then return to the system console.

If the system console shows error messages like *ILLEGAL DEVICE OR CONSOLENAME FORMAT*, you probably made a syntax error in an *ENABLE* command. Type *BYE* ↵ to get back to the master CLI; type *TERM OP:EXEC* ↵ to terminate *EXEC*. Then, use *SED* to fix *UP.CLI* in *:UTIL*, move it to the root, and try *UP* ↵ again.

If an error message is *FILE DOES NOT EXIST*, the console line was not defined through *VSGEN*. If the console exists, you may need to re-execute *VSGEN*. If the console doesn't exist, type *TERM OP:EXEC* ↵, then fix *UP* as in the previous paragraph.

When the *UP* macro runs without errors and all the consoles you want are enabled, try bringing the multiuser environment down with *DOWN*.

The down sequence generally goes as follows

1. Warn users that *EXEC* is coming down, so they can get out of text editors or take other appropriate action. The *CLI SEND* command or *BROADCAST* macro is useful for this. You can use *?.CLI* (created above) to check all user processes.
2. Pause *EXEC*'s queues with the *CX PAUSE* command.
3. When all users have logged off or have only *CLI.PR* running on their consoles, get back to the *OP CLI* by typing *BYE* ↵.
4. Run *DOWN* ↵ to terminate *EXEC*.

To do it, type

*\*) SEND @CON- System coming down NOW! ↵*

*From Pid n : (OP) System coming down NOW!*

... (Console displays error messages; this is why we recommend *BROADCAST* instead of *SEND*) ...

*\*) ? ↵*

|             |          |             |             |                      |
|-------------|----------|-------------|-------------|----------------------|
| <i>PID:</i> | <i>1</i> | <i>PMGR</i> | <i>PMGR</i> | <i>:PMGR.PR</i>      |
| <i>PID:</i> | <i>2</i> | <i>OP</i>   | <i>OP</i>   | <i>:CLI.PR</i>       |
| <i>PID:</i> | <i>3</i> | <i>OP</i>   | <i>EXEC</i> | <i>:UTIL:EXEC.PR</i> |
| <i>PID:</i> | <i>n</i> | <i>OP</i>   | <i>n</i>    | <i>:CLI.PR</i>       |

*You are the following process:*

|             |          |           |          |                |
|-------------|----------|-----------|----------|----------------|
| <i>PID:</i> | <i>n</i> | <i>OP</i> | <i>n</i> | <i>:CLI.PR</i> |
|-------------|----------|-----------|----------|----------------|

*\*)*

Each *WHO* command in *?.CLI* returns the process ID, its username, its process name, and the pathname of the program it is running. There are no other processes now because no users are logged on. As you can see, *?.CLI* is quite handy.

*\*) CX PAUSE 1 ↵*

*From Pid 3 : (EXEC) STREAM 1 PAUSED*

*\*) CX PAUSE @LPB ↵*

*From Pid 3 : (EXEC) @LPB PAUSED*

To bring down the system, you need to get back to the master CLI, PID 2. Do it with BYE ↵ and check again:

```
*) BYE ↵
AOS/VS CLI TERMINATING ...
*) ? ↵
```

*You are the following process:*

```
PID: 2 OP      OP      :CLI.PR
*)
```

As PID 2, with no users logged on, you can proceed with DOWN:

```
*) DOWN ↵
```

*EXEC queues should be paused and users warned about EXEC shutdown. If not: type CTRL-C CTRL-A; then PAUSE queues and send warning to users. If so: press NEW LINE.*

Press ↵ to proceed:

*Tearing down EXEC.*

```
PROCESS TERMINATION, PID: 3
*ABORT*
TERMINATED BY A SUPERIOR PROCESS
```

*EXEC and all its son processes are terminated.  
To check for other processes use ? macro. To shut down system, type BYE then Y.*

*time*

```
*)
```

Type ? ↵ to check on the processes. There should be only two: the peripheral manager and master CLI. The DOWN macro is simple, so the only error messages you get should be the result of syntax errors, fixable with SED. If you get errors, fix them with SED, then type UP ↵, then DOWN ↵ again.

You can, if you wish, make the CX PAUSE commands part of the DOWN macro. But this will cost something in versatility: there may be times when you want to issue EXEC commands other than PAUSE to the queues (as described in Chapter 8, "EXEC and User Processes").

## Special Printing Forms — Creating the FORMS Directory

EXEC can handle not only general-purpose printing jobs, but special forms like invoices or paychecks. For these special printing jobs, users build forms control commands into a disk file with the FCU (Forms Control Utility). Then they submit the job for printing by typing a QPRINT/FORMS=form-file ↵ command; the appropriate person puts the pertinent forms in the printer; and EXEC prints the forms with the format control specified in the form file.

The form files must be in a directory named FORMS, beneath directory :UTIL. Even if you will not use special forms, it can't hurt to create this directory — you may want it later. So type

```
*) CREATE/DIR :UTIL:FORMS ↵
*) ACL :UTIL:FORMS OP,OWARE +,RE ↵
*)
```

This creates the directory named FORMS in UTIL. Then it sets the access control list (ACL) to allow username OP all privileges and to allow all users to read and execute (but not delete or modify) files in FORMS. FORMS is empty at this point — later, users may create forms files that you want to put in it. But you will not need to recreate FORMS.

## If You Have Bisynchronous Communication Lines

If you have bisync lines, needed for DG communications programs like RJE80, HASP, or RCX70, a process called GSMGR must be running before any of these programs can use the lines. (But don't run GSMGR before starting XODIAC or DG/SNA software.)

The GSMGR process can be created before or after EXEC is created. In most cases, it's best to create GSMGR in its own bisync up macro. You might name the bisync macro UP.BSC or equivalent, in directory :UTIL.

The bisync up macro should create the GSMGR process with the following command:

```
PROCESS/RESIDENT/SUPERU/ACCESS/IPCUSAGE/NAME=GSMGR/DIR=@&/
USERNAME=OP/DATA=:SYSGEN:bscgen-file :GSMGR
```

The ampersand (&) is the CLI line-continuation character; it tells the CLI to ignore the following NEW LINE character — allowing you to write multiple-line commands. The `bscgen-file` specifies the data file for GSMGR. It is the name of the sync spec file created by the BSCGEN program (Chapter 4); for example, `SYS_7.00.BSC`.

After creating GSMGR, the bisync up macro can also start the communications program and pertinent EXEC queue (if any). The macro can start the EXEC queue only if it is executed *after* EXEC is created.

To terminate the GSMGR process, the master CLI (or a Superprocess) can issue the command  
**TERM OP:GSPMR**

This command can be made part of a bisync down macro.

The GSMGR process must be resident (/RESIDENT switch) — and, like any resident process, involves a certain amount of system overhead. If you will be using bisync lines a lot, and the overhead doesn't bother you, you can execute the bisync up macro in the UP.CLI macro. Otherwise, you can execute the bisync up macro only when you want to use the bisync lines. DG's RJE80, HASP, and RCX70 are further described in manuals supplied with the software; the EXEC queue that HASP needs is described in Chapter 8, section "Communications and Network Queues".

## PREDITOR and EXEC Summary

With user profiles, EXEC, and the macros done, the multiuser environment is practically complete.

If you wish to bring the system down, type **BYE ↵**, then **Y ↵** — later, you'll need to bootstrap to bring it up. Assuming power stays on to your CPU and disks, the sequence from startup to normal shutdown is

1. Bring up AOS/VS from disk.
2. Type **UP ↵** to CLI.
3. Multiuser environment runs; users log on and off.
4. Warn users; pause queues; type **BYE ↵** and **DOWN ↵**.
5. Type **BYE ↵**, then **Y ↵**.

Actually, you can type **BYE ↵** at any time, with other processes running, from the PID 2 CLI. If you confirm, everything will be shut down. But this risks terminating user processes prematurely and causing users to lose work.

Startup and normal (and abnormal) shutdown are detailed in the next chapter.

There are a number of issues and tools to learn about (described next). And there are other processes and commands you will eventually want to make part of your UP macro. But with user profiles, EXEC, and the `?`, `UP`, and `DOWN` macros, the backbone of the multiuser environment stands. Congratulations.

## Other DG Software

Along with AOS/VS, you may have acquired other DG products, like the communications/networking products, the CEO system, the COBOL, FORTRAN 77, Pascal, and/or PL/I languages, SWAT® debugger, INFOS® II or DG/DBMS data management systems, or others.

Each of these products comes on its own magnetic tape, with its own documentation. Instructions for loading and using it appear in the documentation and/or in the product Release Notice.

Some products, like XODIAC and CEO, have a specific home directory; others, like languages, can be placed where you wish: in their own directories, perhaps under :UTIL, or in :UTIL itself. Putting a product in its own directory keeps it in one place; and may allow faster access. But putting a product in :UTIL makes it easier for users to access because their search lists need include only :UTIL.

Some products have programs that must be executed with the PROCESS command; some have commands that the master CLI process or users can issue. Many products, like XODIAC and CEO, have UP macros of their own to ease operation. CEO may require a one-line edit of your UP.CLI macro (to include the CEO directory in the searchlist, as described in *Managing the CEO® System*).

For products other than XODIAC and CEO, after some experience, you may decide to place the pertinent PROCESS and other commands in the UP.CLI macro. This macro is a tool that summarizes the components of your entire system; you will find it, and perhaps different variations of it, very useful.

## Error Handling — The ERMES File

DG strives to have a unique error code for every kind of error that can occur in every process running under AOS/VS. Each code is a number. The system translates each code to a text error message via a file called ERMES.

The CLI uses ERMES to describe its own errors. And when any program executed from the CLI (with PROCESS or XEQ command) hits a fatal error, the program process terminates and returns control to its parent CLI. The process may describe the error before it terminates, or it may simply return a numeric error code to the CLI.

When the CLI receives an error code, it looks for the text definition in file ERMES, in the root directory. If ERMES defines the code, the CLI will find and display the text error message. But if the code is not defined in ERMES, the CLI will report *UNKNOWN ERROR CODE n*, where *n* is the code.

The ERMES file supplied with AOS/VS contains error message text needed by AOS/VS programs, like the CLI, EXEC, SED, the SPEED editor, the macroassembler, and Link. But the supplied ERMES does not define error codes for other DG software, like high-level languages (e.g., FORTRAN and COBOL), data management software (e.g., INFOS II, DG/DBMS and Sort/Merge), or communications/networking software.

After you have loaded all your DG-supplied software, someone must create an ERMES with text definitions for all its errors. (If this isn't done, users will often get only the numeric error codes, which won't help productivity.)

Creating the tailored ERMES involves editing a macro called LINK\_ERMES to contain all the product names, executing LINK\_ERMES, and copying the new ERMES into the root directory.

For example, assume you have acquired COBOL, FORTRAN 77, AOS/VS BASIC, SORT/MERGE, and XODIAC networking. After loading these onto the system, you might create a new ERMES as follows.

First, turn SUPERUSER on and make the working directory :UTIL.

```
) SUPERUSER ON ↓
*) DIR :UTIL ↓
```

Now, with a text editor (SED or SPEED), edit file LINK\_ERMES.CLI. The following text string in this file defines all the codes for ERMES:

```
<sys z speed pln x pl1 dgl clre link sed xyzzy masm &
dump_ll_load_ll_ f77 lang_rt>ermes pl1ermes16 %-%
```

From this text, you can see that PL/I, DGL, and F77 messages are already part of the system ERMES. Anywhere between the angle brackets, add the proper strings. They are COB for COBOL, BAS for BASIC, SORT for Sort/Merge, and NET for Networking. If all the text won't fit on one line, use the & continuation character to continue the line; then delete the existing first angle bracket and the leading spaces. For example, change the original lines to

```
<COB,BAS,SORT,NET&
sys z speed pln x pl1 dgl clre link sed xyzzy masm &
dump_ll_load_ll_ f77 lang_rt>ermes pl1ermes16 %-%
```

Then leave the editor. Execute the new LINK\_ERMES by typing

```
*) LINK_ERMES ↓
... (Link message) ...

*) MOVE/V/R : ERMES ↓
ERMES
*)
```

Now users will get text explanations of COBOL, FORTRAN 77, BASIC, SORT, and XODIAC network runtime errors. (The /R switch copies the file only if it is more recent than a file with the existing name in the root directory.)

File ERMES.ER contains LINK errors. If you get *FILE DOES NOT EXIST* messages from the LINK\_ERMES macro command, create a link in :UTIL to each pertinent .OB file in its own directory; for example,

```
*) DIR :UTIL ↓
*) CREATE/LINK COBERMES.OB :COBOL:COBERMES.OB ↓
```

Then try LINK\_ERMES ↓ again. The filenames, in this case, are COBERMES.OB, BASERMES.OB, SORTERMES.OB, and NETERMES.OB.

ERMES instructions usually appear on the Release Notices of each relevant software product. Also, file :UTIL:ERMES.SR describes the format of the ERMES file.

## Making Life Easier for Users

This section tells you how to tailor the log-on screen, create log-on messages and give and get Help.

### Tailoring the Log-on Screen

An enabled console displays the log-on banner, which looks like this:

```
**** AOS/VS REV 7.00 / Press NEW-LINE to begin logging on ****
```

For user consoles, you can tailor a log-on screen by creating the file :UTIL:LOGON.BANNER.SCREEN. For hard-copy terminals, you can create the file :UTIL:LOGON.BANNER.HARDCOPY. If these files exist, EXEC will display them instead of the one-line log-on banner.

You can edit either of these screen files using a text editor like SED. Each file can have as many as 2048 characters (an 80 by 24 character screen holds 1920 characters).

You don't have to edit either of the log-on screen files, but it's a nice way to personalize your system. If neither of these screen files exists, EXEC will display the default one-line banner.

## User Log-on Files

When you specified the "Initial IPC file" to PREDITOR, you gave a central macro filename (example, :UTIL:LOGON\_CENTRAL.CLI) that would be executed for users when they logged on. You planned for this macro to execute a logon macro in each user's directory. There will be no error message if the files don't exist, but they serve as a useful information and control tool for users — so you might as well create them to see how they work.

Use a text editor (SED or SPEED) to create the files. First, create the central macro — shown by example as file :UTIL:LOGON\_CENTRAL. The text might look something like this:

Comment This is a central macro that executes user log-on macros.

```
SEARCHLIST :UTIL
DEFACL [!USERNAME],OWARE
:UDD:[!USERNAME]:LOGON.CLI
```

Now, create the LOGON.CLI macro to be moved into user directories. Sample text for the initial IPC file follows.

```
WRITE Welcome to the AOS/VS Operating System. The file you are reading
WRITE is a CLI macro in your own directory. You can edit it as desired:
WRITE to set console characteristics and/or searchlist and/or default
WRITE access control list -- DEFACL -- for your files.
SEARCHLIST [!SEARCHLIST]
WRITE Your searchlist is [!SEARCHLIST]
WRITE Type HELP NEWLINE for Help.
```

After writing both macros, test them by typing

```
*) MOVE/V/R :UDD:[!USERNAME]:LOGON.CLI )      (Put user macro in your directory)
LOGON.CLI
*) LOGON_CENTRAL )      (Try central macro)
```

You should see the text you typed after each WRITE command, and the current searchlist set by the SEARCHLIST command. If there are error messages, they probably result from syntax errors. The system displays only the first 512 characters in the central macro file, so you shouldn't make it more than 512 characters long.

When the log-on macro runs without error messages, give everyone all access to the macro and move a copy of it to everyone's directory by typing the following commands.

```
*) MOVE/V/R :UDD LOGON.CLI )
LOGON.CLI
*) DIR :UDD )
*) ACL LOGON_CENTRAL.CLI +,RE )      (Use your central macro name)
*) ACL LOGON.CLI +,OWARE )
*) SPACE + 50 )
*) MOVE/V ([!FILENAMES +]) LOGON.CLI )
```

... (CLI verifies each file moved) ...

This sequence initializes each user directory and moves a copy of LOGON.CLI into each one.

Note that the macro text applies only to CLI users (users whose *program*, specified to PREDITOR, is CLI.PR.) If a user's *program* is BASIC.PR, LOGON.CLI must be rewritten in BASIC to PRINT the log-on message you want. A BASIC program cannot use CLI commands directly. CEO, however disregards the IPC file text, so you need not rewrite it for a CEO user.

## LOGON.MESSAGE File

If you create a file called LOGON.MESSAGE in :UTIL, EXEC will display the contents of this file to every user who logs on — in whatever program.

LOGON.MESSAGE is quite useful for general system information, like planned shutdowns, new features, and so on. The system manager or operator can add information to this file as needed — any day or any hour. If you wish, you can give the file an access control list that allows any CLI user to edit it — adding messages that he or she feels would be of general interest. As with the user log-on file, only the first 512 characters of LOGON.MESSAGE are read (but people can TYPE LOGON.MESSAGE to see the whole thing, if it exceeds 512 characters).

Create and/or edit file LOGON.MESSAGE as you would any file. It must be in directory :UTIL. Sample text is

This is the wonderful world of AOS/VS.

If you have questions, please see system operator.

After creating both the user log-on and LOGON.MESSAGE files, bring everything UP ), then log on as OP on a user console. You will see the messages just as any user will see them.

## Giving and Getting Help

AOS/VS has a Help mechanism that can help inexperienced people to use the system. You may have used part of this with VSGEN, PREDITOR, and SED; you can also use it with the CLI, EXEC, and other DG products. For example, type the following commands.

\*) HELP )

... (CLI displays list of HELP topics) ...

\*) HELP \*COMMANDS )

... (CLI displays list of its commands) ...

\*) HELPV ACL )

... (CLI describes ACL command) ...

\*) XHELP )

... (EXEC displays all its commands) ...

\*) XHELP ENABLE )

... (EXEC describes its ENABLE command) ...

You can see that HELP provides quick, pertinent information, when people need it. All Help messages, for all programs, are in directory HELP. This directory was created, and its files loaded, when you first brought up the starter system.

Each Help file begins with a character string that identifies it to the system. For example,

### The contents of a Help file named

CLI.TPC.TOPICS  
CLI.TPC.string  
CLI.CMD.string  
CLI.PSM.string  
EXEC.string

### Will be displayed by the CLI command

HELP )  
HELP \*string )  
HELP string )  
HELP !string )  
XHELP string )



Additional Help files in :HELP, accessible from non-CLI programs, are

| <b>Filename</b> | <b>Accessible from</b>              |
|-----------------|-------------------------------------|
| DEBUG4.string   | Assembly language debugger.         |
| FED.string      | Assembly language disk file editor. |
| SED.string      | SED text editor.                    |
| SPEED.string    | SPEED text editor.                  |
| VSGEN.string    | VSGEN program.                      |

By default, every user can read these files (via appropriate HELP or TYPE pathname commands), and the system will automatically find and display them.

Generally, if you want to create one or more Help files and have the system type its contents, use the filename form

CLI.TPC.string

The system will then display the string in proper alphabetical order when a user types HELP ). It will display the file's contents when a user types HELP \*string ).

If a Help message can tell the whole story by itself, you can simply leave it as a Help topic. But if the explanation is quite long, you can use the topic file to tell the user what files to TYPE for more help.

All Help files you create should have an Access Control List (ACL) of at least +,R so the users will be able to read them. You can set ACLs as shown in the example below.

Even if you decide not to create your own Help messages now, all files from nonAOS/VS products that begin with "CLI.TPC." should be in directory :HELP. This will allow users to see the topic when they type HELP ).

You can find all CLI.TPC.- filenames via a filename *template* (character that matches all or parts of filenames). The character + (plus sign) matches all characters. So, in directory "dir", you can see which filenames begin with CLI.TPC. — and sort the filenames — by typing

\*) DIR dir )

\*) F/S CLI.TPC.+ )

... (System lists all filenames that begin with CLI.TPC. alphabetically) ...

\*)

## Help File Example

In directory :HELP, use a text editor to create a file named

**CLI.TPC.ABOUTSYSTEM**

contents of this file can be any message you want. For example:

**ABOUTSYSTEM** — This is a DG MV/Family CPU running the AOS/VS operating system. TYPE any of the following files for more information: )

|                 |                                               |
|-----------------|-----------------------------------------------|
| :HELP:COMPILERS | Describes compilers and how to use them.      |
| :HELP:BATCH     | Describes using Batch.                        |
| :HELP:DAY_RUN   | Describes schedule of application programs.   |
| :HELP:DAY_DUMP  | Describes daily schedule of Dump/Backup runs. |

After leaving the text editor, give everyone read access to the Help file:

\*) ACL/V CLI.TPC.ABOUTSYSTEM +,R )

*CLI.TPC.ABOUTSYSTEM*

\*)

This shows the simplest approach to Help messages. When any user types **HELP )** from the CLI, **ABOUTSYSTEM** will appear as a topic. When the user types **HELP \*ABOUTSYSTEM )**, the file text will be displayed; the user can then type any of the pathnames described for more information. You'll be able to think up more sophisticated ways to use Help messages later on. But the main point is to know about it: it can be a great boost to productivity.

## Overview of Your System File Structure

Your multiuser environment is ready for users. During the whole process, there were a number of directories and files created — some via the system tape, some by the tailored system, some by **PREDITOR** and **EXEC**, and some by you.

Figure 5-1 shows the directory structure, with some pertinent files, and describes how and when the files were created. An oval indicates one or more directory files; a box indicates one or more individual files.

## What Next?

This chapter has given you the essentials on creating the multiuser environment.

It has shown you how to create good general-purpose user profiles with the PREDITOR profile editor and how to initialize EXEC, the multiuser environment “manager”; given you some pointers on other DG software and the ERMES error file; shown you how to make life easier for users with initial user IPC files and the log-on message file; and offered a picture of your finished system’s directory structure.

This chapter ends the “cookbook”, blank-disk to finished-system portion of the book. This portion has introduced you to the DG hardware and software in Chapter 1; told you how to format LDUs, install, and bring up the starter system in Chapter 2 or 3; explained how to generate, test, patch, and optionally install a tailored system in Chapter 4; and showed how to create the multiuser environment in this chapter.

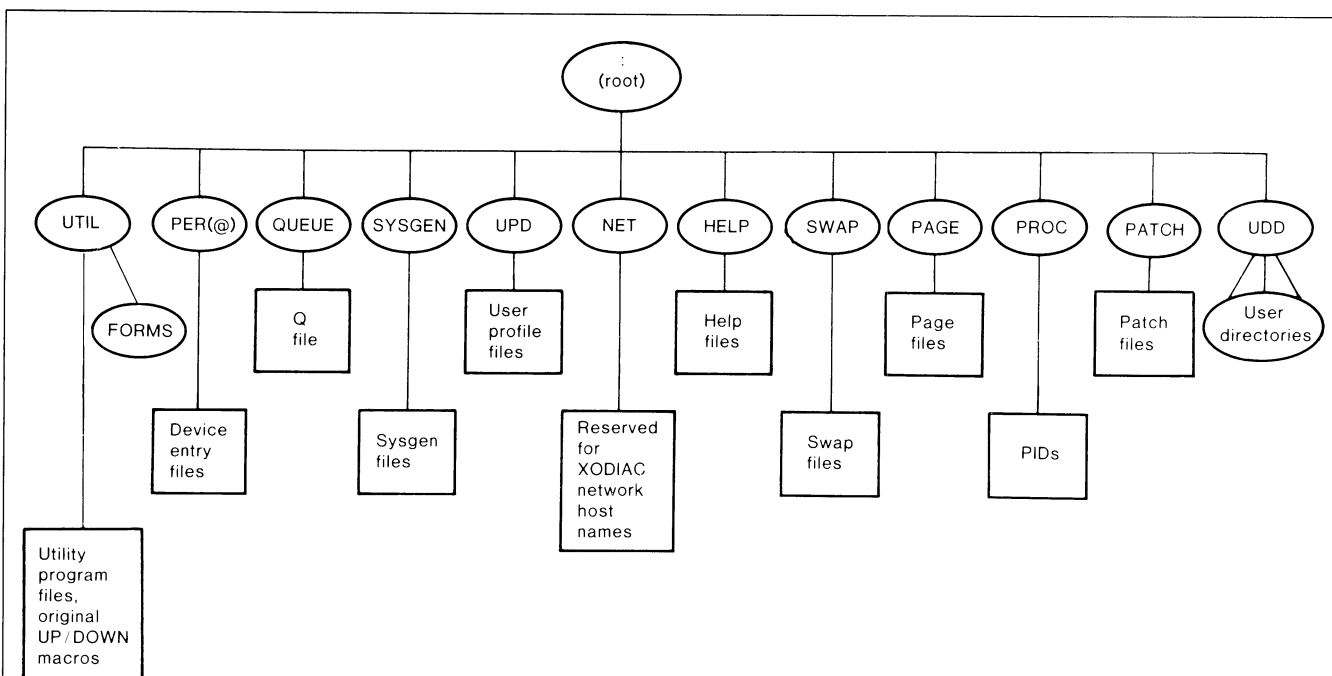
Whoever you are — DG engineer, system manager, DP manager, MIS manager, or nonadministrative person — you have done a tremendous job. Not only have you had to execute many steps, but you’ve had to learn a lot. Your tailored, multiuser system is up and running. You may have to execute parts of preceding chapters again — but you will rarely, if ever, need to do it all again for your installation.

The rest of this book gives the details — in a form designed for reference — of programs to help generate and run an AOS/VS system. The next chapter details startup and shutdown, both normal and abnormal. Read it if you want to learn about startup and/or handling abnormal shutdown. Chapters 7 and 8 give the *details* on PREDITOR and EXEC — batch, spooling, and tape mounting — read them for the inside story on these important programs. Chapter 9, “Other Runtime Tools”, describes general-purpose operator tools, like the PED environment display program, and the system log and report utilities. Chapter 10 describes system backup.

Chapter 11 tells you how to handle unusual system conditions; Chapter 12 details the Disk Formatter; and Chapter 13 details the Installer. Chapter 14 gives some summary pointers and cautions.

Chapter 15 examines system management issues — excluding security; and Chapter 16 deals with security. Both chapters try to show how to make the best decisions for your installation.

Depending on your interest — go to the appropriate chapter, or check the index for a specific topic or product.



## Directory Name (pathname)

## Description

Root (:)

This is the root directory. It contains all other directories. It was created by the Disk Formatter during the Full format. Its nondirectory files include the system Agent, peripheral manager, stand-alone FIXUP disk fixer, and DFMTR Disk Formatter, the CLI files, the edited UP.CLI and DOWN.CLI (which you moved there), and the error message file, ERMES.

UTIL (:UTIL)

This is the utilities directory. It contains most AOS/VS utility program files: the SED text editor, macroassembler, Link, debugger, etc. UTIL also has operator tools like PREDITOR, EXEC, and PED. It was created by the starter system during the initial load.

FORMS (:UTIL:FORMS)

This is the FORMS directory that you created to hold special printing form directive files; it will be empty until someone places files in it.

PER or @ (:PER or @)

This is the Peripherals directory, created by a tailored AOS/VS system each time it comes up. PER contains a device entry file for each device (not controller) generated to be part of the operating system (e.g., MTB0, DPF0, CONn, LPB. The @ is convenient shorthand for PER; for example @MTB0 is easier to type than :PER:MTB0.

PER is also the home directory of EXEC (although the EXEC program and overlay files are in :UTIL). When AOS/VS starts up, it creates device entries in PER. When EXEC starts up, it creates batch and device queues in PER. Other software products, like networking or communications products, also create entries in PER when they are started up. When a system is shut down normally, it deletes PER, so don't place user files there.

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Figure 5-1. Directory Structure in the Finished AOS/VS System (continues)

| Directory Name<br>(pathname) | Description                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| QUEUE (:QUEUE)               | This is directory QUEUE, created by EXEC the first time EXEC starts up. QUEUE contains one file, named Q, which has queue information for EXEC. The QCMP queue compactor may delete all files in QUEUE, so don't place user files here.                                                                                                                                                                                                    |
| SYSGEN (:SYSGEN)             | This is the system-generation directory, it was created by the starter system from the system tape during the initial load procedure. It contains needed VSGEN and library files for system generation.                                                                                                                                                                                                                                    |
| UPD (:UPD)                   | This is the user profile directory, created by the system if it doesn't exist. The user profile for each user lives here. EXEC checks the directory for a matching profile before allowing a user to log on. And, after each user has logged on, the system itself enforces the limits set within the profile file.                                                                                                                        |
| NET (:NET)                   | This is the network directory, created by a tailored operating system the first time the system comes up. XODIAC network host names are put here automatically by XODIAC software. Generally, don't put user files here.                                                                                                                                                                                                                   |
| HELP (:HELP)                 | This is the HELP directory, created by the starter system from tape during the initial load procedure. It contains topic Help files, command and pseudomacro Help files, and VSGEN and EXEC Help files. You can also place your own Help files here.                                                                                                                                                                                       |
| SWAP (:SWAP)                 | The SWAP directory is part of AOS/VS' memory management mechanism. AOS/VS creates it at startup and deletes it at shutdown. Its size is specified at VSGEN, but you can override this if you override default specs when you bootstrap. Do not place user files here.                                                                                                                                                                      |
| PAGE (:PAGE)                 | Like SWAP, PAGE is part of the AOS/VS' memory structure; AOS/VS creates it at startup and deletes it at shutdown. You can override the size specified at VSGEN when you bootstrap. Don't place user files here.                                                                                                                                                                                                                            |
| PROC (:PROC)                 | AOS/VS uses the PROC directory to keep track of running processes. It is created at startup and deleted at shutdown. Don't place user files here.                                                                                                                                                                                                                                                                                          |
| PATCH (:PATCH)               | This is the patch directory, created with patch files and an update notice, by the first AOS/VS update tape loaded. Subsequent update tapes update the contents. Generally, restrict this directory to patch and update files; users should not store files here.                                                                                                                                                                          |
| UDD (:UDD)                   | This is the user directory directory, created by PREDITOR the first time PREDITOR is run on this LDU. In this directory, PREDITOR creates a user directory for each user given a profile. This directory has the name given as a username to PREDITOR; for example, ROBIN, F77, or INFOS. The user directory becomes the user's working directory when the user logs on; within it, the user can create files and subordinate directories. |

DG-27028

*Figure 5-1. Directory Structure in the Finished AOS/VS System (concluded)*



# Chapter 6

## Startup and Shutdown

Read this chapter

- when you want to start up your computer system;
- when you want to start a program like an AOS/VS system or the FIXUP Disk Fixer;
- when you want to shut an AOS/VS system down;
- if AOS/VS hangs or stops with a fatal error or hard error message;
- when power returns after a power failure.

This chapter gives the details on system startup, normal shutdown, and abnormal shutdown. The major sections are

- The SCP and SCP CLI Commands
- CPU Front Panel
- Startup
- Normal Shutdown
- Abnormal Shutdown
- The FIXUP Disk Fixer
- Power Failures

### The SCP and SCP CLI Commands

In addition to running AOS/VS, MV/Family computers also run a second operating system, called the System Control Program (SCP or SCP-OS). On the MV/20000, MV/10000, MV/80000, MV/60000, and MV/4000, AOS/VS and the SCP run concurrently because each runs in a separate processor. When you bring up AOS/VS, it gets and keeps control of the system console until it is shut down. Then, the SCP CLI gets control of the system console.

On the MV/2000 DC, the 4000-series, and the DS/7000-series computers, AOS/VS and the SCP run alternately, sharing the same processor. When you bring up AOS/VS, a subset of the SCP-OS remains in microcode. AOS/VS gets and keeps control of the system console while it runs. When the CPU is halted (as when AOS/VS is shut down), the subset SCP CLI gets control of the system console.

So, on all computers but the MV/2000 DC, the 4000-series, and the DS/7000-series, you can use the SCP CLI while AOS/VS is running. On the other systems, you can use the SCP CLI only when AOS/VS is not running (when it is shut down or frozen).

When the SCP CLI has control, it displays the prompt

*SCP-CLI>*

on the system console. Next to the prompt, you can type SCP commands to boot an AOS/VS system or other stand-alone program; the SCP will then load a program that loads your specified program into the main processor's memory. The new program takes control of the processor and system console and starts its own dialog. But the SCP CLI will regain control if the new program terminates.

SCP CLI commands (also called the *soft console*) extend the functions of hardware switches on the computer front panel. Generally, you should use SCP CLI commands only when AOS/VS is shut down. Most SCP CLI commands change main processor state — so if you use them when AOS/VS is trying to run the processor, AOS/VS may fail when it regains control of the processor.

The most common SCP CLI commands appear in Table 6-1.

SCP features are further described in Chapter 11 and in the *System Control Processor* manual (014-series) supplied with your computer.

**Table 6-1. Commonly-Used SCP CLI Commands**

| Command                   | What it Does                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Example                                                                  |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| ATTACH <i>[n]</i>         | <p>Multiple-processor computers only. Tells the SCP to apply future commands to processor <i>n</i> (<i>n</i> can be 1 or 0; by default the SCP applies all commands to processor 0). Simultaneously, the SCP detaches itself from other processors.</p> <p>If you omit <i>n</i>, the command displays the number of the processor currently attached to the SCP.</p> <p>You might use ATTACH if processor 0 was running diagnostics and you wanted to run AOS/VS in processor 1.</p> | <pre>SCP-CLI&gt; ATTACH 0 SCP-CLI&gt; ATTACH 1 SCP-CLI&gt; BOOT 24</pre> |
| BOOT <i>n</i>             | Program loads from the first device on device code <i>n</i> . The program on this device takes control of the system console. Be sure the main processor is RESET before using BOOT.                                                                                                                                                                                                                                                                                                 | <pre>SCP-CLI&gt; B 24</pre>                                              |
| CONTINUE <i>[arg]</i>     | Tells the main processor to continue running a halted program. With an argument, continues running a program only on the named processor. Useful on MV/2000 DC, 4000-series and DS/7000-series systems to continue running AOS/VS. Also useful when you want to rerun a stand-alone program like the Disk Formatter.                                                                                                                                                                 | <pre>SCP-CLI&gt; CON SCP-CLI&gt; CONTINUE</pre>                          |
| FLAGS arg {No }<br>{Yes } | Sets or clears an SCP flag. The most common flags are DATE, SCOPE, and LOCK. DATE sets the system date. SCOPE tells the SCP to erase characters when you press the DEL key; it's useful if the system console is a CRT (SCOPE is not available on 4000-series systems). LOCK disables the break sequence. This can be useful on MV/8000s — but on other machines, it's better to lock the computer.                                                                                  | <pre>SCP-CLI&gt; FLA SCOPE Y</pre>                                       |

(continues)



**Table 6-1. Commonly-Used SCP CLI Commands**

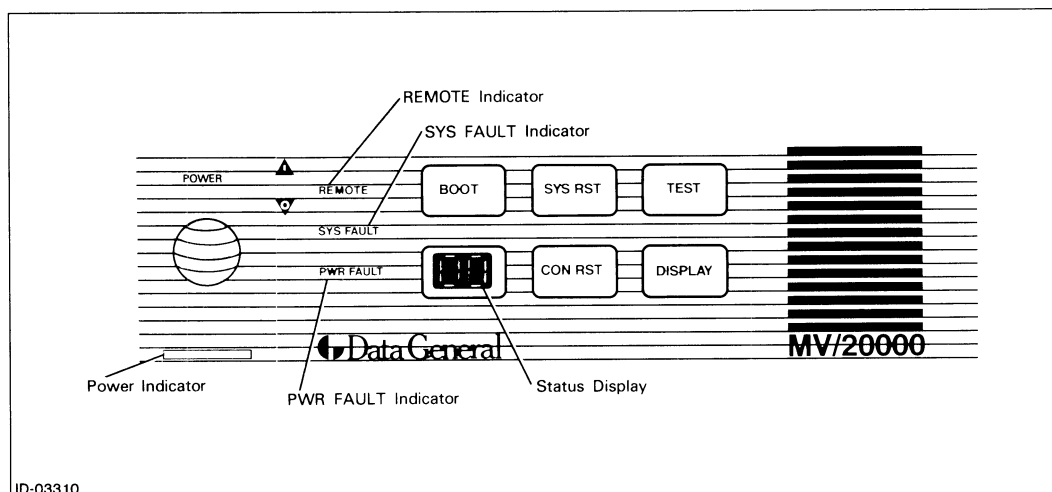
| Command              | What it Does                                                                                                                                                                             | Example                                                     |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| HALT [ <i>arg</i> ]  | Halts the main processor CPU after it has completed the current instruction, or halts the processor specified by <i>arg</i> .                                                            | <i>SCP-CLI&gt; HA ↓</i>                                     |
| HELP [ <i>name</i> ] | Give a general Help message (without <i>name</i> ) or, depending on computer model, gives help on a specific command <i>name</i> .                                                       | <i>SCP-CLI&gt; HE ↓</i>                                     |
| RESET [ <i>arg</i> ] | Halts and resets the whole system. With an argument, halts and resets that processor without resetting I/O. Use RESET before booting or running ESD. You cannot abbreviate this command. | <i>SCP-CLI&gt; RESET ↓</i>                                  |
| START addr           | Starts the main processor CPU at addr. The CPU must be halted. This command is useful under unusual circumstances for emergency AOS/VS shutdown.                                         | <i>SCP-CLI&gt; RESET ↓</i><br><i>SCP-CLI&gt; START 50 ↓</i> |
| TTY                  | Gives the main processor CPU control of the system console. (TTY is not available on 4000-series systems; use CONTINUE ↓ instead.)                                                       | <i>SCP-CLI&gt; TTY ↓</i>                                    |
| .(period)            | Displays the status of the attached processor accumulators, program counter, carry, and map. This is useful whenever you want to check these or see if the SCP CLI is active.            | <i>SCP-CLI&gt; . ↓</i>                                      |

(concluded)

## CPU Front Panel

The switches on your computer's front panel affect how — and if — the SCP gets control while AOS/VS is running.

### MV/20000 Model 2, MV/20000 Model 1, and MV/20000 Model C Front Panels



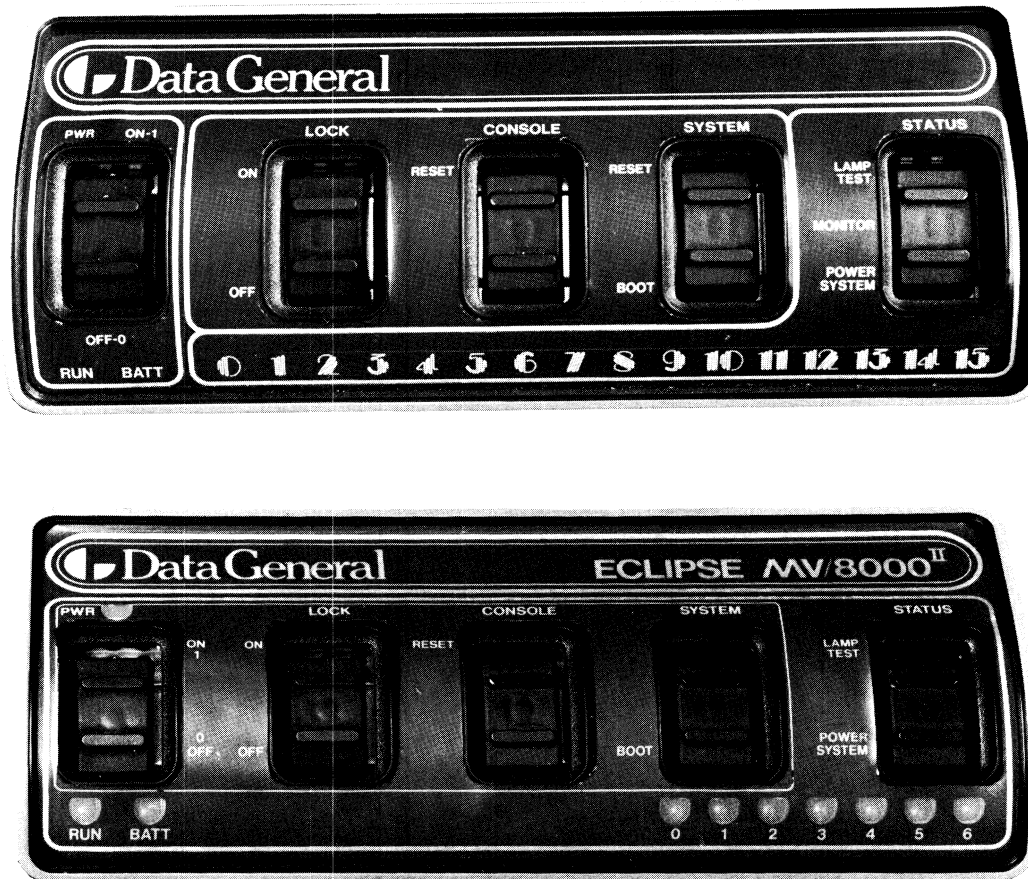
*Figure 6-1. MV/20000 Computer Front Panel*

Figure 6-1 shows the front panel on ECLIPSE MV/20000 Model 2, MV/20000 Model 1, and MV/20000 C computers. From left to right, the panel has sliding power switch, four backlit switches, an unlit switch, three lights, and two digital displays.

After powerup, it's easy to communicate with the computer via the SCP CLI or a startup menu. The switches and lights work as follows:

- **POWER switch**                      Sliding the switch up (toward 1) turns computer power on. Sliding the switch down (toward 0) turns power off.  
Don't turn power off when AOS/VS is running.
- **POWER light**                      This glows when you turn the power switch on.
- **REMOTE light**                      This flashes when there's a remote connection to the computer (for example, a DG engineer has made a telephone connection to run diagnostics).
- **BOOT switch**                      If all processors are halted and this switch is lit, pressing it tells the SCP to program load from the default device code (usually disk). If any processor is running, nothing happens.
- **SYS RST switch**                      If this switch is lit, pressing it resets the computer. When you release the switch, the processor(s) are halted and fault codes are cleared. *Don't do this when AOS/VS is running.*
- **TEST switch**                      If this switch is lit, pressing it tests the switches and digital displays. These will light and show each digit for one second, then the panel will return to normal.
- **SYS FAULT light**                      This flashes when there is a system fault that causes the processor(s) to halt; the digital display shows a fault code.
- **PWR FAULT light**                      This lights if a power fault occurs. The digital display shows a fault code.
- **CON RST switch**                      If this switch is lit, pressing it resets the system console. If the console is locked by the SCP command LOCK, CON RST unlocks it.  
  
Use CON RST when the system console seems frozen and CTRL-Q doesn't help. AOS/VS, if running, will continue. Don't use this switch unless you must.
- **DISPLAY switch**                      DISPLAY is really a lock switch: pushing DISPLAY backlights the other touch-sensitive switches and enables them. When you touch an enabled switch, it stays lit but the others go dark. When you release it, the other switches light again.  
  
When AOS/VS is running, if the other switches are lit, press DISPLAY to disable them.
- **Digital display**                      These light and show a fault code when a processor or power fault occurs. For fault codes, see *ECLIPSE MV/20000<sup>TM</sup> System Control Program* or *Starting the ECLIPSE MV/20000<sup>TM</sup> Series Computer Systems* manuals.

## MV/10000 SX, MV/10000, and MV/8000 II Front Panels



PH-687

*Figure 6-2. MV/10000 SX and MV/10000 (top), and MV/8000 II Computer Front Panels*

MV/10000-series and MV/8000 II computers, as you can see in Figure 6-2, have five front panel switches — PWR, LOCK, CONSOLE, SYSTEM, and STATUS — and a row of lights. The switches work as follows:

- PWR switch. This switch should be at the ON-1 position, unless you want to cut CPU power.

- **LOCK switch.** In the ON position, the LOCK switch disables the SYSTEM RESET switch, the CONSOLE switch, the OFF-0 switch, and the break sequence. LOCK ON enables transfer to the backup battery (if any) if outside power goes down. LOCK ON also tells the hardware to program load from the jumper-selected device code on the first IOC (often the code of your primary disk) when power is turned on. You must turn LOCK OFF to turn power off, enable the break sequence, or to bootstrap from a device other than the one selected with jumpers. *Keep LOCK in the ON position unless you want to do one of these things.* Pressing LOCK to its current position (for example, pressing it ON when it is ON) has no effect; so, whenever you don't know what position it is in, it does no harm to press it to the desired position.

If LOCK is off when you turn power on, a microcoded console loader program (*BOOT WHAT DEVICE?* prompt) gets control. Then, you can press `l` to bootstrap from the jumper-selected device code as above or you can type `nn l` (`nn` is the device code) to bootstrap from any device; for example, tape.

- **CONSOLE switch.** Pressing this to RESET on an unlocked computer gives control of the system console to the SCP operating system. AOS/VS, if running, continues. To return control of the console to AOS/VS, type

TTY `l`

- **SYSTEM switch.** If the console loader program (*BOOT WHAT DEVICE?* prompt) has control, pressing SYSTEM BOOT tells the hardware to load from the jumper-selected device code as above. If the SCP CLI has control, SYSTEM BOOT tells it to display *BOOT WHAT DEVICE?* on the system console; you can then type the desired device code and `l`. SYSTEM BOOT has no effect if the CPU is running (as when AOS/VS is running). Pressing SYSTEM RESET (MV/10000-series only) resets the computer, if unlocked — *don't do it if AOS/VS is running.*
- **STATUS switch.** Pressing STATUS to LAMP TEST tests the condition of the data lights; they should all glow. On an MV/10000-series machine, STATUS at the MONITOR position continuously displays the control store (microcode) memory address. (The control store address display indicates the amount of control store activity.)

STATUS in the POWER SYSTEM position gives the power supply status in the rightmost seven lights (9–15 on MV/10000-series, 0–6 on MV/8000 II). *There has been a power supply fault if any of the rightmost seven lights stays on with the STATUS switch at POWER SYSTEM.* This position gives the most useful information. MV/10000-series and MV/8000 II power supply fault codes are described in Chapter 17.

If you find the *SCP CLI>* prompt on the console when AOS/VS is running, you can return control to AOS/VS by typing TTY `l`; e.g.,

```
SCP-CLI>   TTY l
l
)
```

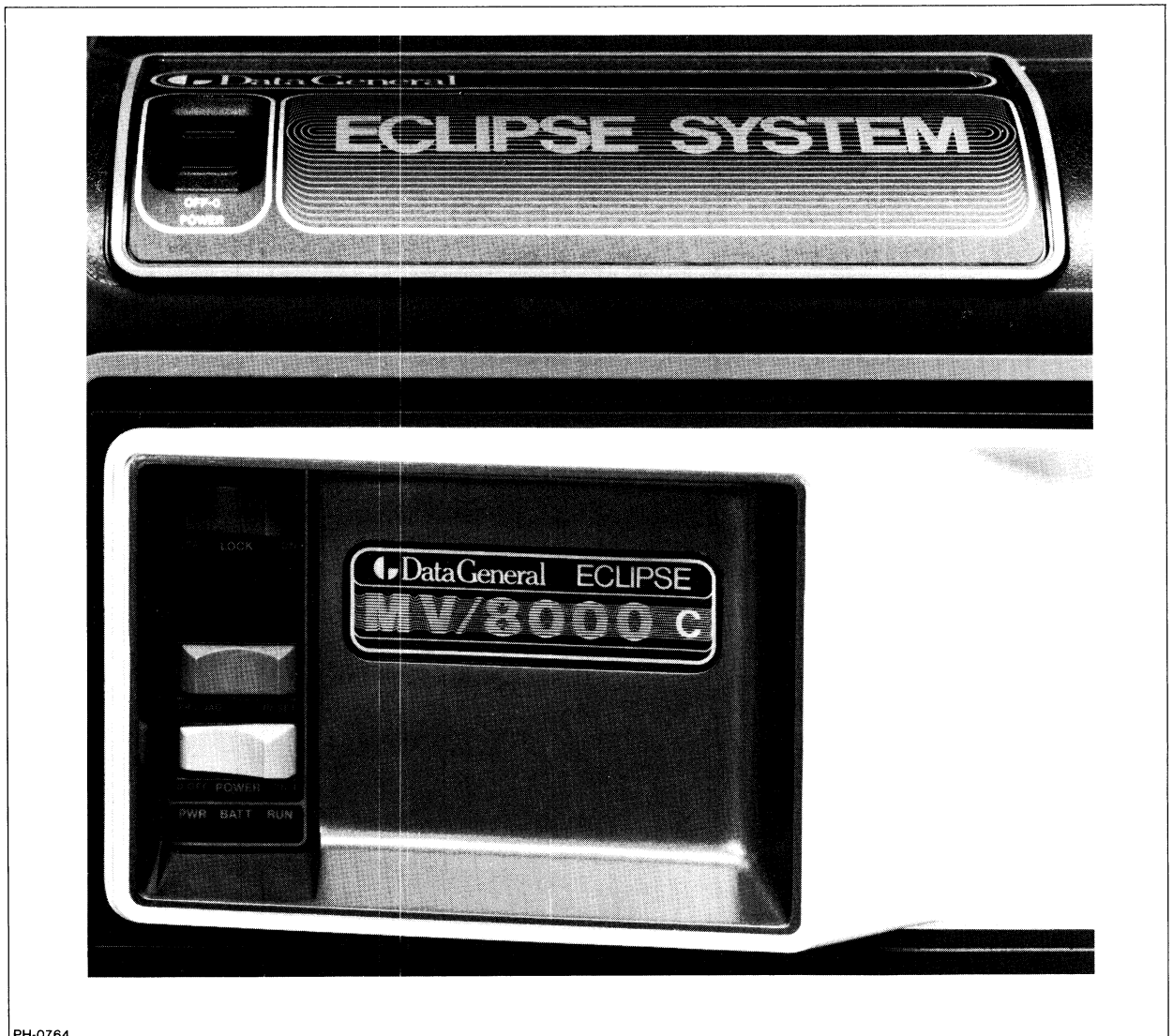
The lights on the front panel work as follows:

|             |                                                                            |
|-------------|----------------------------------------------------------------------------|
| ON light    | lit when power is flowing to the computer.                                 |
| RUN light   | lit when the main CPU is executing instructions (AOS/VS, etc.)             |
| BATT light  | on when the CPU has transferred from normal power to backup battery.       |
| data lights | the meaning depends on the STATUS switch, as described under STATUS above. |

When the computer is running AOS/VS on normal power, the ON and RUN lights are lit. When the POWER switch is OFF, all lamps are off.

When the system is running normally, you don't need the panel switches. To cut CPU power, press LOCK OFF and POWER OFF. To power up, press LOCK ON and POWER ON. For a continuous power status display, keep STATUS in the POWER SUPPLY position. (Or, for an inside look at the MV/10000-series control store, leave STATUS in the MONITOR position.) Generally, avoid touching the panel switches unless you must force shutdown.

## MV/8000 C Panel Switches and Lights



PH-0764

*Figure 6-3. MV/8000 C Computer Front Panel*

MV/8000 C computers — shown in Figure 6-3 — have three front panel rocker switches: LOCK, PR LOAD/RESET, and POWER. The *cabinet* power switch, above these, must be set ON to provide cabinet power; we suggest that you leave this switch ON and use device switches to control power. The front panel has three lights that indicate faults by blinking; fault codes are described in Chapter 17.

The *panel* switches work as follows.

- **LOCK switch.** In the ON position, the LOCK switch disables the PR LOAD/RESET switch, and the break sequence. LOCK ON enables transfer to the backup battery (if any) if outside power goes down. LOCK also tells the hardware to program load from the jumper-selected device code (24, 27, or 33) when power is turned on. You must turn LOCK off to enable the break sequence, or to bootstrap from a device other than the one selected with jumpers. *Keep LOCK in the ON position unless you want to do one of these things.* (LOCK does not disable either the local *or* cabinet power switches on MV/8000 C machines.)

If LOCK is off when you turn power on, a microcoded console loader program (*BOOT DEVICE* prompt) gets control. Then, you can press `]` to bootstrap from the jumper-selected device code, or you can type `nn ]` (`nn` is the device code) to bootstrap from any device; for example, tape.

- **PR LOAD/RESET switch.** If the console loader program (*BOOT DEVICE*) has control, pressing PR LOAD tells the hardware to load from the jumper-selected device code. If the SCP CLI has control, PR LOAD tells it to display *BOOT DEVICE?* on the system console; you can then type the desired device code and `]`. PR LOAD has no effect if the CPU is running (as when AOS/VS is running). Pressing RESET resets the computer, if unlocked — *don't press RESET if AOS/VS is running.*
- **POWER switch.** This switch should be at the ON-1 position, unless you want to cut CPU power.

If you find the *SCP-CLI>* prompt on the console when AOS/VS is running, you can return control to AOS/VS by typing `TTY ]`; e.g.,

```
SCP-CLI>  TTY ]  
]  
)
```

The lights on the MV/8000 C panel work as follows:

|            |                                                                                                               |
|------------|---------------------------------------------------------------------------------------------------------------|
| PWR light  | lit when DC power is normal; off when power is off or the computer is under partial battery backup.           |
| BATT light | lit when computer has transferred from normal power to backup battery (full or partial backup).               |
| RUN light  | lit when the computer is executing instructions (AOS/VS, diagnostics, etc.); off when the computer is halted. |

When the computer is running AOS/VS on normal line power, the PWR and RUN lamps are lit. When the POWER switch is OFF, all lamps are off. When one or more lights *blink*, this indicates a power supply fault. MV/8000 C power supply fault codes are described in Chapter 17.

In the normal course of system operations, you don't need any panel switches. To cut CPU power, press the local CPU rocker switch POWER OFF. To power up, press rocker switch POWER ON. Otherwise, avoid touching the switches unless you must force shutdown.

## MV/8000 Panel Switches



*Figure 6-4. MV/8000 Computer Front Panel Switches*

As you can see from Figure 6-4, MV/8000 computers have one light (on when power is on) and two front panel switches: RESET and POWER. The switches work as follows:

- **RESET switch.** Pressing this to SYSTEM resets the CPU; *don't do it if AOS/VS is running.* Pressing this to CONSOLE has the same effect as a break sequence.
- **POWER switch.** This switch should be ON, unless you want to cut CPU power.

Typing the break sequence (CMD and BREAK keys, or BRK key, or BREAK key, depending on console type) gives the SCP control. Avoid typing the break sequence unless you must (as for an AOS/VS deadlock). You can disable break with the SCP CLI FLAGS command. It will stay disabled while power stays up or until you re-enable it. If you really need the SCP CLI, you can get to it by pressing the RESET switch to CONSOLE.

If you find the SCP-CLI> prompt on the console when AOS/VS is running, you can return control to AOS/VS by typing TTY ). For example,

```
SCP-CLI>    TTY )  
)  
)
```

In the normal course of system operations, you don't need any panel switches. To cut CPU power, press POWER OFF. To power up, press POWER ON. Otherwise, avoid touching the switches unless you must force shutdown.

## Data General DS/7000-Series and MV/2000 DC Front Panels

Figure 6-5 shows the Data General DS/7000-series and MV/2000 DC front panels.

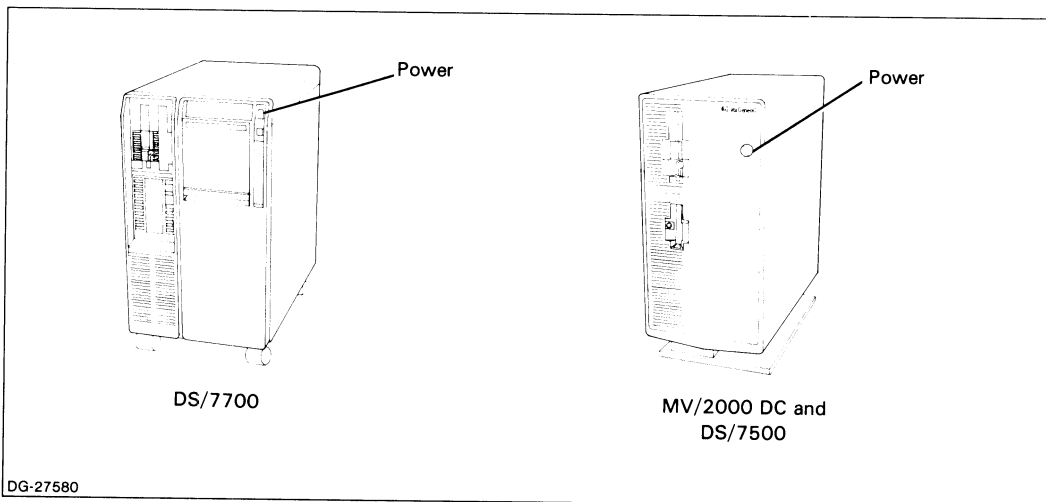


Figure 6-5. Data General DS/7000-Series and MV/2000 DC Front Panels

The Data General DS/7700 computer front panel has an on/off rocker switch for power and a digital display for fault codes. A light near the power switch glows when power is on.

The Data General DS/7500 and MV/2000 DC front panels have an on/off button switch for power. A light within the button glows when power is on.

On both machines

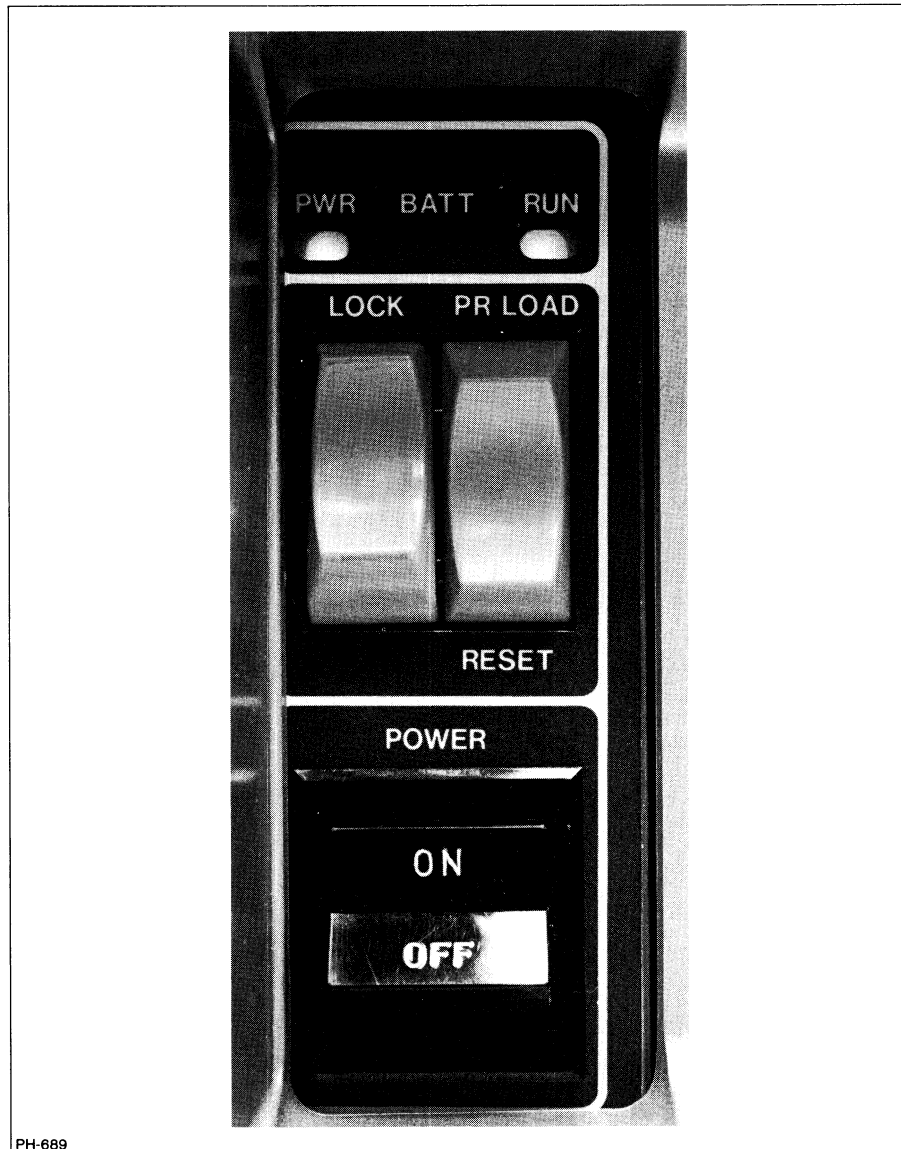
- The power switch controls power to the computer and all devices in the cabinet, including disk, diskette, and/or tape units. (Disk, diskette, tape, and other I/O devices are controlled by an integral 80186 processor.) When you turn power on, the computer displays an automatic program load menu, which allows you to run specify the startup device (code), run diagnostics, and other things. If you do nothing, or select the default choice, the main processor tries to program load from the preset device code. Usually, when you've reached this point, the device code will already be preset to the device code of the hard disk, 24 — and the AOS/VS bootstrap program will be loaded from the hard disk.

Powerup diagnostics test every PC board in the system; the test messages, followed by *PASSED* messages, appear on the system console. If a fault occurs on power up, the digital display (DS/7000 only) or system console will indicate an error condition (fault code or partial powerup *TEST* message). To interpret the error indicator, consult the System Control Processor (SCP) manual supplied with the computer.

In the normal course of system operations, you don't need the power switch. To cut CPU power *after shutdown*, press the power switch to the 0 (off) position. To power up, press the switch to the 1 (on) position. Otherwise, avoid touching the power switch.



## MV/6000 Panel Lights and Switches



*Figure 6-6. MV/6000 Computer Front Panel*

MV/6000 computers — as shown in Figure 6-6 — have three front panel lights: PWR, BATT, and RUN, and three switches. The lights work as follows:

- |            |                                                                                                               |
|------------|---------------------------------------------------------------------------------------------------------------|
| PWR light  | lit when DC power is normal; off when power is off or the computer is under partial battery backup.           |
| BATT light | lit when computer has transferred from normal power to backup battery (full or partial backup).               |
| RUN light  | lit when the computer is executing instructions (AOS/VS, diagnostics, etc.); off when the computer is halted. |

When the computer is running AOS/VS on normal power, the PWR and RUN lamps are lit. When the POWER switch is OFF, all lamps are off.

The three MV/6000 panel switches are LOCK, PR LOAD/RESET, and POWER. The switches work as follows:

- LOCK switch. In the LOCK position, the LOCK switch disables the PR LOAD/RESET switch and POWER OFF switch. LOCK also tells the hardware to program load from the jumper-selected device code (often 27) when power is turned on. You must unlock LOCK to turn power OFF or to bootstrap from a device code other the one selected with jumpers; *but we recommend that you keep the computer locked otherwise.*
- PR LOAD/RESET switch. Pressing this to RESET resets the computer if it is unlocked; *don't do this if AOS/VS is running.*
- POWER. This should be ON, unless you want to cut CPU power.

Typing the break sequence (CMD and BREAK keys, or BRK key, or BREAK key, depending on console type) gives the SCP control. Avoid doing this unless you must (as for an AOS/VS deadlock).

If you find the *SCP-CLI>* prompt on the console when AOS/VS is running, you can return control to AOS/VS by typing TTY ). For example,

```
SCP-CLI>    TTY )  
)  
)
```

In the normal course of system operations, you don't need any panel switches. To cut CPU power, press LOCK off and POWER OFF. To power up, press LOCK and POWER ON. Otherwise, avoid touching the switches unless you must force shutdown.

## MV/4000 Panel Switches and Lights



PH-690

*Figure 6-7. MV/4000 Computer Front Panel*

MV/4000 computers — as you can see in Figure 6-7 — have four front panel rocker switches: LOCK, CONSOLE, SYSTEM, and POWER. The *cabinet* power switch, above these, must be set ON to provide cabinet power; we suggest that you leave this switch ON and use device switches to control power. The front panel has three lights that indicate faults by blinking; fault codes are described in Chapter 17.

The *panel* switches work as follows.

- **LOCK switch.** In the ON position, the LOCK switch disables the SYSTEM RST switch, the CONSOLE switch, the POWER OFF switch, and the break sequence. LOCK ON enables transfer to the backup battery (if any) if outside power goes down. LOCK also tells the hardware to program load from the jumper-selected device code (27 or 33) when power is turned on. You must turn LOCK off to turn power off with the rocker switch, enable the break sequence, or bootstrap from a device other than the one selected with jumpers. *Keep LOCK in the ON position unless you want to do one of these things.* (LOCK does not disable cabinet power OFF.)

If LOCK is off when you turn power on, a microcoded console loader program (@ prompt) gets control. You must type L to bootstrap from the jumper-selected device code as above (or type nnL — nn is the device code — to bootstrap from any device; for example, tape.

- **CONSOLE switch.** Pressing this to RST on an unlocked computer halts the CPU and gives control to the SCP operating system. AOS/VS, if running, is frozen. To have AOS/VS continue, type CONTINUE ↵. Avoid using this switch unless you really need the SCP CLI.
- **SYSTEM switch.** If the console loader program (@ prompt) has control, pressing SYSTEM BOOT tells the hardware to load from the jumper-selected device code. If the SCP CLI has control, SYSTEM BOOT tells it to display *BOOT DEVICE?* on the system console; you can then type the desired device code and ↵. SYSTEM BOOT has no effect if the CPU is running (as when AOS/VS is running). Pressing SYSTEM RST resets the computer, if unlocked — *don't do this if AOS/VS is running.*
- **POWER switch.** This switch should be at the ON-1 position, unless you want to cut CPU power.

If you find the *SCP CLI>* prompt on the console when AOS/VS was running, and there is no other error, you can return control to AOS/VS by typing CONTINUE ↵; e.g.,

```
SCP-CLI>    CONTINUE ↵  
↵  
)
```

The lights on the MV/4000 panel work as follows:

|            |                                                                                                               |
|------------|---------------------------------------------------------------------------------------------------------------|
| PWR light  | lit when DC power is normal; off when power is off or the computer is under partial battery backup.           |
| BATT light | lit when computer has transferred from normal power to backup battery (full or partial backup).               |
| RUN light  | lit when the computer is executing instructions (AOS/VS, diagnostics, etc.); off when the computer is halted. |

When the computer is running AOS/VS on normal power, the PWR and RUN lamps are lit. When the POWER switch is OFF, all lamps are off. When one or more lights *blink*, this indicates a power supply fault. MV/4000 power supply fault codes are described in Chapter 17.

In the normal course of system operations, you don't need any panel switches. To cut CPU power, press LOCK OFF and rocker switch POWER OFF. To power up, press LOCK ON and rocker switch POWER ON. Otherwise, avoid touching the switches unless you must force shutdown.

## MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series Front Panels

MV/4000 DC, MV/4000 SC and Data General DS/4000-series front panels have two switches: power ON and OFF, and RESET.

The panel switches work as follows:

- The power switch controls power to the computer and all devices in the cabinet, including disk and diskette units. When you turn power on, the action depends on the setting of a DIP switch on the multifunction I/O controller PC board (IOC). This DIP switch can be set to a device code (usually done by a DG engineer when the system is installed). If the DIP switch is set to a device code, the computer tries to program load from this device on power up. The device code is usually that of the disk, 24. If the DIP switch is *not* set to a device code, the computer runs the console loader program, which displays an @ prompt. You must then type the desired device code and L; for example, 24L to load from disk, or 22L to load from tape.
- RESET switch. Pressing this resets the computer. *Don't do it if AOS/VS is running.*

In the normal course of system operations, you don't need any panel switches. To cut CPU power *after shutdown*, press power OFF. To power up, press power ON. Otherwise, avoid touching the switches.

## MV/2000 DC Front Panel

The MV/2000 DC front panel has an on/off button switch for power. Its front panel is further described earlier, in the section "DS/7000-Series and MV/2000 DC Front Panels."

## Startup

Startup includes turning power on (if off), initializing an AOS/VS operating system or other stand-alone program, and bringing up the multiuser environment. It assumes that AOS/VS was shut down normally (not by a fatal error or power fail). If abnormal shutdown occurred, see "Abnormal Shutdown".

From a cold start (computer power turned off), startup differs for different computer models. Startup is easier from a warm start, in which computer power has remained on — because the SCP operating system and microcode need not be loaded. (These are in volatile memory and vanish when power is cut.)

## Cold Start, Computer Power Off, MV/20000 Computers

1. Make sure the system console is on and on line. Make sure that the disk(s) you want to use are on, started (for removable disks), and write-enabled. Each unit's READY light must be lit.
2. Turn the computer POWER switch ON. The POWER light should glow.
3. Now, EPROM code in the SCP does some powerup tests. When these succeed, the system console displays

**\*\* POWER UP TESTING COMPLETED \*\***

(If this entire message doesn't appear, try again. POWER switch to OFF, then to ON. If you get the message

**\*\* POWER UP TESTING FAILED xx-yy-zz \*\***

consult the *ECLIPSE MV/20000<sup>TM</sup> Series System Control Program* or *Starting the ECLIPSE MV/20000<sup>TM</sup> Series Computer Systems* manuals for the fault codes.)

If your system configuration has changed since the last time you brought it up, you will see

*WARNING: Configuration changed from previous power-up:*

followed by a list of the current configuration. For example, you might see

*CPU0 Present  
IOC0 Present  
Memory-12MB*

Code in EPROM then displays the Automatic Program Load Menu:

*date time*

*Automatic Program Load Menu*

*1 Continue immediately with preset values  
2 Change preset values*

*...*

*The default device is dd*

*...*

*Enter choice [1]:*

4. The default choice (1) has the hardware continue with AOS/VS startup, using preset values for startup device, date, time, and timeout delay. You can change a preset value by typing 2 ) then working from another menu (described later in this chapter, in section "Changing MV/20000 Automatic Program Load Preset Values". You must type 2 ) and select 3 "Start from a different device" if you want to start from a device other than the one specified by code dd; for example if you want to start from tape (device code 22 or, for tape on a second IOC, 122).

Generally, you'll want to start from the default device, dd. To do so, press ) or wait out the time-out delay (original default 45 seconds). The hardware reads the default startup device and loads the disk bootstrap, which in turns loads the SYSBOOT program. SYSBOOT displays the Operating System Load Menu:

*Operating System Load Menu*

*1 Continue immediately with operating system load  
2 Enter the Technical Maintenance Menu*

*...*

*The default operating system pathname is xxx*

*...*

*Enter choice [default]:*

5. Generally, you'll want the default choice 1 "Continue ..." with the load of operating system xxx. (If the default choice is 2, this means AOS/VS wasn't shut down normally. You must run FIXUP. SYSBOOT defaults will lead you to through the Technical Maintenance Menu to FIXUP.)

To take the default, press ) or wait out the time-out delay (original default is 45 seconds). To avoid the default, perhaps to change the default system or shorten SYSBOOT's time-out delay, skip to the next numbered step.

SYSBOOT now loads microcode from the default microcode file, MV20000.MCF. This may take up to a minute. Then SYSBOOT loads AOS/VS. There's a pause, and the system console displays *AOS/VS REV n* and a question. Skip to "Initializing AOS/VS — All Computers".

(If FIXUP is needed, SYSBOOT displays the Technical Maintenance Menu. Press J for the default or outwait the time-out delay. SYSBOOT loads microcode from the default microcode file, which takes a minute or so, then loads FIXUP. The system console displays the FIXUP banner. If a default script filename has been identified to SYSBOOT, FIXUP runs automatically. Otherwise, FIXUP will ask questions. The FIXUP section later in this chapter can help you answer these questions or create a script file to run FIXUP automatically.)

If an error occurs during any of these operations, control goes to the SCP CLI. Turn power off and on again and return to step 1.

6. To avoid the default choice, type 2 J. SYSBOOT then displays the Technical Maintenance Menu. On the Technical Maintenance Menu, make the choice you want (like a new default system or shorter time-out delay).

After changing defaults on the Technical Maintenance Menu, you can continue loading the default operating system by selecting choice 1. SYSBOOT will then load microcode and the default system as above. Details on changing defaults using SYSBOOT's Technical Maintenance Menu appear later in "Changing Operating System Load (SYSBOOT) Defaults".

### **Cold Start, Computer Power Off, MV/10000-Series, MV/8000 II, and MV/8000 C Computers**

1. Make sure the system console is on and on line. Make sure that the disk(s) you want to use are on, started (for removable disks), and write-enabled. Each unit's READY light must be lit.
2. Press the CPU LOCK switch to ON unless you want to cold start from magnetic tape or from a device attached to the second I/O controller (IOC), on MV/10000-series.
3. Turn the CPU POWER switch ON. The POWER lamp should light.
4. Now, EPROM code in the SCP does some power up tests. When these succeed, the system console says

**\*\*POWER UP TESTING COMPLETED\*\***

(If this entire message doesn't appear, try again: LOCK switch to off, power off, LOCK switch to on, power on. If this doesn't help, consult Chapter 17 for the pertinent "Power Up Error Codes" table.

The SCP reads the startup device and loads the disk bootstrap, which in turns loads the SYSBOOT program.

- 4a. If your system disk was formatted as part of a multiple-disk LDU by a Revision 6.00 Disk Formatter, then the first time you start AOS/VS, SYSBOOT will prompt you to *Specify each additional disk in the LDU*.

Specify each disk unit name (for example, DPJ1 J) and default or specify the device code until you've described all disks; then press J. SYSBOOT then loads microcode and the system (or FIXUP) as described next. In future, SYSBOOT will skip these questions unless all disks in the LDU aren't on line at startup.

Then, SYSBOOT displays

#### *Operating System Load Menu*

*1 Continue immediately with operating system load*

*2 Enter the Technical Maintenance Menu*

*...*

*The default operating system pathname is xxx*

*...*

*Enter choice [default]:*

(If you turn power on when the LOCK switch is unlocked, no menu is displayed. Instead, an MV/10000-series computer asks *BOOT WHAT DEVICE? (CHANNEL AND DEVICE CODE)*. An MV/8000 II or MV/8000 C asks *BOOT DEVICE?* On either machine, type the device code of the device you want to boot from; for example, 22 J for tape or 27 J for a DPF-type disk. The first blocks on the device must contain the appropriate bootstrap (tape or disk). The device must contain the SCP-OS and needed microcode; and it must include a program to load SCP-OS and microcode. All these conditions are true for the MV/n system tape you received from DG and for your master LDU.)

(If the LOCK switch is in the ON position and nothing happens, consult Chapter 17.)

5. Generally, you'll want the default choice 1 "Continue ..." with the load of operating system xxx. (If the default choice is 2, this means AOS/VS wasn't shut down normally. You must run FIXUP. SYSBOOT defaults will lead you to FIXUP through the Technical Maintenance Menu.)

To take the default, press J or outwait the time-out delay (original default is 45 seconds). To avoid the default, perhaps to change the default system or shorten SYSBOOT's time-out delay, skip to the next numbered step.

SYSBOOT now loads microcode from the default microcode file, (the filename appears in Table 6-2, later). This may take up to a minute. Then SYSBOOT loads AOS/VS. There's a pause, and the system console displays *AOS/VS REV n* and a question. Skip to "Initializing AOS/VS — All Computers".

(If FIXUP is needed, SYSBOOT displays the Technical Maintenance Menu. Press J for the default choice or outwait the time-out delay. SYSBOOT loads microcode from the default microcode file, which takes a minute or so, then loads FIXUP. The system console displays the FIXUP banner. If a default script filename has been identified to SYSBOOT, FIXUP runs automatically. Otherwise, FIXUP will ask questions. The FIXUP section later in this chapter can help you answer these questions or create a script file to run FIXUP automatically.)

If an error occurs during any of these operations, control goes to the SCP CLI. Turn power off and on again and return to step 1.

6. To avoid the default choice, type 2 J. SYSBOOT then displays the Technical Maintenance Menu. On the Technical Maintenance Menu, make the choice you want (like a new default system or shorter time-out delay).

After changing defaults on the Technical Maintenance Menu, you can continue loading the default operating system by selecting choice 1. SYSBOOT will then load microcode and the default system as above. Details on changing defaults using SYSBOOT's Technical Maintenance Menu appear later in "Changing Operating System Load (SYSBOOT) Defaults".

## **Cold Start, Computer Power Off, MV/8000 Computers**

1. Make sure the system console is on and on line. Make sure that the disk(s) you want to use are on, started (for removable disks), and write-enabled. Each unit's READY/light must be lit.
2. Make sure the supplied diskette is correctly inserted in its CPU slot and that the diskette door is latched.
3. Turn the CPU POWER switch ON. The POWER lamp should light.



4. Now, EPROM code does some power up tests. When these succeed, the system console displays

**\*\*CONSOLE READY\*\***

*MV/8000 SYSTEM CONTROL PROGRAM  
TYPE H<CR> FOR HELP*

*COPYRIGHT DATA GENERAL ...  
STARTING POWER UP SEQUENCE*

*ENTER DATE (MO DAY YEAR)*

(If one or more power up tests fail, the console will show a partial or no **\*\*CONSOLE READY\*\*** message; and the SCP octal debugger prompt (!) will appear. Turn power OFF and ON again. If the problem recurs, see Chapter 17, "Power Up Error Codes.")

Enter the date in numeric form. For example, for May 30, 1986, type

5 30 86 ↵

*TIME (HR MIN SEC)*

5. Enter the time per a 24-hour clock. For example, for 2:52 p.m., type

14 52 ↵

*MICROCODE(1 = STD, 2 = C350/MMPU[1])?*

- 5a. Accept the default microcode by pressing ↵.

*LOADING FROM FILE MV8000  
LOADING COMPLETE*

...

*BEGIN SYSTEM INITIALIZATION  
# OF 256 KB MEMORY MODULES - n  
MV/8000 MICROCODE REVISION n  
END SYSTEM INITIALIZATION*

*SCP-CLI>*

The SCP and microcode load take a little more than a minute. If you see an error message, make sure the diskette is inserted properly; turn power off and on again. If the error recurs, try another diskette or see Chapter 17.

6. Reset; then boot from the device code of your master LDU:

*SCP-CLI> RESET ↵*

7. *SCP-CLI> BOOT 27 ↵*

The SCP reads the startup device and loads the disk bootstrap, which in turns loads the SYSBOOT program.

- 7a. If your system disk was formatted as part of a multiple-disk LDU by a Revision 6.00 Disk Formatter, then the first time you start AOS/VS, SYSBOOT will prompt you to *Specify each additional disk in the LDU*.

Specify each disk unit name (for example, DPF1 J) and default or specify the device code until you've described all disks; then press J. SYSBOOT then loads microcode and the system (or FIXUP) as described above. In future, SYSBOOT will skip these questions unless all disks in the LDU aren't on line at startup.

Then, SYSBOOT displays

*Operating System Load Menu*

*1 Continue immediately with operating system load*

*2 Enter the Technical Maintenance Menu*

...

*The default operating system pathname is xxx*

...

*Enter choice [default]:*

8. Generally, you'll want the default choice 1 "Continue ..." with the load of operating system xxx. (If the default choice is 2, this means AOS/VS wasn't shut down normally. You must run FIXUP. SYSBOOT defaults will lead you to FIXUP through the Technical Maintenance Menu.)

To take the default, press J or outwait the time-out delay (original default is 45 seconds). To avoid the default, perhaps to change the default system or shorten SYSBOOT's time-out delay, skip to the next numbered step.

SYSBOOT now loads AOS/VS. There's a pause, and the console displays *AOS/VS REV n* and asks for the date. Skip to "Initializing AOS/VS — All Computers".

(If FIXUP is needed, SYSBOOT displays the Technical Maintenance Menu. Press J for the default choice or outwait the time-out delay. SYSBOOT then loads FIXUP and the system console displays the FIXUP banner. If a default script filename has been identified to SYSBOOT, FIXUP runs automatically. Otherwise, FIXUP will ask questions. The FIXUP section later in this chapter can help you answer these questions or create a script file to run FIXUP automatically.)

If an error occurs during any of these operations, control goes to the SCP CLI. Turn power off and on again and return to step 1.

9. To avoid the default choice, type 2 J. SYSBOOT then displays the Technical Maintenance Menu. On the Technical Maintenance Menu, make the choice you want (like a new default system or shorter time-out delay).

After changing defaults on the Technical Maintenance Menu, you can continue loading the default operating system by selecting choice 1. SYSBOOT will then load the default system as above. Details on changing defaults using SYSBOOT's Technical Maintenance Menu appear later in "Changing Operating System Load (SYSBOOT) Defaults".

If an error occurs during any of these operations, control goes to the SCP CLI. Turn power off and on again and return to step 1.

10. To avoid the default choice, type 2 J. SYSBOOT will then display the Technical Maintenance Menu. On the Technical Maintenance Menu, make the choice you want (like a new default system or shorter time-out delay).

After changing defaults on the Technical Maintenance Menu, you can continue loading the default operating system by selecting choice 1. SYSBOOT will then load the default system, which may take a minute or so. Details on changing defaults using SYSBOOT's Technical Maintenance Menu appear later in "Changing Operating System Load (SYSBOOT) Defaults".

Skip to "Initializing AOS/VS — All Machines."

## Cold Start, Computer Power Off, DS/7000-Series Computers

See the cold start section on MV/2000 DC computers.

## Cold Start, Computer Power Off, MV/6000 Computers

1. Make sure the system console is on and on line. Make sure that the disk(s) you want to use are on, started (for removable disks), and write-enabled. Each unit's READY light must be lit.
2. Press the CPU LOCK switch to LOCK unless you want to cold start from magnetic tape. LOCK is a two-position rocker switch; you can see whether it's in LOCK or unlock.
3. Turn the CPU POWER switch ON. The POWER lamp should light.
4. Now, EPROM code in the SCP does some power up tests. When these succeed, the system console says

**\*\*POWER UP TESTING COMPLETED\*\***

(If this entire message doesn't appear, try again: LOCK switch to unlock, power OFF, LOCK switch to LOCK, power ON. If this doesn't help, consult Chapter 17, "Power Up Error Codes".)

The SCP reads the startup device and loads the disk bootstrap, which in turns loads the SYSBOOT program.

- 4a. If your system disk was formatted as part of a multiple-disk LDU by a Revision 6.00 Disk Formatter, then the first time you start AOS/VS, SYSBOOT will prompt you to *Specify each additional disk in the LDU.*

Specify each disk unit name (for example, DPF1) and default or specify the device code until you've described all disks; then press J. SYSBOOT then loads microcode and the system (or FIXUP) as described next. In future, SYSBOOT will skip these questions unless all disks in the LDU aren't on line at startup.

Then, SYSBOOT displays

### *Operating System Load Menu*

*1 Continue immediately with operating system load*

*2 Enter the Technical Maintenance Menu*

...

*The default operating system pathname is xxx*

...

*Enter choice [default]:*

(If you turn power on when the LOCK switch is unlocked, no menu is displayed. Instead, it asks *BOOT DEVICE* and you must the two-digit device code of the device you want to boot from; for example, 22 J for tape or 27 J for a DPF-type disk. The first blocks on the device must contain the appropriate bootstrap (tape or disk). The device must contain the SCP-OS and needed microcode; and it must include a program to load SCP-OS and microcode. All these conditions are true for the MV/n system tape you received from DG and for your master LDU.

(If the LOCK switch is in the ON position and nothing happens, consult Chapter 17.)

5. Generally, you'll want the default choice 1 "Continue ..." with the load of operating system xxx. (If the default choice is 2, this means AOS/VS wasn't shut down normally. You must run FIXUP. SYSBOOT defaults will lead you to FIXUP through the Technical Maintenance Menu.)

To take the default, press *↓* or outwait the time-out delay (original default is 45 seconds). To avoid the default, perhaps to change the default system or shorten SYSBOOT's time-out delay, skip to the next numbered step.

SYSBOOT now loads microcode from the default microcode file, MV6000.MCF. This may take up to a minute. Then SYSBOOT loads AOS/VS. There's a pause, and the system console displays *AOS/VS REV n* and a question. Skip to "Initializing AOS/VS — All Computers".

(If FIXUP is needed, SYSBOOT displays the Technical Maintenance Menu. Press *↓* for the default choice or wait out the time-out delay. SYSBOOT loads microcode from the default microcode file, which takes a minute or so, then loads FIXUP. The system console displays the FIXUP banner. If a default script filename has been identified to SYSBOOT, FIXUP runs automatically. Otherwise, FIXUP will ask questions. The FIXUP section later in this chapter can help you answer these questions or create a script file to run FIXUP automatically.)

If an error occurs during any of these operations, control goes to the SCP CLI. Turn power off and on again and return to step 1.

6. To avoid the default choice, type 2 *↓*. SYSBOOT then displays the Technical Maintenance Menu. On the Technical Maintenance Menu, make the choice you want (like a new default system or shorter time-out delay).

After changing defaults on the Technical Maintenance Menu, you can continue loading the default operating system by selecting choice 1. SYSBOOT will then load microcode and the default system as above. Details on changing defaults using SYSBOOT's Technical Maintenance Menu appear later in "Changing Operating System Load (SYSBOOT) Defaults".

If an error occurs during any of these operations, control goes to the SCP CLI. Turn power off and on again and return to step 1.

## **Cold Start, Computer Power Off, MV/4000 Computers**

1. Make sure the system console is on and on line. Make sure that the disk(s) you want to use are on, started (for removable disks), and write-enabled. Each unit's READY light must be lit.
2. If the CPU cabinet power switch is OFF, press it to ON. Then press the CPU LOCK switch to ON (unless you want to cold start from magnetic tape). LOCK is a two-position rocker switch; you can see whether it's OFF or ON.
3. Press the POWER rocker switch ON. The POWER lamp should light.
4. Now, EPROM code in the computer does some power up tests. When these succeed, the system console displays

*MV4000 READY*

(If this entire message doesn't appear, try again: LOCK switch to OFF, power OFF, LOCK switch ON, power ON. If this doesn't help, consult Chapter 17, "Power Up Error Codes," for the appropriate table.)

The SCP reads the startup device and loads the disk bootstrap, which in turns loads the SYSBOOT program.

- 4a. If your system disk was formatted as part of a multiple-disk LDU by a Revision 6.00 Disk Formatter, then the first time you start AOS/VS, SYSBOOT will prompt you to *Specify each additional disk in the LDU.*

Specify each disk unit name (for example, DPF1 J) and default or specify the device code until you've described all disks; then press J. SYSBOOT then loads microcode and the system (or FIXUP) as described next. In future, SYSBOOT will skip these questions unless all disks in the LDU aren't on line at startup.

Then, SYSBOOT displays

*Operating System Load Menu*

- 1 Continue immediately with operating system load*  
*2 Enter the Technical Maintenance Menu*

...

*The default operating system pathname is xxx*

...

*Enter choice [default]:*

(If you turn power on when the LOCK switch is OFF, no menu is displayed. Instead, the loader program prints a commercial at sign (@). You must manually load by typing the desired two-digit device code, followed by L: for example 22L for tape. The first blocks on the device must contain the appropriate bootstrap (tape or disk). The device must contain the SCP-OS and needed microcode; and it must include a program to load SCP-OS and microcode. All these conditions are true for the MV/4000 system tape you received from DG and for your master LDU.)

(If the LOCK switch is in the ON position and nothing happens, consult Chapter 17.)

5. Generally, you'll want the default choice 1 "Continue ..." with the load of operating system xxx. (If the default choice is 2, this means AOS/VS wasn't shut down normally. You must run FIXUP. SYSBOOT defaults will lead you to FIXUP through the Technical Maintenance Menu.)

To take the default, press J or outwait the time-out delay (original default is 45 seconds). To avoid the default, perhaps to change the default system or shorten SYSBOOT's time-out delay, skip to the next numbered step.

SYSBOOT now loads microcode from the default microcode file, MV4000.MCF (or a different name if the default microcode filename was changed on the Technical Maintenance Menu). Then SYSBOOT loads AOS/VS. There's a pause, and the system console displays *AOS/VS REV n* and asks for the date. Skip to "Initializing AOS/VS — All Computers".

(If FIXUP is needed, SYSBOOT displays the Technical Maintenance Menu. Press J for the default choice. SYSBOOT loads microcode from the default microcode file, then loads FIXUP. The system console displays the FIXUP banner. If a default script filename has been identified to SYSBOOT, FIXUP runs automatically. Otherwise, FIXUP will ask questions. The FIXUP section later in this chapter can help you answer these questions or create a script file to run FIXUP automatically.)

If an error occurs during any of these operations, control goes to the SCP CLI. Turn power off and on again and return to step 1.

6. To avoid the default choice, type 2). SYSBOOT then displays the Technical Maintenance Menu. On the Technical Maintenance Menu, make the choice you want (like a new default system or shorter time-out delay).

After changing defaults on the Technical Maintenance Menu, you can continue loading the default operating system by selecting choice 1. SYSBOOT will then load microcode and the default system as above. Details on changing defaults using SYSBOOT's Technical Maintenance Menu appear later in "Changing Operating System Load (SYSBOOT) Defaults".

7. SYSBOOT loads the default microcode file and the default operating system.

The MV/4000 hardware cannot tell SYSBOOT whether a hardware floating-point unit is installed. Thus, the DG default microcode file is MV4000.MCF, which is for firmware (not hardware) floating point. The blank-disk procedure in Chapter 3 advised readers who have hardware floating point to change the default file, and explained how. But if your machine has hardware floating point or if you want a different default, change the default as shown in "Changing the Default Microcode File," near the end of this "Startup" section.

As SYSBOOT loads microcode, you'll see the messages

```
MV4000 MICROCODE REV n LOADING
CONTROL STORE LOADING
CONTROL STORE VERIFIED
SCRATCH PAD LOADING
SCRATCH PAD VERIFIED
MV4000 MICROCODE REV n LOADED AND VERIFIED
```

(If an error occurs, control goes to the microcoded loader program and you will see the @ prompt. Press LOCK OFF, power OFF, press LOCK, power ON to try again.)

At this point, you can get to the SCP CLI by typing the break sequence (CMD and BREAK keys, or BRK, or BREAK, depending on the console model). But let's assume you want to bring up AOS/VS. Skip to "Initializing AOS/VS — All Machines."

## **Cold Start, Computer Power Off, MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series Computers**

To cold start your MV/4000 DC, MV/4000 SC or Data General DS/4000-series computer, do the following:

1. Make sure the system console is on and on line.
2. If you have a cartridge tape unit, turn it on now — by moving its switch to ON-1. (To use the tape unit, you must turn it on before turning computer power on.)
3. Turn computer power on via the switch on the cabinet.
4. Now, the computer does some power up tests. When these succeed, the system console displays

```
MV4000 READY
... (test message about IOC board) ...
```

(If these messages don't appear, try again: turn power off and on. If this doesn't help, consult Chapter 17, "Power Up Error Codes," for the appropriate table.)

The message that follows these depends on the setting of a switch in the computer (specifically, a DIP switch on the IOC PC board).

5. If the DIP switch is set to the disk device code, a loader program loads the disk bootstrap, which in turns loads the SYSBOOT program.

- 5a. If your system disk was formatted as part of a multiple-disk LDU by a Revision 6.00 Disk Formatter, then the first time you start AOS/VS, SYSBOOT will prompt you to *Specify each additional disk in the LDU.*

Specify each disk unit name (for example, DPJ1 ) and default or specify the device code until you've described all disks; then press ). SYSBOOT then loads microcode and the system (or FIXUP) as described next. In future, SYSBOOT will skip these questions unless all disks in the LDU aren't on line at startup.

Then, SYSBOOT displays

*Operating System Load Menu*

*1 Continue immediately with operating system load*  
*2 Enter the Technical Maintenance Menu*

...

*The default operating system pathname is xxx*

...

*Enter choice [default]:*

If this menu appears, you can proceed to bring up any disk-based software. To do so, skip to step 7.

To start from tape or diskette (perhaps to install a new system, type the break sequence (press CMD, hold it down, and press the BREAK/ESC key) to get the @ prompt. Then continue to the next step.

6. If the DIP switch isn't set to the disk device code, or if you typed the break sequence in step 5, the system console displays a commercial at sign (@):

@

You must manually load by typing the desired two-digit device code, followed by L. The device code of the disk is 24; the device code of the diskette is 64; and the code of the tape unit (if you have one) is 22. For example

@ 64L (To program load from diskette)

The device you specify must contain the appropriate bootstrap (tape or disk). The device must also contain needed microcode and the SCP-OS; and it must include a program to load SCP-OS and microcode. All these conditions are true for the MV/4000 system tape or first system diskette you received from DG, and for your master LDU.

Now, the computer tries to program load from the device you specify. When it succeeds, the bootstrap program displays a prompt. For disk or an AOS/VS diskette, the bootstrap program is SYSBOOT, whose prompt is the menu shown in step 5a above: *Operating System Load Menu*. If you see that prompt, return to step 5a and continue as described there. (But if you're installing a new revision of AOS/VS from diskette or tape, you should be reading Chapter 15, not this one.)

7. Generally, you'll want the default choice 1 "Continue ..." with the load of operating system xxx. (If the default choice is 2, this means AOS/VS wasn't shut down normally. You must run FIXUP. SYSBOOT defaults will lead you to FIXUP through the Technical Maintenance Menu.)

To take the default, press ) or wait out the time-out delay (original default is 45 seconds). To avoid the default, perhaps to change the default system or shorten SYSBOOT's time-out period, skip to the next numbered step.

SYSBOOT now loads microcode from the default microcode file, MV4000.MCF (unless a different microcode file was specified to the Technical Maintenance Menu; for supplied microcode files, see Table 6-2). Then SYSBOOT loads AOS/VS. There's a pause, and the system console displays *AOS/VS Rev n* and asks for the date. Skip to "Initializing AOS/VS — All Computers".

(If FIXUP is needed, SYSBOOT displays the Technical Maintenance Menu. Press ) for the default choice. SYSBOOT loads microcode from the default microcode file, then loads FIXUP. The system console displays the FIXUP banner. If a default script filename has been identified to SYSBOOT, FIXUP runs automatically. Otherwise, FIXUP will ask questions. The FIXUP section later in this chapter can help you answer these questions or create a script file to run FIXUP automatically.)

If an error occurs during any of these operations, control goes to the SCP CLI. Turn power off and on again and return to step 1.

8. To avoid the default choice, type 2 ). SYSBOOT then displays the Technical Maintenance Menu. On the Technical Maintenance Menu, make the choice you want (like a new default system or shorter time-out delay).

After changing defaults on the Technical Maintenance Menu, you can continue loading the default operating system by selecting choice 1. SYSBOOT will then load microcode and the default system as above. Details on changing defaults using SYSBOOT's Technical Maintenance Menu appear later in "Changing Operating System Load (SYSBOOT) Defaults".

### **Cold Start, Computer Power Off, Data General DS/7700, DS/7500, and MV/2000 DC Computers**

To cold start your Data General DS/7700, DS 75000, or MV/2000 DC computer, do the following:

1. Make sure the system console is on and on line.
2. If you have a tape unit, turn it on now. (With some models, to use the tape unit, you must turn it on before turning computer power on.)
3. Turn computer power on via the switch on the cabinet.

Now, the computer runs powerup tests on each PC board in the computer. On the system console, you'll see messages like

*TESTING...*

*Model nnnn, Slot n, device xxxxxxxx  
ABCDEFGHIJKLMNPOQRSTUVWXYZ0123456789, PASSED*

These powerup tests may take up to a minute or so to complete. (If the system fails to complete a message after 15 seconds or so, turn computer power off and on. If the problem recurs, this indicates a hardware fault condition. Consult your System Control Processor manual for explanation of the fault code.)

After the computer hardware passes the powerup tests, EPROM code in the SCP does some powerup tests. When these succeed, the system console displays

*date and time*

*Automatic Program Load Menu*

*1 Continue immediately with preset values  
2 Change preset values*

*...*

*The default device is device*

*...*

*Enter choice [1]:*



4. The default choice (1) has the hardware continue with AOS/VS startup, using preset values for startup device, date, time, time-out delay, and system console. (You might want to change the system console if you have two consoles including a graphics console but the graphics console isn't the system console). You can change a preset value by typing 2 ↵, then working from another menu (described later in this chapter, in section "Changing Automatic Program Load Preset Values on MV/20000, DS/7000-Series and MV/2000 DC Systems". You must type 2 ↵, then specify a different startup device if you want to start from a device like a tape or diskette.

For now, press ↵ or outwait the time-out delay (original default 45 seconds). The hardware reads device dd, normally the hard disk. It then loads the disk bootstrap, which in turn loads the SYSBOOT program. SYSBOOT displays

*Operating System Load Menu*

*1 Continue immediately with operating system load*

*2 Enter the Technical Maintenance Menu*

...

*The default operating system pathname is xxx*

...

*Enter choice [default]:*

5. Generally, you'll want the default choice 1 "Continue ..." with the load of operating system xxx. (If the default choice is 2, this means AOS/VS wasn't shut down normally. You must run FIXUP. SYSBOOT defaults will lead you to FIXUP through the Technical Maintenance Menu.)

To take the default, press ↵ or outwait the time-out delay (original default is 45 seconds). To avoid the default, perhaps to change the default system or shorten SYSBOOT's time-out delay, skip to the next numbered step.

SYSBOOT now loads microcode from the default microcode file, (the filename appears in Table 6-2, later). You may see *LOADING MICROCODE* messages. Then SYSBOOT loads AOS/VS. There's a pause, and the system console displays *AOS/VS Rev n* and a question. Skip to "Initializing AOS/VS — All Computers".

(If FIXUP is needed, SYSBOOT displays the Technical Maintenance Menu. Press ↵ for the default choice. SYSBOOT loads microcode from the default microcode file, then loads FIXUP. The system console displays the FIXUP banner. If a default script filename has been identified to SYSBOOT, FIXUP runs automatically. Otherwise, FIXUP will ask questions. The FIXUP section later in this chapter can help you answer these questions or create a script file to run FIXUP automatically.)

If an error occurs during any of these operations, control goes to the SCP CLI. Turn power off and on again and return to step 1.

6. To avoid the default choice, type 2 ↵. SYSBOOT then displays the Technical Maintenance Menu. On the Technical Maintenance Menu, make the choice you want (like a new default system or shorter time-out delay).

After changing defaults on the Technical Maintenance Menu, you can continue loading the default operating system by selecting choice 1. SYSBOOT will then load microcode and the default system as above. Details on changing defaults using SYSBOOT's Technical Maintenance Menu appear later in "Changing Operating System Load (SYSBOOT) Defaults".

## Warm Start, Computer Running — All Computers

You can *warm start* your system if AOS/VS was shut down normally and power remained on.

1. Make sure all disks are on, write-enabled, and ready.
2. Reset the main processor and boot from the disk:  
`SCP-CLI> RESET ↵`
3. `SCP-CLI> BOOT 24 ↵` (Or 27 for a model DPF-type disk;  
or 33 for a model 6234 disk)

The SYSBOOT program displays

### *Operating System Load Menu*

*1 Continue immediately with operating system load*

*2 Enter the Technical Maintenance Menu*

...

*The default operating system pathname is xxx*

...

*Enter choice [default]:*

4. Generally, you'll want the default choice 1 "Continue ..." with the load of operating system xxx. (If the default choice is 2, this means AOS/VS wasn't shut down normally. You must run FIXUP. SYSBOOT defaults will lead you to through the Technical Maintenance Menu to FIXUP.)

To take the default, press ↵ or outwait the time-out delay (displayed on the screen). (To avoid the default, perhaps to change the default system or shorten SYSBOOT's time-out delay, skip to the next numbered step.)

SYSBOOT loads AOS/VS. There's a pause, and the system console displays *AOS/VS REV n* and asks a question. You can start initializing AOS/VS (next section).

(If FIXUP is needed, SYSBOOT displays the Technical Maintenance Menu. Press ↵ for the default choice. SYSBOOT will load FIXUP, and the system console will display the FIXUP banner. If a default script filename has been identified to SYSBOOT, FIXUP will run automatically. Otherwise, FIXUP will ask questions. The FIXUP section later in this chapter can help you answer these questions.)

5. To avoid the default choice, type 2 ↵; then SYSBOOT displays its Technical Maintenance Menu. Make the choice(s) you want (like a new default system or shorter time-out delay). After changing defaults on the Technical Maintenance Menu, you can continue loading the default operating system by selecting choice 1. SYSBOOT will then load the default system as describe above. You can start initializing AOS/VS (next section).
6. If your system disk was formatted as part of a multiple-disk LDU, then the first time you start AOS/VS, SYSBOOT will prompt you to *Specify each additional disk in the LDU*.

Specify each disk unit name (for example, DPJ1 ↵) and default or specify the device code until you've described all disks; then press ↵. SYSBOOT then loads microcode and the system (or FIXUP) as described above. In future, SYSBOOT will skip these questions unless all disks in the LDU aren't on line at startup.

## Initializing AOS/VS — All Computers

The system console shows

*AOS/VS Rev n*

*Master LDU: name* (name as given to the Disk Formatter)

*Date (MM/DD/YY) ?*

If your computer has a battery-powered clock (boot clock), AOS/VS can get the time and date from this clock. If so, AOS/VS will skip the *Date* and *Time* questions and ask *Override default specs?*, item 3 below. (But if the boot clock isn't running or its battery is exhausted, AOS/VS will ask the date and time questions.) Having the date and time supplied automatically is a convenience, but check to make sure they're correct when the AOS/VS CLI displays its banner on the system console. Computers with boot clocks include MV/20000s, DS/7000-series, and MV/2000 DC systems.

(If you see a message starting with *WARNING:SYSTEM PATCH AREA CONTAINS NO PATCHES* continue bringing up AOS/VS — but, immediately, install patches as described in Chapter 4. Patches are extremely important. Unless you apply them, your system may crash repeatedly.)

1. It's very important that the date and time be correct. (You can fix them if needed, via the DATE or TIME command, after the CLI comes up.) Type the date as numbers for month, day, and year. Spaces or slashes can separate numbers. For example, for May 30, 1986, type

5 30 86 ↵

*TIME (HH:MM:SS) ?*

2. Type the time, based on a 24-hour clock, in hours, minutes, and seconds. (Minutes and seconds are optional. If you omit them, the system sets each to 0.) Use spaces or colons to separate each number pair. For example, for 2:35 p.m., type

14 35 ↵

*Override default specs [N] ?*

3. *Specs* means the parameters in the system specification file created during VSGEN. These parameters include

*Number of buffers in cache* (number of system buffers), *Swap directory definition* (swap file size or device), *Page directory definition* (page file size or device), and *Initial load* (used when you are installing a new revision of AOS/VS on this LDU).

If you wish to override any default spec, answer Y ↵; the system will then ask about each one and you can take the default or specify a new value. In most cases, though, you will not want to override the default specs, so you will press

↵

A pause occurs here, then

*AOS/VS CLI REV n date time*

)

The master CLI, process ID (PID) 2, is running.

**NOTE:** If the date or time is wrong, fix it now, with the **DATE** or **TIME** command, before bringing up the multiuser environment. (On computers with boot clocks, the CLI commands **DATE** and **TIME** also set the boot clock's date and time.) Changing date or time while **EXEC** is running can confuse **EXEC** as it tries to keep track of user log-on time. Also, if you run the system log (**SYSLOG**), changing the time after you start logging may produce wrong account information. For these reasons, you should never change the date or time while the multiuser environment is running. Bring the environment down first.

It is possible, via **VSGEN**, to have the master CLI execute a command file automatically when it starts up. A likely candidate for automatic execution is your **UP.CLI** macro. If the **UP** macro is executed automatically, then

- you must ensure that all printers are on and on line before bringing up **AOS/VS**;
  - you must take extra care to type the correct date and time when you initialize **AOS/VS**; and
  - you can skip the next two steps.
4. Make sure that all your line printers are **ON** and **ON LINE**, with paper aligned.
  5. Bring the multiuser environment up by running your tailored **UP** macro:

```
) UP )
Pid n
... (EXEC messages) ...

... (Messages you may have put in UP.CLI) ...

)
```

6. Make sure the **CPU LOCK** switch (if any) is in the locked position. Or, on an **MV/20000**, press the **DISPLAY** switch if the other switches are lit.

**EXEC** and the multiuser environment are up; users can log on; and you can bring up other processes and/or issue **EXEC** and CLI commands (described in Chapter 8, "EXEC and User Processes" and Chapter 9, "Other Runtime Tools") as needed.

If you have a multiple-processor system like an **MV/20000 Model 2**, your **UP** macro should have initialized the second processor via the CLI command **JPINITIALIZE**. **JPINITIALIZE** is described in Chapter 9.

Figure 6-8 shows the steps taken by all parties to bring the whole system up. Later in the chapter, Figure 6-9 summarizes cold startup and normal shutdown for computers other than **MV/8000s**; Figure 6-10 does the same for **MV/8000** computers. And, there is a handy startup/shutdown reference card you can consult.

## **Changing Automatic Program Load Preset Values on MV/20000, DS/7000-Series, and MV/2000 DC Computers**

**MV/20000**, **DS/7000-series**, and **MV/2000 DC** computers have automatic program load menus built into hardware (EPROM code). Via a menu, you can change any or all of the following preset values:

- date and time (maintained in the boot clock and passed to **AOS/VS**)
- startup device
- default startup device
- time-out delay

To change any of these values except date and time, you must first power down the computer. (Make sure AOS/VS is shut down first.) Then turn power on again. (The boot clock date and time can also be changed by CLI commands DATE and TIME.)

The hardware will display the Automatic Program Load Menu. Type 2 ↵ before the default time-out delay expires. (Startup continues automatically after the delay expires, giving SYSBOOT control. Changing SYSBOOT defaults is explained later on). The hardware will then display the Change Preset Values Menu. Depending on your machine and options, there may be up to eight choices. You may not see eight choices. All possible choices follow.

- 1 Continue the powerup
- 2 Change the system date or time
- 3 Start from a different device
- 4 Change the default device
- 5 Change the time-out delay
- 6 Enter the SCP CLI
- 7 Change the system console (DS/7700 or DS/7500)
- 8 Select diagnostics sequence (DS/7700 or DS/7500)

The following sections explain how to change the system date or time (choice 2), start from a different device (choice 3), change the default device (choice 4), change the time-out delay (choice 5), access the SCP CLI (choice 6), change the system console to a graphics console (choice 7), and run abbreviated diagnostics (choice 8).

## Changing the System (Boot Clock) Date or Time

The battery-powered boot clock maintains date and time even while power to the computer is off. At startup, AOS/VS asks this boot clock for the date and time; if the boot clock responds, AOS/VS uses its date/time for its own real-time clock. Also, SCP log settings (not vital) depend on this clock. Thus, the boot clock's settings can be very important. (However, setting AOS/VS' clock with the CLI commands DATE and TIME also sets the boot clock, so setting it from this menu isn't essential.)

In any case, you can set the boot clock via choice 2 on this menu. Then, the system displays

*Date [dd-mmm-yy]:*

Type the correct date — numbers for day and year, three letters for the month. Or, if you don't want to change the date, press ↵. For example, to specify July 23, 1986:

*Date [22-JUL-86]:* 23-JUL-86 ↵

Then it displays

*Time [hh:mm:ss]:*

Type the correct time, using a 24-hour clock. Or, if the time is correct, press ↵. For example, to specify 2:15 p.m.:

*Time [14:10:00]:* 14:15:00 ↵

Next, it displays

*Offset to GMT [+00:00]:*

"Offset to GMT" (Greenwich Mean Time) has meaning only if your system will communicate with another computer system in a different time zone. To specify no offset — skip the issue — press ↵. Otherwise, find out the number of hours (and fractions of an hour, if this applies) from Greenwich Mean Time. Then type the number of hours and minutes to add (+ or -) to local time to equal Greenwich Mean Time. For example, if you're in New York City during Eastern Daylight Savings Time, type

*Offset to GMT [+00:00]:* +6:00 ↵

After answering this question, you will return to the Change Preset Values Menu.

## Starting From a Different Device

If you want to load from a device other than the default device — for example, to start from tape — you must select choice 3 from the Change Preset Values Menu.

The tape (file 0) or disk(ette) (blocks 0 and 1) must have a loader bootstrap; a disk(ette) also must have a bootstrap program (SYSBOOT). The tape or disk(ette) must be on unit 0 of the pertinent controller. And, the tape or disk(ette) unit must be on, on line, and ready.

When the tape or disk(ette) is ready, choose option 3 from the Change Preset Values Menu. On DS/7000-series and MV/2000 DC systems, it displays

*Start from a Different Device*

1. Hard disk
2. Diskette
3. Tape

...

*Start from which device? [1]*

Choose the device you want. After you type a valid number and ↵, the hardware tries to program load from the device. If you made a mistake and the device isn't on line, turn power off and on again and retry.

On an MV/20000, it asks

*Boot from what device? [dd]*

On an MV/20000, *dd* is the two- or three-digit device code (if three, the first digit is the IOC channel number: 0, 1, or 2). Most devices you boot from are on the first IOC; if so, specify channel 0. On an MV/20000, the default device code of the tape unit is 22 (for an MTB tape unit) or 62 (for an MTD unit). For other computers that have automatic program load menus, the tape device code is usually 23. For example, to start from an MTB tape unit:

*Boot from what device? [24] 22 ↵*

*Channel number? [0] 1 ↵* (Asked only for MV/20000s)

If the device you want is on the second IOC, specify channel number 1; on the third IOC, specify channel 2. For example, to start from MV/20000 device code 124 (a DPJ disk on the second IOC), the sequence might go

*Boot from what device [24] 1 ↵*

*Channel number? [0] 1 ↵*

When you've finished specifying the device with the "channel" question, the hardware tries to start from the device. If you made a mistake, turn power off and try again.

## Changing the Default Device

When your first system was built, we recommended setting the default device. If you ever want to change the default device, select choice 4 from the Change Preset Values Menu. The system will run through the same dialog as in the previous section; then the Change Preset Values Menu will return.

Generally, the default device should be your system disk ("Disk" for DS/7000-series and MV/2000 DC systems, device code 24 — or possibly 27 — for MV/20000 systems). Don't make the default device anything but the system disk unless you *must*.

## Changing the Time-out Delay

After you've cold started your computer a few times, you may want to shorten the time-out delay before the hardware loads from the default device (loading SYSBOOT, which displays the Operating System Load Menu). To change the delay, select choice 5 from the Change Preset Values Menu. The system prompts

*Time-out delay (in seconds) for the Automatic Program Load Menu [45]:*

Let's say you want to reduce the number from 45 to 15. This gives you 15 seconds to type 2 ↓ into the the Automatic Program Load Menu, which is probably enough time for most people. You'd type

15 ↓

and return to the Change Preset Values Menu.

## Entering the SCP CLI

Choice 6 takes you into the SCP CLI. Normally, you need the SCP CLI only for emergency shutdown (break sequence, **RESET** ↓, **START 50** ↓) and, rarely, to check diagnostic indicators like the CPUID (**EXAMINE** command). However, the SCP *is* needed to change default (mother) processors on a MV/20000 Model 2 computer (**ATTACH** command).

After you select choice 6, the system displays the SCP CLI prompt:

*SCP-CLI>*

Common SCP CLI commands you might want to use appear in Table 6-1. You can exit from the SCP to the Automatic Program Load Menu by typing the TTY or **CONTINUE** command.

## Changing the System Console (DS/7000-Series Systems)

Changing the system console is useful if you have a graphics machine (DS/7700 or DS/7500) with

- a standard system console connected to the standard system controller board, and
- a graphics terminal connected to a graphics controller board (video memory board).

After selecting choice 7, the system asks you to choose between

*1 System Board*

*2 Video Memory Board*

Type the number for the board connected to the terminal you want to use for the system console. The Change Preset Values Menu will return. Any change you specify won't occur until you power down and up again.

## Running Abbreviated Diagnostics (DS/7000-Series and MV/2000 DC)

The diagnostics that run when you power up are important; they ensure that your system hardware is functioning properly. The full set of diagnostics takes about a minute and a half to run.

Choice 8 on the Change Preset Values Menu lets you choose abbreviated diagnostics. If you have MV/ADES (Advanced Diagnostic Executive System) installed on the hard disk, the abbreviated set eliminates testing of the processor board, shortening powerup testing by 2 or so minutes. (Without MV/ADES, abbreviated testing isn't worthwhile.) Generally, the full diagnostic sequence is a good idea, even if MV/ADES *is* installed.

If you do decide to change the default diagnostics sequence, select choice 8 on the Change Preset Values Menu. The system will ask whether you want to run full or abbreviated diagnostics.

Select the choice you want, and the Change Preset Values Menu will return. The sequence you select will not take effect until you turn power off and on again.

## Changing Operating System Load (SYSBOOT) Defaults

At startup, some computers display an Automatic Program Load Menu, described above. On *all* computers, hardware settings (set on the program load menu or some other way), tell the hardware to load software from a magnetic medium, usually disk. The software most often loaded is SYSBOOT, which has menus of its own.

Via SYSBOOT's Technical Maintenance Menu, you can change a number of default settings, including

- time-out delay (before SYSBOOT starts loading the default system)
- default AOS/VS system
- default microcode filename
- FIXUP script file filename (runs FIXUP automatically, without need for human answers to its questions)

The Technical Maintenance Menu also allows you to run any stand-alone program (like the Disk Formatter). And, it will prompt you to run FIXUP if AOS/VS wasn't shut down normally.

To change any of these values, you must start up AOS/VS (this runs SYSBOOT). Either a cold or warm start works.

During startup, SYSBOOT will display its Operating System Load Menu. Type 2 before the default time-out delay expires. (The default system gets control automatically after the delay expires.) SYSBOOT will then display the Technical Maintenance Menu. Depending on your machine and options, the menu may show from four to ten choices. You may not see more than four choices. All possible choices follow.

- 1 Load and start the default operating system
- 2 Load and verify microcode
- 3 Enter the SCP CLI
- 4 Change the time-out delay
- 5 Run diagnostics (if MV/ADES is installed on disk)
- 6 Run a specified program
- 7 Run FIXUP
- 8 View or change the default operating system filename
- 9 View or change the default microcode filename
- 10 View or change the FIXUP default script filename

Choice 1 is the default unless FIXUP must be run; it tells SYSBOOT to load the default operating system.

Choice 2, to load and verify microcode, is sometimes useful if you're seeing mysterious error messages, like *CPU RUNNING* or *Insufficient memory for FIXUP*. SYSBOOT loads and verifies the default microcode file.

Choice 3, "Enter the SCP CLI," is useful when you really need the SCP CLI; for example, on an MV/20000, to attach a different processor (described under the SCP entry in the Automatic Program Load, in the previous section).

Choice 4 lets you change the default time-out delay, originally 45 seconds. You might want to shorten the delay and speed up automatic startup (although you can always press ↵ to start loading immediately). If you type 4 ↵, SYSBOOT prompts

*Number of seconds to wait before loading the operating system [n]:*

Type the new figure, 10 to 45 seconds, and press ↵ (for example, 10 ↵).

Choice 5 lets you run MV/ADES diagnostics (if these are installed on your disk). These diagnostics are explained in the Advanced Diagnostic Executive System manual. If you type 5 ↵, SYSBOOT asks

*Are you sure you want to run diagnostics? [N]:* —



To continue with MV/ADES, type Y ↵, to skip them press ↵.

Choice 6 lets you specify the pathname of any program to run (for example, the stand-alone Disk Formatter. After you type 6 ↵, SYSBOOT asks

*Pathname? —*

Type the pathname of the program to run, starting at the root directory. For example, type DFMTR ↵.

Choice 8, lets you change the default AOS/VS operating system. This is useful after you've generated (and patched and tested) an AOS/VS system with a name different from the old one. Originally, when your system LDU was built, there was no operating system. If no one has specified a system name since then, the default system is the installed system. When you type 8 ↵, SYSBOOT asks

*Default operating system [default-name]: —*

To retain the default, which may be a system pathname or INSTALLED SYSTEM if the default is the installed system, press ↵. (With AOS/VS Revision 7.00, there's little point in installing a system since it's so easy to specify a default to SYSBOOT.) To change the default, you can type a pathname from root (like SYSGEN:SYS\_7.00.PR ↵), or, if you used the Installer to install a system, you can type INSTALLED SYSTEM ↵ to specify the default system.

Choice 9 lets you view or change the default microcode filename, useful if you have an 4000-series computer with an option like hardware floating point, or if you have a custom microcode file. After you type 9 ↵, SYSBOOT asks

*Default microcode filename [MVxxxxx.MCF]:*

You can press ↵ to retain the default, or specify a microcode file pathname from the root directory; for example, MV4000GFP.MCF ↵. You can make sure the new microcode is loaded by selecting choice 2, "Load and verify microcode", on the Technical Maintenance Menu. The microcode filename issue gets more detail in the next section.

When you change the microcode file, SYSBOOT records the new default microcode filename in "invisible" space on the LDU. The new microcode filename will become the default microcode. It will remain in effect until you change it again (or run a Full format on the disk). (Just as an aside, SYSBOOT cannot resolve link files, so the procedure above is the neatest way to make a nondefault microcode file the default.)

Choice 10 lets you specify (or change) the FIXUP script filename. When run without a script file, FIXUP asks a minimum of five or so questions for each LDU you want fixed. Via stand-alone FIXUP itself, using the /BUILDSRIPT switchm, you can create a script file, then specify its name here. Thereafter, FIXUP will run the script file without requiring operator interaction. This is a convenience, especially with inexperienced system operators.

Until someone specifies a default script file, there is no default. If you want to create (or change) a script file, the FIXUP section near the end of this chapter tells how. To *specify* the script filename, type 10 ↵ to the Technical Maintenance Menu. SYSBOOT then asks

*Default FIXUP script filename [default]:*

To retain the default, press ↵. To change it, type the script filename (must be in the root directory). FIXUP script files always have the suffix .FXP. You can include — or omit — the suffix when you type the name. For example, type FIX\_DPJO ↵.

## Microcode Filenames

Microcode is the heart of your MV/Family computer. It's essential that the correct microcode for your system be loaded. SYSBOOT does this load on a cold start — you specify the default name using a SYSBOOT Technical Maintenance Menu.

Correct microcode for your system was supplied on the MV/n tape or diskette shipped with the system. You'll receive periodic updates if you belong to the Microcode Subscription Service. Table 6-2 shows the correct filenames for all MV/Family machines.

**Table 6-2. ECLIPSE MV/Family Default Microcode Filenames**

| CPU Name                      | Hardware Floating Point Option | Other Options                      | No Options    |
|-------------------------------|--------------------------------|------------------------------------|---------------|
| MV/20000                      | MV20000.MCF                    | Doesn't apply                      | MV200000.MCF  |
| MV/10000 SX                   | MV10000SX.MCF                  | Doesn't apply                      | Doesn't apply |
| MV/10000                      | MV10000.MCF                    | Doesn't apply                      | Doesn't apply |
| MV/8000 II                    | MV8000_IIFP.MCF                | Doesn't apply                      | MV8000_II.MCF |
| MV/8000 C                     | MV8000_CFP.MCF                 | Doesn't apply                      | MV8000_C.MCF  |
| DS/7700                       | Doesn't apply                  | Graphics Instruction DS7700GIS.MCF | DS7700.MCF    |
| DS/7500                       | Doesn't apply                  | Graphics Instruction DS7500GIS.MCF | DS7500.MCF    |
| MV/8000<br>(file on diskette) | MV8000FP.MCF                   | Doesn't apply                      | MV8000.MCF    |
| MV/6000                       | Not available                  | Doesn't apply                      | MV6000.MCF    |
| MV/4000                       | MV4000FP.MCF                   | Doesn't apply                      | MV4000.MCF    |
| MV/4000 DC                    | MV4000FP.MCF                   | Doesn't apply                      | MV4000.MCF    |
| MV/4000 SC                    | MV4000FP.MCF                   | Doesn't apply                      | MV4000.MCF    |
| DG DS/4000- series            | MV4000FP.MCF                   | MV4000G.MCF *<br>MV/4000GFP.MCF    | MV4000.MCF    |
| MV/2000 DC                    | Doesn't apply                  | Doesn't apply                      | MV2000.MCF    |

\*With Graphics Instruction Set (GIS) alone, the filename is MV4000G.MCF; with GIS and hardware floating point, the filename is MV4000GFP.MCF

If microcode is loaded when you change the default, SYSBOOT *may not* load the new microcode, but may just bring up AOS/VS. You can make sure the new microcode is loaded by selecting choice 2, "Load and verify microcode", on the Technical Maintenance Menu.

## Normal Shutdown

Normal shutdown means orderly shutdown from an active multiuser system to the SCP CLI, and, optionally, to turning off power to devices.

These shutdown steps assume that EXEC is running and that multiple users are logged onto the system.

1. Send a message to all users indicating that the multiuser environment will be coming down. You could use the BROADCAST macro (Chapter 5) for this.

```
) SEND /2=1 @CON- System coming down in 5 min. Please log off. )
```

or

```
) BROADCAST System coming down in 5 min. Please log off. )
```

2. Use the EXEC PAUSE command to pause batch streams and spool queues; for example:

```
) CX PAUSE )
```

```
) CX PAUSE @LPB )
```

```
)
```

3. Use the ? macro (Chapter 5) to verify that users are logged off. Use SEND (or BROADCAST) and ? until all users who stand to lose work are logged off. CLI users might not lose anything when you bring EXEC down (although they might be annoyed if they are not notified). People using text editors — and perhaps user processes running application programs — *will* lose work if you terminate EXEC, so you should try to get them out of their editors or programs before you do it. For example, type

```
) ? )
```

|      |         |       |               |
|------|---------|-------|---------------|
| PID: | 1 PMGR  | PMGR  | :PMGR.PR      |
| PID: | 2 OP    | OP    | :CLI.PR       |
| PID: | 3 OP    | EXEC  | :UTIL:EXEC.PR |
| PID: | 4 JACK  | CON4  | :CLI.PR       |
| PID: | 5 SALLY | CON5  | :CLI.PR       |
| PID: | 6 SALLY | 006   | :UTIL:SED.PR  |
| ...  |         |       |               |
| PID: | 20 OP   | CON20 | :CLI.PR       |

```
) SEND @CON- System coming down in 2 min. Please log off now. )
```

or

```
) BROADCAST System coming down in 2 min. Please log off now. )
```

```
) ? )
```

|      |        |       |               |
|------|--------|-------|---------------|
| PID: | 1 PMGR | PMGR  | :PMGR.PR      |
| PID: | 2 OP   | OP    | :CLI.PR       |
| PID: | 3 OP   | EXEC  | :UTIL:EXEC.PR |
| PID: | 20 OP  | 00020 | :CLI.PR       |

```
)
```

4. Eventually, all users will have logged off or be in the CLI. Now, you need to get back to PID 2, the master CLI. Type

) BYE ↓

then

) WHO ↓

If the answer is PID 2, go to step 5.

- 4a. If you are running a locked LOCK\_CLI (a lockable CLI, described in the “Other Runtime Tools” chapter), LOCK\_CLI will remain an active PID on the system console: the BYE command does not affect it. To terminate LOCK\_CLI, type UNLOCK ↓, the password, and BYE ↓. For example:

) WHO ↓

PID:            20 OP :LOCK\_CLI.PR            (Running LOCK\_CLI.)

) UNLOCK ↓            (Start to UNLOCK it.)

XYZZY ↓            (Password doesn't echo)

BYE ↓            (Return to master CLI.)

*AOS/VS CLI TERMINATING date time*

) WHO ↓

PID:            2 OP :CLI.PR            (Back in the master CLI.)

)

5. Run the DOWN macro to bring EXEC down.

) DOWN ↓

... (Messages, etc., if you put them in DOWN.CLI) ...

*PROCESS TERMINATION, PID: 3*

*\*ABORT\**

*TERMINATED BY A SUPERIOR PROCESS*

... (More messages, if you put them in DOWN.CLI) ...

6. With EXEC terminated, check the processes again with ? ↓. There may be only two processes left: the peripheral manager and the master CLI.

If processes like CEO, XODIAC, and INFOS II are still running, terminate these normally (for CEO, type CEO.SYSTEM STOP ↓; for XODIAC processes, type DOWN.NETWORK.VS ↓, and so on). If there are any other processes (e.g., application-based processes), terminate *these* normally. Eventually, you may want to put all the process-terminating commands needed in the DOWN.CLI macro.

When ready, start shutdown by typing

) BYE ↓

*Do you really want to shut the system down?*

7. This message gives you a chance to change your mind. To keep it running, type **N** ; to shut it down, type

**Y** ;

*Starting system shutdown date time*

*System shutdown*

*CPU halted*

|            |            |            |            |           |          |             |                                   |
|------------|------------|------------|------------|-----------|----------|-------------|-----------------------------------|
| <i>AC0</i> | <i>AC1</i> | <i>AC2</i> | <i>AC3</i> | <i>PC</i> | <i>C</i> | <i>MAP</i>  | (Skipped on 4000-series; for this |
| <i>n</i>   | <i>n</i>   | <i>n</i>   | <i>n</i>   | <i>n</i>  | <i>n</i> | <i>PHYS</i> | status display, type ;)           |

*SCP-CLI>*

AOS/VS has shut down and the main CPU has halted; the SCP CLI has control. (If AOS/VS's last message is *Abnormal system shutdown*, see the next section.)

Note that PID 2, the master CLI, can always shut the system down directly via **BYE** ;. If so, AOS/VS will say

*You have sons. do you want to terminate?*

If you say **Y** ;, all processes below PID 2 will be terminated. The system will ask for confirmation again, and then shut down. (If you say **N** ; to either question, nothing will be terminated.) If any processes other than EXEC are running, this can be a very dangerous way to shut the system down. For example, certain processes that use databases (like CEO) depend on normal shutdown to close the database properly. If shut down improperly, the structure and/or the integrity of the database may be compromised. So, use this quick method only if processes that would not be jeopardized (like CLI processes) are running.

After shutdown, you can boot an AOS/VS system as described under "Warm Start" above; or you can bootstrap another system or stand-alone program. Or you can leave everything as is; or you can cut power to any or all devices.

To power down your disk(s), press disk switches **STOP** and **DC POWER OFF** on a removable-pack disk unit; or press **READY** on a sealed disk unit. On a removable-pack unit, give the disk pack time to stop spinning before pressing **DC power off**. (Cutting power eliminates braking action; if the disk is spinning when you cut power, it will continue spinning without cooling air, which could damage unit bearings).

To power down a tape unit, take it off line and unload the tape (if a tape is mounted); then press power off. To power down the system console, use the rocker switch behind the console or the knob near the front lower right; or for a hardcopy console, use the switch under the keyboard to the right.

If you power down the computer, the SCP-OS and microcode will vanish and will have to be reloaded later. Thus the next start will be a cold start, described above. If you decide to cut power to the computer, press the **LOCK** switch (if any) to **OFF** or unlock, and press the rocker **POWER** switch to **OFF**. Powering down any machine but an MV/8000 deletes the SCP error log (if any), which is kept in volatile memory, so don't do it if you want to retain entries in this log.

Figure 6-8 shows the steps taken by all parties to bring the whole system up.

Figure 6-9 summarizes startup and normal shutdown for MV/Family Systems that don't have a blue and white MV/8000. Figure 6-10 summarizes startup and normal shutdown for blue and white MV/8000 systems.

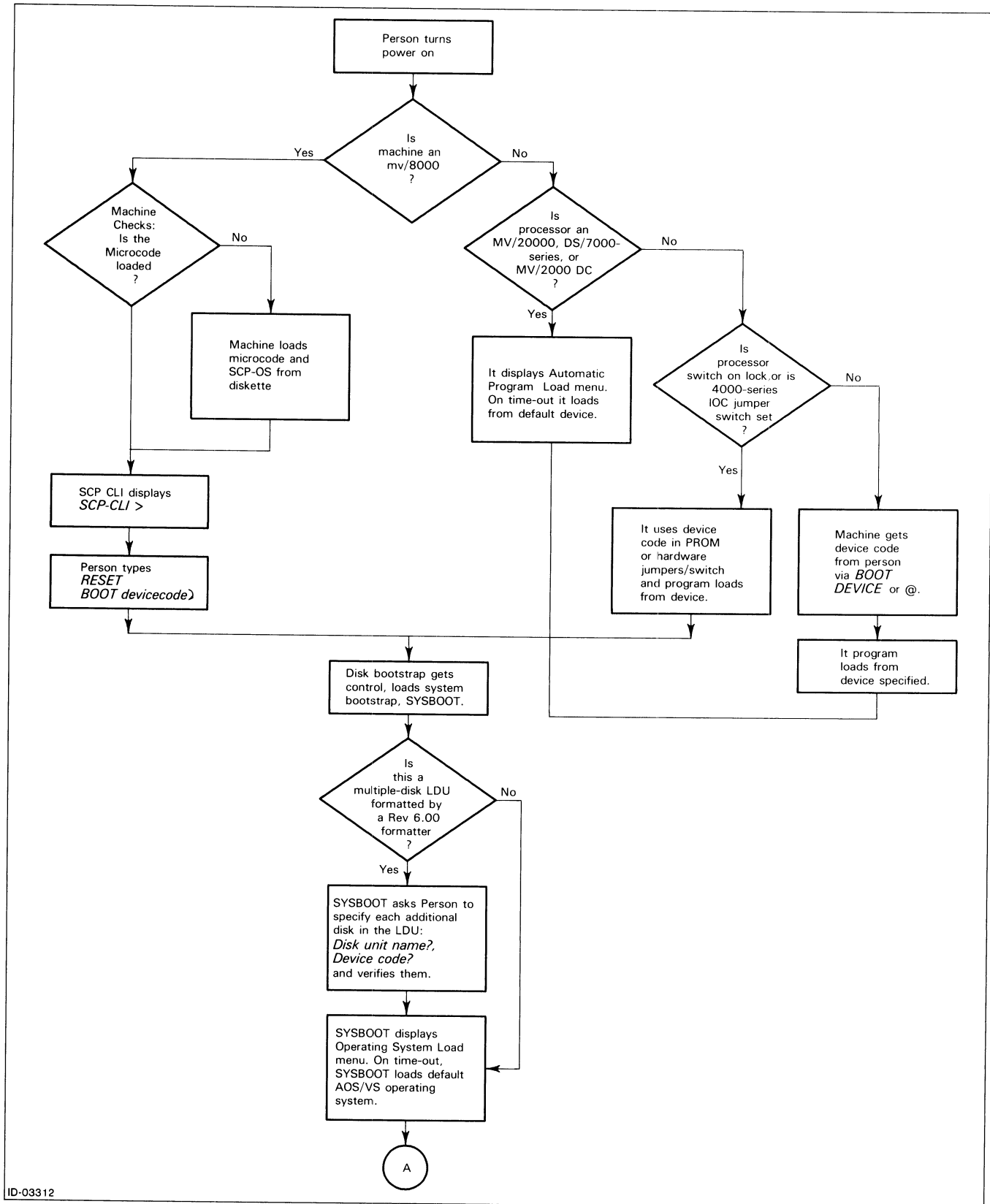


Figure 6-8. How to Bring Up the System (continues)

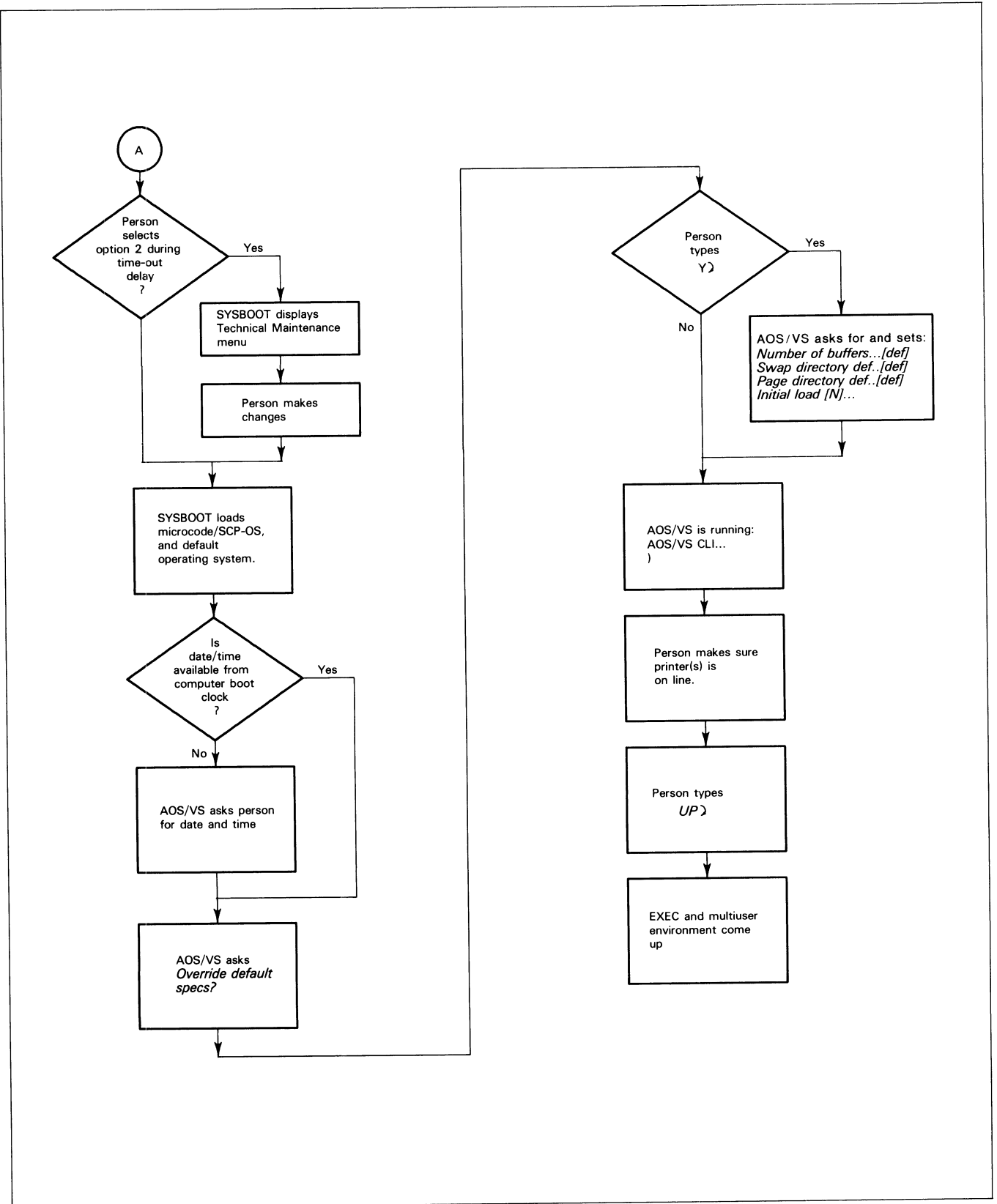


Figure 6-8. How to Bring Up the System (concluded)

For a cold start, begin with step 1.

For a warm start, type RESET ↵, BOOT 24 ↵ (or other master LDU device code) and begin with step 4.

1. Turn non-CPU devices on and on line: system console, disks READY and write-enabled.

On computers with tape unit, turn tape unit on.

2. Press CPU LOCK switch (if any) to ON or LOCK position.

3. Press CPU POWER switch ON.

**\*\*POWER UP TESTING COMPLETED\*\***

or

*MV/4000 READY*

*Automatic Program Load Menu* (MV/20000s, DS/7000-series,  
MV/2000 DCs only)

...

4. Enter choice [1]: ↵

5. *Operating System Load Menu* (All machines)

...

Enter choice [1]: ↵

6. Computers with a working boot clock get date and time from the boot clock. Go to step 7.

*AOS/VS Rev n*

*Master LDU: name*

- 6a. Date (MM/DD/YY) ? 5 30 86 ↵ (Current date)

- 6b. Time (HH:MM:SS) ? 14 35 ↵ (Current time)

7. Override default specs [N]? ↵

*AOS/VS CLI REV n date time*

)

8. Verify date and time. Correct with DATE or TIME commands, if needed.

9. Make sure all line printers are on line, with paper aligned.

10. ) UP ↵

*Pid n*

... (EXEC messages) ...

)

Figure 6-9. Startup-Shutdown Summary for Computers Other Than Blue and White MV/8000s (continues)



Normal operation occurs here; then, you want to shut the system down. Follow these steps.

1. ) BROADCAST System coming down in 5 min. Please log off. )

or

) SEND / 2 = 1 @CON- System coming down in 5 min. Please log off. )

2. ) CX PAUSE )

) CX PAUSE @LPB ) (and/or @LPE or @LPD)  
)

3. Use the ? macro and SEND/BROADCAST until all text editor and other users who stand to lose work are out of their programs.

4. ) BYE )

) WHO )

If answer is PID 2, go to step 5. Else

4a. Type UNLOCK ), password ), BYE ) for LOCK\_CLI.

5. ) DOWN )

*PROCESS TERMINATION, PID: 3*  
*\*ABORT\**  
*TERMINATED BY A SUPERIOR PROCESS*

6. Shut down other software as needed. Then,

) BYE )

7. Do you really want to shut the system down? Y )

*Starting system shutdown date time*  
*System shutdown*  
*CPU halted*

|            |            |            |            |           |          |             |                                                  |
|------------|------------|------------|------------|-----------|----------|-------------|--------------------------------------------------|
| <i>AC0</i> | <i>AC1</i> | <i>AC2</i> | <i>AC3</i> | <i>PC</i> | <i>C</i> | <i>MAP</i>  | } Skipped on some systems; for display, type . ) |
| <i>n</i>   | <i>n</i>   | <i>n</i>   | <i>n</i>   | <i>n</i>  | <i>n</i> | <i>PHYS</i> |                                                  |

SCP-CLI>

Power down devices if desired; for computer, press lock switch to OFF or unlock first.

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Figure 6-9. Startup-Shutdown Summary for Computers Other Than Blue and White MV/8000s (concluded)

For a cold start, begin with step 1.  
For a warm start, begin with step 6.

1. Turn non-CPU devices on and on line: system console, disks READY and write-enabled.
2. Diskette in slot.
3. Turn CPU POWER switch ON.  
    *\*\*CONSOLE READY\*\**
4. *ENTER DATE (MO DAY YEAR)      5 30 86 ↓      (Current date)*
5. *TIME (HR MIN SEC)      14 52 ↓      (Current time)*
- 5a. *MICROCODE(1 = STD, 2 = C350/MMPU[1])? ↓*  
    ... *SYSTEM CONTROL PROGRAM*  
    *LOADING...*  
    *VERIFYING...*
6. *SCP-CLI>    RESET ↓*
7. *SCP-CLI>    BOOT 27 ↓      (Or other master LDU device code)*  
    *Operating System Load Menu*  
    ...
8. *Enter choice [1]: ↓*  
    *AOS/VS Rev n*  
    *Master LDU: name*
9. *Date (MM/DD/YY) ?    5 30 86 ↓      (Current date)*
10. *Time (HH:MM:SS) ?    14 35 ↓      (Current time)*
11. *Override default specs [N]?    ↓*  
    ... (Pause) ...  
    *AOS/VS CLI REV n date time*  
    *)*
12. Make sure all line printers are on line, with paper aligned.
13. *) UP ↓*  
    *Pid n*  
    ... (EXEC messages) ...  
    *)*

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Figure 6-10. Startup-Shutdown Summary for Blue and White MV/8000 Systems (continues)

Normal operation proceeds here; then, you want to shut the system down. Follow these steps.

1.   ) BROADCAST    System coming down in 5 min. Please log off. ↓  
       or  
       ) SEND/2=1 @CON-   System coming down in 5 min. Please log off. ↓
2.   ) CX PAUSE ↓  
       ) CX PAUSE @LPB ↓  
       )
3.   Use the ? macro and SEND/BROADCAST until all text editor and other users who stand to lose work are out of their programs.
4.   ) BYE ↓  
       ) WHO ↓  
       If answer is PID 2, go to step 5. Else
- 4a.   Type UNLOCK ↓, password ↓, BYE ↓ for LOCK\_CLI.
5.   ) DOWN ↓  
       PROCESS TERMINATION: PID: 3  
       \*ABORT\*  
       TERMINATED BY A SUPERIOR PROCESS
6.   Shut down other software as needed. Then,  
       ) BYE ↓
7.   Do you really want to shut the system down?   Y ↓  
       Starting system shutdown date time  
       System shutdown  
           CPU halted  
           AC0                   AC1    AC2    AC3    PC    C    MAP  
           n                   n    n    n    n    n    PHYS  
       SCP-CLI>  
       Power down devices if desired.

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Figure 6-10. Startup-Shutdown Summary for Blue and White MV/8000 Systems (concluded)

## Abnormal Shutdown

An abnormal shutdown is any shutdown not executed by the **BYE** command from the master CLI, PID 2, on the system console. If you get an *ABNORMAL SYSTEM SHUTDOWN* message during a normal shutdown then it — too — is an abnormal shutdown.

An abnormal shutdown can result from a deadlock (hang), panic (FATAL AOS/VS ERROR), hardware failure (which may cause a panic), or power failure.

There are several software tools to help you handle and recover from abnormal shutdown situations. They are

- the Memory Dump routine, which copies main processor memory to tape or diskette for later analysis;
- the AOS/VS Emergency Shutdown (ESD) routine, which tries to turn the abnormal shutdown into a normal shutdown;
- the AOS/VS disk fixer, **FIXUP**. **FIXUP** corrects disk inconsistencies and allows you to restart AOS/VS. It takes much longer than ESD, but also corrects inconsistencies that ESD can't. You are not *required* to run **FIXUP** unless ESD fails.
- Diagnostic tests. There are some easy CPU diagnostics (FRU tests) described in Chapter 11, "Unusual System Conditions." If you suspect CPU errors, try these. In any case, if a problem persists, you should call your DG support organization.

## System Deadlocks

If AOS/VS seems to be denying service, it may be hung in a deadlock. Deadlocks can result from high-priority and/or resident processes that loop, monopolizing processor time. Deadlocks can also occur if three or four heavily used batch streams are running along with many interactive processes.

The primary symptom of a deadlock is long response time. Another symptom is a process (like a text editor) that is not aborted by the abort sequence **CTRL-C CTRL-B**. Users may complain that nothing is happening on their consoles; and/or there may be little or no response to commands given at the system console. (If this console shows a FATAL AOS/VS ERROR message, a panic has occurred; see the next section.)

The first thing to do, if a console seems dead, is to type **CTRL-Q** to cancel a **CTRL-S** that may have frozen display. If this restores activity, fine. If not, make sure the console is on and on line, and that the fault lights (if any) aren't lit.

If the problem persists, check processes from the system console by typing **? l**. This may identify one or more hungry processes (for example, a batch stream that's dumping for file backup). If so, you can then decide whether to block or terminate the process(es) (CLI command **BLOCK** or **TERMINATE**), or to reduce the process priority (**PRIORITY** command); or change the process type (**PRTYPE**), or to live with the situation until the process(es) finish what they are doing.

If you can't identify a problem process, try running **PED** (Chapter 9) to see if any process is getting too much processor time. If so, block or terminate it (or use **CX FLUSH** to flush it, if a batch stream).

If the deadlock persists, and/or the system console is not accepting input, you must force a shutdown and bring up AOS/VS again. Note that if you want to report this deadlock to DG in a Software Trouble Report (STR), there are additional steps, described in the STR section in Chapter 11. But to simply force a shutdown, follow these steps:

- Unlock the computer using the computer **LOCK** switch (if any).
- Type the break sequence on the system console: **CMD** and **BREAK** keys, **BRK** key, or **BREAK** key. (If the software **FLAGS** lock is set, press the CPU **RESET** switch to **CONSOLE**.)

*SCP-CLI>*

- Reset the CPU; then force an emergency shutdown by typing

```
SCP-CLI>    RESET ;
SCP-CLI>    START 50 ;
```

This should abort processing and start a shutdown. (If nothing happens, type the break sequence again; then type TTY ).

The system console prompts

*Do you want a memory dump (to submit a Software Trouble Report) (Y or N)? [Y]*

- To shut down, type N ; and the Emergency Shutdown routine will run as described in “Running ESD”, below. To do a Memory Dump, proceed as described under “Doing a Memory Dump”, below.

Chapter 17 contains more information on errors. Deadlocks are described under the first message, “None.Nothing...”, in Table 17-1.

## Panics

A panic (crash) results from an error that AOS/VS recognizes but cannot rectify. It may involve hardware or software. On a panic, the system console displays the message

*FATAL AOS/VS ERROR: p*

|               |               |               |               |
|---------------|---------------|---------------|---------------|
| <i>value1</i> | <i>value2</i> | <i>value3</i> | <i>value4</i> |
| <i>value5</i> | <i>value6</i> | <i>value7</i> | <i>value8</i> |
| <i>sp</i>     | <i>fp</i>     | <i>sl</i>     | <i>sb</i>     |

*Do you want a memory dump (to submit a Software Trouble Report) (Y or N)? [Y]*

The panic values have the following meanings:

|                   |                                           |
|-------------------|-------------------------------------------|
| <i>p</i>          | is the octal panic code.                  |
| <i>values 1–8</i> | may contain additional panic information; |
| <i>sp</i>         | is the value of hardware stack pointer;   |
| <i>fp</i>         | is the value of hardware frame pointer;   |
| <i>sl</i>         | is the value of hardware stack limit;     |
| <i>sb</i>         | is the value of hardware stack base.      |

File :UTIL:AOSVS.PANICS.SR tells you how to interpret the panic values *p* and *values 1–8*. Your site should keep a printout of the *current revision* of this file near the system console. Within this file, “AOS” is DG’s 16-bit ECLIPSE operating system; and “AOS-16” means a 16-bit program running under AOS/VS. The panic codes appear after the first few pages in the file.

Generally, you should log each panic in a system log book kept near the system console. Note the time, revision of AOS/VS system, any unusual conditions (like new software or hardware) that may have helped cause the panic, and the panic values. The written record is especially important if your system console is a CRT. Panic records can be very important to DG personnel whom you may call on for assistance.

The panic may have originated in hardware, as described in file :UTIL:AOSVS.PANICS.SR and in the next section. In any case, you may want to do a Memory Dump, and have ESD run, described below.

## Hardware Errors

AOS/VS relies on hardware to run. Inconsistencies in the processor (including components like the ATU, map, and buses), disk, or other devices (like NBAs or MCP1s) can cause it to panic.

### Processor Errors

If an error occurs in the processor, AOS/VS may panic, and/or control may go to the SCP-OS, which may try to describe the error.

Some computers have sensors that will cut AC power under fan failure, overtemperature or brownout (voltage drop) conditions. If such a condition occurs, computer power will be cut; and you must fix the problem if possible. Fault lights on the front panel may identify the problem; if any lights are lit, check for your computer in Chapter 17. If the solution is easy, fix the problem; then proceed as described under "Power Failures", later in this chapter.

If you can't identify the problem, check microcode as described next.

### Microcode Errors

If abnormal shutdowns recur, there may be a microcode problem. Use the microcode utility to verify processor microcode (if possible). For this, see the VSPAD or VERIFY command in your *System Control Processor* manual (014-series). If there are microcode verification errors, reload microcode via a cold start. If abnormal shutdowns and microcode verification errors recur often, note the verification results and contact your DG support organization.

If microcode is not the culprit, check the SCP log or SYSLOG. If neither of these identifies the problem, run FRU diagnostics. The SCP log and FRU diagnostics are described in Chapter 11, "Unusual System Conditions."

### Disk and Tape Errors

If AOS/VS hits a hardware error on a disk, it will write an error message to the system console; then, it may either panic or continue.

The error message is

*HARD error, device dd, unit u*

*Statuses: DIA=n, DIB=m, DIC=l*

*Retries r*

*dd* is the device code; for example, 67.

*u* is the unit number; for example, 0.

*n, m, l* are hardware status codes, described in Chapter 17, under *HARD ERROR* message. The code(s) may indicate a bad sector (bad disk block), ECC, or other error. On a model 6236 or 6239 disk, a status code may be displayed in the unit's digital display.

*r* is the number of retries AOS/VS made before it gave up and signaled an error. Usually, it will retry 15 times. But on certain errors (for example, if a disk goes off line), it can't retry at all.

If AOS/VS is still running, and the disk is nonessential (a nonmaster LDU), try to RELEASE the disk, using the LDU name given by the Disk Formatter. Run FIXUP on the LDU.

If AOS/VS is still running and the disk is essential, warn users to log off immediately, get back to the master CLI, and shut the system down with DOWN ↵ and BYE ↵ as shown in "Normal Shutdown". If AOS/VS panics, note the panic code and have ESD run.

When AOS/VS is down, check the disk for obvious problems. For example, it may have gone off line or may be write protected; you can correct this with disk switches. If you fix the problem, and ESD succeeds, you can warm start AOS/VS. If the status code *s* indicates a bad sector (bad block), or if you suspect a new bad block, run a Disk Formatter Partial format on the LDU, changing nothing; and specify read-only surface analysis. If the Formatter finds one or several new bad blocks, answer *Y* when it asks *Update bad block table*. You may need to run FIXUP on the LDU before reusing it. But if the Formatter finds *many* new bad blocks (say 20 or more), do not let it update the bad block table; the problem may well be head alignment. Turn disk power off and call your DG support organization.

If you cannot identify and solve the problem, turn disk power off and call your DG support organization. If possible, run without the disk until it is fixed.

If a hard error occurs on a tape unit, AOS/VS will usually stay up. Try cleaning the unit heads, or try another tape. If the hard error recurs, call your DG support organization, and run without the tape unit until it is fixed.

While AOS/VS is running, if system logging is on, it will try to record hardware errors in the system log file, SYSLOG. Using SYSLOG is described in Chapter 9, "Other Runtime Tools." The SCP log (if any) will also record hardware errors; this log is described in Chapter 11, "Unusual System Conditions."

## Doing a Memory Dump

AOS/VS always offers to do a memory dump after a panic or break, START 50 sequence. This dump is required if you want to submit an STR (Chapter 11). You *can* skip the dump by typing *N* to the *Do you want a memory dump ...* question. Skip the dump only if you don't want to submit an STR.

To do a memory dump, do the following:

- For reel-to-reel tape, get a scratch tape, 800 feet or more with the write-enable ring in. Mount the tape on unit 0 on the first controller, if available. If the unit has a density switch, choose DENSITY HIGH.
- For diskette, get several scratch diskettes (3-4 needed with 2 Mbytes of memory). These must be hardware formatted but need not be formatted with the Disk Formatter. Insert a diskette in unit DPJ10 (or DPJ1 if the diskette and disk share a controller).

- The system console is displaying

*Do you want a memory dump (to submit a Software Trouble Report) (Y or N)? [Y]*

- Type *Y*.

The system console displays

*Dump to magnetic tape or diskette (T or D) ? [T]*

For tape, press *Y* or type *T*. For diskette, type *D*. Depending on the device, it then displays

Please     $\left\{ \begin{array}{l} \text{mount tape.} \\ \text{insert diskette in unit.} \end{array} \right\}$                       Then specify unitname. [default]

- If you mounted the tape or diskette in the unit shown as default (for example, MTB0 or DPJ10), press *Y*. If the tape or diskette is on a different unit, type the unitname and press *Y*; for example, *MTB1*.

After you respond, the memory dump routine copies main memory and other things to tape or diskette. For diskette, it displays *DUMPING*, followed by periods to indicate the passage of time. If it needs another diskette, it will display

*Diskette is full.*

*Please insert next diskette in unit. Press NEW LINE when ready.*

Insert another diskette and press J.

When done, the routine rewinds the tape (if using tape), and starts Emergency Shutdown (ESD). ESD runs as shown in the next section. The messages are

*Memory dump completed — running Emergency Shutdown (ESD)*

*File system restart*

*Now restarting device ...*

*... (Other ESD messages) ...*

*System shutdown*

*SCP-CLI>*

Dismount the tape or diskette — and, if you want to save the dump in preparation for the STR, label the tape or diskettes.

(If the memory dump routine hits an error, it will prompt you to retry. To retry, mount a different tape or diskette; then type Y J.)

## About ESD

ESD is a routine that tries to restart AOS/VS and force a normal shutdown, by writing system buffers to disk and closing open files. ESD is not perfect: it can't cope with certain system errors, and it can't verify the accuracy of system databases that the panic may have affected. But it offers a good way to handle panics.

The system tries to run ESD after a panic or break, START 50 J sequence — after you've done a memory dump or skipped the dump.

ESD messages are:

*File system restart*

*Now restarting device nn unit n*

*Flushing buffers*

*Open file processing*

*System shutdown*

*SCP-CLI>*

The main processor is halted. You can bring up AOS/VS as described under "Warm Start" above. (If you want to submit an STR, you must dump the AOS/VS system symbol table to tape or diskette after AOS/VS comes up. Doing this is described in Chapter 11, STR section.)

If ESD fails, it issues a FATAL ERROR message of its own. You can help us improve ESD by taking a memory dump at this failure, and submitting it, with an STR, to us at DG. To take a dump, mount a tape or diskette and type Y J as described in the previous section. To skip the dump, type N J. In either case, if ESD fails again, it cannot deal with the error. Reset the computer, boot, and have FIXUP run on all LDUs that were part of the system when the error occurred.

If AOS/VS comes up, but you cannot initialize any nonmaster LDUs that were initialized when the error occurred, then you should execute stand-alone FIXUP from AOS/VS and run it on the inaccessible LDU(s). If AOS/VS displays *FIXUP RECOMMENDED* for any LDU, you should also run FIXUP on that LDU.



## The FIXUP Disk Fixer

Abnormal shutdown leaves the master LDU (and other initialized LDUs, if any) in an unpredictable state, with open files that may not have been updated. ESD, if it succeeds, writes system buffers to update open files, closes the files, and restores disk integrity.

But if ESD fails, this means it could not close files on one or more LDUs. You must run FIXUP to fix the pertinent LDU(s). If an LDU does not need fixing, FIXUP will tell you that fixing is not necessary, and allow you to skip the fix. You may want to do the fix anyhow if you suspect errors in the LDU. You should always run FIXUP on an LDU about which AOS/VS displays FIXUP RECOMMENDED.

Even if you are not forced to run FIXUP, you should run it periodically — at least monthly — to clean up and verify the file structure on your LDUs.

A *hard error* on an LDU may not cause abnormal shutdown. But a hard error often means that part of the LDU is inaccessible — perhaps with an unreadable bad block in the middle of a file. After a hard error, you should run a Disk Formatter Partial format on the LDU(s) to check for new bad blocks, and let the Formatter update the bad block table. Then, if the Formatter gives a *MUST RUN FIXUP* message, you must run FIXUP to correct the file structure. FIXUP may be able to rebuild — thus save — part of the pertinent file.

There are two FIXUP programs: stand-alone FIXUP, in the root directory; and stand-among FIXUP, in directory :UTIL. Stand-among FIXUP runs under AOS/VS control: you can use it while AOS/VS is up. Also, stand-among FIXUP lets you create FIXUP *script files*. A script file is usable by stand-alone *or* stand-among FIXUP. It streamlines the fixing procedure by eliminating dialog, and — for stand-among FIXUP — by allowing you to run multiple FIXUP jobs concurrently. You can tell SYSBOOT the name of the script file, and then run FIXUP easily by choosing option 7, “Run FIXUP”, from the Technical Maintenance Menu. (If SYSBOOT must be run when you bring the system up, option 7 is the default.) See “Changing the FIXUP Default Script Filename” later in this chapter.

Stand-among FIXUP works only on LDUs that are not opened. This means it can't run on the master LDU, since AOS/VS has this LDU open. Stand-alone FIXUP works on any LDU.

## Starting Stand-Among FIXUP

You can start stand-among FIXUP — with :UTIL in the search list — using the form

```
XEQ  FIXUP [ /DEFAULT=existing-file
             /BUILDSCRIPT=file /DEFAULT=existing-file
             /SCRIPT=existing-file ]
```

where

*/BUILDSCRIPT=file*

This switch tells FIXUP to create the script file *file*, with the suffix .FXP, then ask questions and store your answers in the script file. When you include this switch, FIXUP simply builds the script file; it does not execute the file.

Any script file can be used by either stand-alone or stand-among FIXUP. A script file for stand-alone FIXUP must be in the root directory for stand-alone FIXUP to execute it. If you don't specify a pathname with *file*, FIXUP creates the file in the working directory.

If the *file* already exists, FIXUP will give you the choice of replacing it or restarting FIXUP. Any script file FIXUP creates has the suffix .FXP. For example, if you type the name FIX\_ROOT, the script filename will be FIX\_ROOT.FXP. You never use the .FXP suffix when you tell FIXUP to use a script file. The suffix serves simply to identify a FIXUP script file.

For example, to start building a script file named FIX\_DPJ0.FXP, you'd type

```
) X FIXUP /BUILD=FIX_DPJ0 )
```

*/DEFAULT=existing-file*

Used alone, this switch tells FIXUP to display the settings in script file *existing-file* (omit the .FXP suffix). If you also use the /BUILDSCRIPT switch, FIXUP will ask the dialog questions, using the responses in *existing-file* as the defaults, and build a new script file using the responses you enter. You can use these switches to create a different version of a script file; or, if you use the same name with both switches, to edit a script file. For example, the command

```
) X FIXUP /BUILD=FIX_DPJ0 /DEF=FIX_DPJ0
```

starts a session to edit script file FIX\_DPJ0.FXP

*/SCRIPT=existing-file*

Tells FIXUP to run on one or more LDUs, using the values in script file *existing-file*. Do not include the .FXP suffix.

**NOTE:** It's easy to tell SYSBOOT the name of a script file. See "Changing the FIXUP Default Script Filename" later in this chapter.

For a FIXUP session without a script file, omit switches. For example, XEQ FIXUP ). FIXUP will then ask questions, and run using the answers, without building or consulting a script file.

## Starting Stand-Alone FIXUP

You can start stand-alone FIXUP when you bring up your system. At startup, when SYSBOOT displays the Operating System Load Menu, type 2 ).

*Technical Maintenance Menu*

...

7 Run FIXUP

...

Enter choice [1]:

Then type 7 ) to run stand-alone FIXUP:

7 )

*AOS/VS Disk Fixer, Rev n*

Later in this chapter, we explain how to build a script file and tell SYSBOOT its name. Then, FIXUP can use the script file to run without operator interaction.

You can also start FIXUP — without a script file — from an AOS/VS system tape (type BOOT 22 ), then 1 ); or from AOS/VS diskette number 1 (type BOOT 64 ), DPJ10 ), and FIXUP ).

## If You Make a Mistake

If you make a typing mistake before pressing NEW LINE, press the DEL key to erase characters one-by-one; or enter CTRL-U to erase the entire line.

If you have already pressed NEW LINE to enter an incorrect answer, FIXUP may recognize your error and repeat the question. If so, type the desired answer.

If you decide to abort stand-alone FIXUP, type the break sequence and RESET ), then reboot FIXUP. To abort and restart stand-among FIXUP, type CTRL-C CTRL-B and repeat the command sequence that started FIXUP.

On a CRT display console, you can suspend display by typing CTRL-S and resume display by typing CTRL-Q.

## Running FIXUP

To run FIXUP interactively, you must use an upper- and lowercase console, because FIXUP console dialog is upper- and lowercase.

To run FIXUP, follow these steps.

1. If you want to fix disks (instead of create or edit script files), make sure that all disks are mounted in their units (if removable), write-enabled, and ready.
2. Decide what you want to do, as follows:
  - 2a. To run stand-alone FIXUP (perhaps to fix the system LDU), skip to step 3.
  - 2b. Decide where you want the script file. For stand-among FIXUP, :UTIL is a good directory, since it's in most search lists. For stand-alone FIXUP, the script file must be in the root directory, but you can always move it there from :UTIL.

Then, to run stand-among FIXUP and create or edit a script file, type XEQ FIXUP/BUILD=name ) or XEQ FIXUP/DEFAULT=name/BUILD=name ). And skip to step 5.

- 2c. To run stand-among FIXUP, using a script file, type

) XEQ FIXUP/SCRIPT=name )

FIXUP will then run using the script file. FIXUP may display messages on the console screen; this depends on the script file log selection. At the end, FIXUP will display *DONE!* as shown in step 22.

- 2d. To run stand-alone FIXUP interactively, using no script file, type XEQ FIXUP ↵ and skip to step 5.
3. See if the SCP-CLI is active on the system console, by typing . ↵ (status command). If nothing happens, do a cold start as described earlier in this chapter. If the SCP-CLI is active, follow these steps:

SCP-CLI> RESET ↵

SCP-CLI> BOOT 27 ↵

(Or other disk device code, like 24, instead of 27.)

#### *Operating System Load Menu*

1 Continue immediately with operating system load

2 Enter the Technical Maintenance Menu

...

Enter choice [2]:

4. Press ↵ or outwait the time-out delay to display the Technical Maintenance Menu:

#### *Technical Maintenance Menu*

...

7 Run FIXUP

...

Enter choice [1]:

Type 7 ↵ to run stand-alone FIXUP:

7 ↵

(Later in this chapter, we explain how to build a script file and tell SYSBOOT its name. Then, FIXUP can use the script file to run without operator intervention. See "Changing the FIXUP Default Script Filename".

5. The previous steps read FIXUP into memory. It asks

*AOS/VS Disk Fixer Rev. n*

*Verbosity [1] ?*

6. FIXUP can write messages to a log file, covered in the next question. Your answer to this question sets the amount of detail in each message.

0 ↵ tells FIXUP not to log messages.

↵ or 1 ↵ tells FIXUP to log the message and file pathname for each file that it deletes, rebuilds, renames, closes, or finds incomplete. If you choose certain options later in the dialog, FIXUP will also log messages that pertain to these options. This is a good general-purpose answer.

2 ↵ tells FIXUP to log the following for each disk error: message, file pathname, LDU unique ID, file address, index level, disk unit, and logical and physical disk addresses of the error. FIXUP reports all multiply-allocated blocks, rebuilding FNB and FIB chains, invalid pointers, and empty chain anchor blocks.

3 ↵ tells FIXUP to log everything it does: all actions included in verbosity 2, plus replacement of directory bitmaps, updates of file lengths, and deallocation of empty directory blocks.

A verbosity of 0 produces the fastest fix, but yields no error information; so you should answer 0 ↵ only when you don't care about error information. If you answer 0 ↵, go to step 9. Verbosity 1 gives user-oriented messages, on which you can act. In most cases, you will want verbosity 1 and a line printer log.

Verbosities 2 and 3 are intended for DG personnel. If you want to submit a Software Trouble Report to DG, please specify 3 ↵.

If you answer anything but 0 ↵, FIXUP asks

*Error log file [console] ?*

or

*Error log file for standalone [console] :* (For script file)

7. Your answer determines the error log file — or, if you're building a script file, the log file for stand-alone FIXUP.

For stand-alone FIXUP, the most common log file is the line printer (device names LPB, LPB1, LPD, LPD1, LPE, LPE1, LPJ0). A slower option is the console (default). A console is most useful as a log file only if the console is a hardcopy device.

For stand-among FIXUP, you can specify the console (default), @LPT, or a disk file (which FIXUP will create if it doesn't exist or append to if it does exist). Preferably, specify the printer; e.g.,

LPB ↵ (or @LPT ↵ for stand-alone)

If you're building a script file, remember that the log file you specify must be available later on, when FIXUP runs the script file.

8. If you're building a script file or running stand-alone FIXUP interactively, it asks

*Device code [17]*

Press ↵ if the printer you want as your log file is on the default device code of the first line printer. If the desired printer is on another device code, type that code and ↵.

9. If you're building a script file, it asks

*Error logfile for standamong [console] ?*

For stand-among FIXUP, you can specify your console (default), @LPT, or a disk file (which FIXUP will create if it doesn't exist or append to if it does exist). Preferably, specify the printer queue; e.g.,

@LPT ↵

10. *Should I report closing files and deleting transients [n] ?*

Reporting on each open and transient file adds time to the fix — especially if the log file is a hardcopy console. (Transients are files that would normally have been deleted by other programs. FIXUP normally deletes them in the course of cleaning up.) The "closing" and "deleting" information is not needed for diagnostic purposes. If you want FIXUP to report open files and deleting transients, type Y ↵. But unless you really need to know which files were open, press

↵

11. *May I fix it [n] ?*

This question determines whether FIXUP will fix the LDU(s) or simply report errors. Unless you type Y ↵, the LDU(s) will remain inaccessible to AOS/VS. If you *do* type Y ↵, FIXUP will act to correct the LDU; if any disk blocks are multiply allocated, or contain bad information, this might involve the loss of files.

If you answer ↵ (No), FIXUP will not write to the LDU. You will see the same messages as if you said Yes, but FIXUP will not try to rebuild files and won't display *FILE REBUILT* messages. You might answer ↵ if you suspected disk controller hardware problems, and didn't want your LDU(s) fixed on the basis of hardware problems. If you answer ↵, FIXUP will say *DONE, BUT NOT FIXED!* after it runs on the LDU.

Generally, answer

Y ↵

12. *Would you like to select any options [n] ?*

Options include: confirmation if fixing will cause deletions; deleting temporary files, cancellation of queued requests on serious errors, and output to the console in addition to the log file.

If you decline options, and have told FIXUP to fix it, FIXUP will correct the LDU even if fixing will cause deletions; it will delete temporary files (usually a productive thing to do); it will proceed with queued requests regardless of errors; and it will send messages to the log file only (but abort messages will go to the console in any case).

Options add time and steps to the fix. But, some options — like the one in step 12c — may be desirable, especially if you're creating a script file. Any option you choose will be carried over into the next request, if you queue multiple requests.

If you don't want to select any options, press ↵ and go to step 13.

To select one or more options, answer Y ↵. FIXUP then asks one or more of the following questions.

12a. *Confirm fixing if an error will cause deletions [n] ?*

FIXUP asks this only if you chose verbosity 2 or 3 and said Y ↵ to *May I fix it?*. If you answer Y ↵, when FIXUP finds an error where fixing would cause a deletion, it reports the error, stops, and asks

*May I continue fixing [n] ?*

To have FIXUP continue, which will mean the loss of at least part of a file and may mean the loss of multiple files, you will need to type Y ↵. FIXUP will then delete something and continue fixing until it finds another error that requires deletion to fix.

If you answer Y ↵ to this *Confirm fixing...* question, FIXUP will send messages to the console as well as the log file.

If you choose to say No by pressing ↵, FIXUP will stop fixing the LDU and proceed as if you had said No to *May I fix it?*. The LDU will remain inaccessible to AOS/VS.

12b. *Delete ?+.TMP files [y] ?*

Temporary files, whose names have the form “?name.TMP”, are created and used by DG utility programs; the utility programs delete them after completing their jobs. But if a utility is interrupted before finishing, its temporary files remain on the LDU.

Normally, unless you know that the LDU has important files of the form ?name.TMP, answer Yes by pressing *Y*. If you want to keep all ?+.TMP files, type *N*.

12c. *Should I cancel queueing on serious errors [n] ?*

This is asked only if you answered *Y* to *May I fix it ?*

By default, FIXUP continues fixing queued LDU requests, regardless of errors on the current LDU, even if it aborts on the current LDU. If you answer *Y*, FIXUP will fix the LDUs in sequence; and if it finds a serious error on one LDU, it will finish fixing that LDU, then ask

*May I continue fixing [n] ?*

If you see this question, you will know that the current LDU has been fixed (unless FIXUP aborted). If you say No by pressing *N*, FIXUP will cancel the remaining requests and terminate; the remaining LDUs will remain inaccessible to AOS/VS. If you type *Y*, FIXUP will continue with the next queued request; if it encounters another serious error, it will ask for confirmation again as above.

A “serious” error is any read/write error (even if retries succeeded), deletion of any whole file or a multiply-allocated block, or an invalid pointer in an index block.

If FIXUP is running from a script file that specifies *cancel on serious errors*, FIXUP will cancel all remaining requests on a serious error — without asking this question.

The option to cancel queueing on serious errors requires a person at the console to confirm — eliminating the main advantage of queueing. But, under some circumstances (perhaps in a script file, to make sure the system operator consults someone on serious errors), you may want to choose this option. If so, type *Y*. Generally, say No by pressing *N*.

12d. *Send output to console in addition to logfile [n] ?*

FIXUP asks this only if you specified a log file other than the console and said No to *Confirm fixing...*

If you chose a log file other than the console, and want error messages to appear on the console as well as the log file, type *Y*. Otherwise, say No by pressing *N*. Abort messages are repeated on the console in any case.

13. *Specify each disk unit in the LDU*

*Enter disk unit name :*

Now, you need to identify each disk in the LDU. The order in which you give the unit names doesn't matter, but FIXUP will insist that you specify each disk. If you're building a script file, FIXUP cannot check for a complete LDU; but otherwise, it does check.

With stand-alone FIXUP, for the master LDU, the disk unit name is often DPJ0 or DPF0. With stand-alone FIXUP, under AOS/VS, the name(s) can be unit names (e.g., @DPF10); or, if the LDU was mounted under EXEC in a user MOUNT request, the linkname used in the MOUNT command. For example,

DPF0 ) (or DPJ0 )

For a mirrored LDU, type the LDU names separated by a !. For example

DPJ2!DPJ3 )

14. *Device code [default] ?*

This is asked only if needed. Unless you know that the disk unit is connected to a nonstandard device code, select the default by pressing

]

15. If you're building a script file, continue with this step. If you're running FIXUP interactively, skip to step 17.

For a script file, after you give the device code, FIXUP asks

*Is there another disk unit in this LDU [n] ?*

If the LDU includes another disk, type Y ] and answer the *Enter disk unit name* and *DEVICE CODE* questions for the next disk. For any multiple-disk LDU, it's essential to describe all disks; if you don't, the script file won't work.

15a. *Is disk mirrored [n] ?*

FIXUP asks whether the disk is part of a mirror, whether or not you've specified one disk (or image) or two. If the disk(s) is part of a mirror, answer Y ]. Otherwise, press

]

15b. *Enter the preferred image unique ID [default] :*

This question is only asked if you answered Y to 15a. Enter the preferred LDU unique ID, as given to the Disk Formatter. For example, DPJ2 ].

If you've described all disks in the LDU, press ].

16. *If fixing is not needed for this LDU, would you like to cancel this request [n] ?*

This question — asked for script files only — allows you to have FIXUP skip fixes on LDUs that don't need fixing. FIXUP will then proceed to the next request (if any) or terminate. (An LDU that doesn't need fixing is one on which all files were closed normally.)

Fixing an LDU that doesn't need fixing does no harm, and may streamline access by cleaning up the file structure — but it does take time. Generally, for script files, you will want to answer Y ] to skip unnecessary fixes. Regardless of your answer, though, all disks you specify in steps 13 and 14 must be on-line and ready before FIXUP runs with this script file. (This is true because FIXUP must consult all disks in the LDU before deciding that fixing isn't necessary.)

If this is a mirrored LDU, FIXUP prompts

*LDU (DPJn,...) has been selected for FIXUP*

*Do you want to continue fixing [y] ?*

16a. FIXUP will store the answer you give to this question in the script file. Usually, you do want FIXUP to continue fixing the LDU, so type

]

Since you're creating a script file, skip to step 20.

17. FIXUP cycles the *Enter disk unit name* and *Device code* questions until you specify all disks in one LDU.



18. FIXUP now checks the LDU you identified in steps 13 and 14. If the LDU does not *need* fixing, FIXUP advises

*\*\*\* This LDU was not in use, fixing is not necessary \*\*\**

This means that the LDU (and all files on it) were closed normally by AOS/VS. The LDU is accessible to AOS/VS, so you need not run FIXUP on it. However, there might be other errors FIXUP will fix if you run it on the LDU.

19. Then, for each LDU, FIXUP asks

*Would you like to cancel this request [n]*

To cancel this request (perhaps because FIXUP said fixing wasn't needed, or for any reason), type Y ↵. To have FIXUP run on the LDU, press

↵

20. Next, FIXUP asks

*Would you like to queue up another request [n] ?*

If you want to specify another LDU fix, answer Y ↵. FIXUP allows up to 16 requests to be queued. If you answer Y ↵, FIXUP asks about the LDU as in steps 13 and 14. If you have specified all the LDUs you want, press ↵.

21. Now, if you're creating a script file, FIXUP terminates with the message *SCRIPTFILE BUILT*. Just for good measure, especially if you have any questions about the way the script file will work, we suggest you try the script file (X FIXUP/SCRIPT=file, or shut down and specify FIXUP/SCRIPT=file to *SYSTEM PATHNAME?*). Before you can use a script file for stand-alone FIXUP, the file must be in the root directory (:). So, if you want to use the script file for stand-alone work, move the file to the root with the CLI MOVE command.

If you're running FIXUP interactively, it starts on the LDU(s). For a request that involves more than one LDU, it displays a --- *REQUEST n* --- message as it fixes each LDU.

22. However you run FIXUP (via script or interactively), a typical fix takes about 10 minutes for an average 190-Mbyte LDU. You need not stay at the console, unless you chose options (or the script file specifies options) that require confirmation. As FIXUP finishes with each LDU, it displays

*DONE!* (Or *DONE, BUT NOT FIXED!* if you told FIXUP not to fix the LDU.)

When FIXUP has run on the last LDU specified, control returns to either the SCP-CLI or — for stand-alone FIXUP — the CLI.

To rerun FIXUP, return to step 2. Otherwise, you're done with FIXUP. You can warm start AOS/VS (RESET, BOOT device code, etc.) and/or continue with system operations.

If FIXUP hits a disk error that it can't correct, it aborts. Make sure the disk is write enabled and try again. If the abort recurs, the cause is usually hardware. See the *DISK ERROR* message in Table 6-3.

If you suspect disk alignment problems or surface damage, don't put a backup pack in the unit (if this applies). FIXUP verbosity 1 error messages, and all abort error messages, are shown in Table 6-3.

## Script File Hints

Script files have two main benefits:

- They simplify recovery after abnormal shutdown. FIXUP script files make running FIXUP easy. (See the next section.)
- They can be useful for fixing multiple LDUs concurrently, perhaps from different terminals enabled with `PROCESS/DEF/IOC=@CONn :CLI ↓` commands. In a system with many LDUs, this can shorten recovery time.

To take advantage of these features, minimize the number of settings where FIXUP will require console interaction. In very serious error conditions, FIXUP will abort anyway — doing no harm. If you have many LDUs, you can specify a fix for all of them in one or two script files (which makes it easy for the operator, but requires all LDUs to be ready). Or, you can have a script file to fix each LDU; for example, `FIX_DPJ10`, `FIX_DPJ11`, and so on.

Generally, you should test each script file (using settings that allow the fix to occur even if fixing is not necessary) before making the script file a part of your routine system procedures.

## Changing the FIXUP Default Script Filename

Once you've created a script file and tested it, it's a good idea to make it the default. Then, when you must run FIXUP, FIXUP will run from the script file without operator intervention. It's easy to change the FIXUP default script filename. Follow these steps.

1. Shut the system down as you would normally.
2. Bring the system up again (cold or warm start), but when SYSBOOT displays the Operating System Load Menu, type 2 ↓
3. Choose option 10, "View or change the FIXUP default script filename," from the Technical Maintenance Menu:

*Technical Maintenance Menu*

...

*10 View or change the FIXUP default script filename*

...

*Enter choice [1]: 0 ↓*

*SYSBOOT prompts*

*Default FIXUP script filename []:*

4. Type the name of the script file you created, with or without the .FXP extension, and press ↓. The first time you run FIXUP, there is no default. But let's suppose you built a script file named `FIX_DPJ0.FXP`. You'd type

`FIX_DPJ0 ↓`

5. SYSBOOT has stored the script filename (here `FIX_DPJ0`). To run FIXUP with this script file, you must finally choose option 7, "Run FIXUP":

*Enter choice [1]: 7 ↓*

In the future, when you choose to run FIXUP, FIXUP will run with the script file you've made the default.

## FIXUP Examples

A nonscript FIXUP example with the simplest dialog follows in Figure 6-11. A nonscript example with multiple requests and options appears in Figure 6-12. A FIXUP example session that creates and uses two script files follows in Figure 6-13.

```
(Run FIXUP from the Technical Maintenance Menu or XEQ FIXUP !.)  
  
AOS/VS Disk Fixer, Rev 7.00.00.00  
  
Verbosity [1] ?      ↵  
Error logfile [console] ?      ↵  
Should I report closing files and deleting transients [n] ?      ↵  
May I fix it [n] ?      Y ↵  
Would you like to select any options [n] ?      ↵  
  
    --- REQUEST 1 ---  
Specify each disk unit in the LDU  
  
Enter disk unit name:      DPJ0 ↵      (Or @DPJ0 for stand-among FIXUP)  
Device code [24] ? ↵      (Omitted for stand-among FIXUP)  
  
Would you like to cancel this request [n] ?      ↵  
Would you like to queue up another request [n] ?      ↵  
  
REQUEST 1 (DPJ0), FIXING LDU 'ROOT' NOW...  
... (Time passes as FIXUP fixes LDU) ...  
  
REPAIR IN FILE :XDIR:TEST -- PART OF FILE MAY BE MISSING  
... (Time passes) ...  
  
DONE!
```

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Figure 6-11. Simple FIXUP Dialog Example

(Run FIXUP from the Technical Maintenance Menu or XEQ :FIXUP )

AOS/VS Disk Fixer, Rev 7.00.00.00

Verbosity [1] ?   ↓  
Error logfile [console] ?   LPB    (@LPT for stand-among FIXUP)  
Device code [17] ? ↓   (Skipped for stand-among FIXUP)  
Should I report closing files and deleting transients [n] ? ↓  
May I fix it [n] ?   Y ↓  
Would you like to select any options [n] ?   Y ↓  
  
Delete ?+.TMP files [y] ?   ↓  
Should I cancel queueing on serious errors [n] ?   Y ↓  
Send output to console in addition to logfile [n] ?   Y ↓

--- REQUEST 1 ---

Specify each disk unit in the LDU

Enter disk unit name:   DPJ0 ↓    (@DPJ0 for stand-among FIXUP)  
Device code [27] ?   ↓    (Omitted for stand-among FIXUP)

Would you like to cancel this request [n]?   ↓  
Would you like to queue up another request [n] ?   Y ↓

--- REQUEST 2 ---

Enter disk unit name:   DPJ21 ↓    (@DPJ21 for stand-among FIXUP)  
Device code [no default] ?   44 ↓    (Omitted for stand-among FIXUP)

\*\*\* This LDU was not in use, fixing is not necessary \*\*\*  
Would you like to cancel this request [n] ?   Y ↓

--- REQUEST 2 CANCELLED ---

Would you like to queue up another request [n] ?   Y

-- REQUEST 2 --

Specify each disk unit in the LDU

Enter disk unit name:   DPJ11 ↓    (@DPJ11 for stand-among FIXUP)  
Device code [67] ?   ↓    (Omitted for stand-among FIXUP)

Would you like to cancel this request [n] ?   ↓  
Would you like to queue up another request [n] ?   ↓

--- 2 REQUESTS QUEUED ---

REQUEST 1 (DPJ0), FIXING LDU 'ROOT' NOW...

REPAIR IN FILE :XDIR:TEST -- PART OF FILE MAY BE MISSING

DONE!

\*\*\* QUEUEING CANCELLED - FIXING OF REMAINING  
REQUESTS MUST BE CONFIRMED \*\*\*

(FIXUP displays this because the  
"Cancel queueing" option was chosen and  
a serious error occurred)

May I continue fixing [n] ?   Y ↓

REQUEST 2 (DPJ11), FIXING LDU 'STRS' NOW...  
DONE!

The line printer listing from this FIXUP session would show request, option, and message information.

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Figure 6-12. Multiple-Request FIXUP Dialog, with Options

) XEQ FIXUP / BUILD=FIX\_DPJO )

AOS/VS Disk Fixer, Rev 7.00.00.00

Verbosity [1] ? )

Error logfile for standalone [console] ? LPB )

Device code [17] ? )

Error logfile for standamong [console] ? @LPT )

Should I report closing files and deleting transients [n] ? )

May I fix it [n] ? Y )

Would you like to select any options [n] ? )

--- REQUEST 1 ---

Specify each disk unit in the LDU

Enter disk unit name: DPJO )

Device code [24] ? )

Is there another disk unit in this LDU [n]? )

If fixing is not necessary for this LDU, would you like to cancel this request? [n] Y )

Would you like to queue up another request [n] ? )

SCRIPTFILE BUILT!

) SUPERUSER ON ) (Superuser is needed to move the  
file to the root directory.)

\*) MOVE / V / R : FIX\_DPJO.FXP ) (Script files for stand-alone  
FIX\_DPJO.FXP FIXUP must be in the root directory.)  
\*)

The dialog above builds the script file. Next, shut down AOS/VS. And try the script file:

SCP-CLI> BOOT 24 )

Operating System Load Menu

Enter choice [2]: ) (Choose option 2)

Technical Maintenance Menu

Enter choice [1]: 6 ) (Choose option 6)

Pathname? FIXUP / SCRIPT=FIX\_DPJO ) (Type script filename)

... (FIXUP runs on the LDU. If it doesn't need fixing, FIXUP will  
cancel the request and terminate.) ...

-- REQUEST 1 (DPJO), FIXING LDU 'ROOT' NOW

... (Minutes pass)

DONE!

The test above ensures that the script file for the master LDU works. The next steps are to create another script file for two other LDUs:

```

) DIR :UTIL )
) XEQ FIXUP /BUILD=FIX_DPF0_DPF1 )

AOS/VS Disk Fixer, Rev 7.00.00.00

Verbosity [1] ? )
Error logfile for standalone [console] ?    LPB )
Device code [17] ? )
Error logfile for standamong [console] ?    @LPT )
Should I report closing files and deleting transients [n] ? )
May I fix it [n] ?    Y )
Would you like to select any options [n] ?    Y )

Delete ?+ .TMP files [y] ? )
Should I cancel queueing on serious errors [n] ?    Y )
Send output to console in addition to logfile [n] ?    Y )

--- REQUEST 1 ---

Specify each disk unit in the LDU
Enter disk unit name:    DPF0 )
Device code [27] ? )

Is there another disk unit in this LDU [n] )

If fixing is not necessary for this LDU, would you like to cancel this request [n] ?    Y )
Would you like to queue up another request [n] ?    Y )

--- REQUEST 2 ---

Specify each disk unit in the LDU
Enter disk unit name:    DPF1 )
Device code [27] ? )

If fixing is not necessary for this LDU, would you like to cancel this request [n] ?    Y )
Would you like to queue up another request [n] ?    )

SCRIPTFILE BUILT!

The dialog above builds the script file for two additional disks in :UTIL. To test the file, type

*) XEQ FIXUP /SCRIPT=FIX_DPF0_DPF1 )

AOS/VS Disk Fixer, Rev 7.00.00.00

--- 2 REQUESTS QUEUED ---

REQUEST 1 (DPF0), FIXING LDU 'UDD' NOW...

*** This LDU was not in use, fixing is not necessary ***

*** REQUEST 1 CANCELLED ***

REQUEST 2 (DPF1), FIXING LDU 'UDD1' NOW

DONE!

```

Figure 6-13. Multiple-Request FIXUP Example, with Script Files (concluded)

Figure 6-13 shows that one LDU didn't need fixing, thus was skipped. The other LDU (DPF1, UDD1) did need fixing and was fixed.

The line printer log file from this FIXUP session would show FIXUP request, option, and message information.

When you've had some experience using both of these script files, run FIXUP with the /BUILDSCRIPT switch again, creating one script file with dialog for all of the LDUs needed to come up on your system. Then bring the system down and make the new script file the default.

### What FIXUP Does

If you tell FIXUP to "fix it," it performs the following tasks on an LDU.

- Closes all open files.
- Checks for multiple-allocation of disk blocks. For each multiply-allocated block, FIXUP deletes all but the first use of the block. Only the block itself (or the file element, if the block is part of a data file) is deleted.
- Checks that each directory data block and each index element is correct; and corrects it if needed.
- Shrinks directories by deallocating (freeing) empty directory blocks.
- Checks that the directory data blocks in each directory are correctly linked; and rebuilds directory data block chains if needed.
- Deletes temporary files in every directory. Temporary files are used by system utilities and are normally deleted when the utilities finish their jobs. Their names have the form ?name.TMP
- Deletes all "transient" files from the peripherals directory (:PER or @), if :PER is on the LDU. These include device entry files, user tape volumes (if any), names of nonmaster LDUs initialized (if any), and IPC files created by other DG software (if any). The next AOS/VS system will recreate the device entry files when it comes up. The tape volume files represented outstanding user tape MOUNT requests: users will need to reissue any outstanding tape MOUNT requests when EXEC is running. The nonmaster LDUs will need to be initialized (INITIALIZE command) when AOS/VS is running; this is often done in the UP macro.
- Recomputes the count of subordinate directories for every directory, the length of every file, and the current size for every control point directory.
- Builds an updated bit map for the LDU.

All this action cleans up the file structure and frees disk space. (When AOS/VS is running, you can use the CLI command **SPACE : ↓** to check the amount of free space in the master LDU.)

## Interpreting FIXUP Messages

FIXUP verbosity 1 messages are designed for user action; they are described in Table 6-3.

FIXUP verbosity 2 and 3 messages concern directory-file structures: chains, disk addresses, multiply-allocated blocks, and invalid or incorrect file block entries (e.g., FIB, FNB). These messages are really intended for DG personnel; you can't do anything about them, so they are not included in Table 6-3.

**Table 6-3. FIXUP Error Messages, Verbosity 1**

| Message                                 | Description and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>ABORT</i><br>message                 | <p>The word <i>ABORT</i> may precede any of several messages.</p> <p>If the message is <i>xxx is off-line</i>, this means a device FIXUP needs to access is off line. The device was specified in a script file. Put the device on line and restart FIXUP.</p> <p>For a message other than <i>xxx is off-line</i>, find "message" in this table and take the action described.</p>                                                                                                                                                                                                                                                                                                                                               |
| <i>ACL DELETED (FILE filename)</i>      | <p>The access control list (ACL) information for this file has been deleted because FIXUP found inconsistencies. FIXUP may rebuild the file, with a <i>FILE REBUILT (FILE filename)</i> message, with a new ACL. If FIXUP doesn't rebuild the file, it will be left with a null ACL. Whether or not FIXUP rebuilds the file, you can assign the desired ACL later, from AOS/VS, if you want.</p>                                                                                                                                                                                                                                                                                                                                 |
| <i>ABOVE VALUE IS INVALID</i>           | <p>FIXUP found an invalid value in a script file. You must edit the script file before you can use it.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <i>CAN'T DELETE ROOT DIRECTORY, ...</i> | <p>The first index block for the root directory contains invalid addresses. FIXUP will not delete this block, because doing so would effectively destroy the LDU directory structure.</p> <p>Run FIXUP again. If this message recurs, then this LDU cannot be fixed <i>in this unit</i>. There may be alignment or other hardware problems. MV/ADES diagnostics are needed; run them on a scratch pack if pack is removable. If there is a correctable hardware problem, the LDU file structure may be intact.</p> <p>If diagnostics show the hardware is okay, the LDU can't be fixed. It may need hardware formatting; in any case, a Disk Formatter Full format must be run on the pertinent disk(s) to recreate the LDU.</p> |
| <i>DEVICE ALREADY IN USE</i>            | <p>The disk unit you specified is in use by AOS/VS. Abort FIXUP; release the unit (command <b>RELEASE ldu-name</b> !); or, for the master LDU, shut down AOS/VS. Then, if you are running FIXUP after a hard error, run a Disk Formatter Partial format on the LDU, and update the bad block table. Then run FIXUP again.</p>                                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>DEVICE IS OFF LINE</i>               | <p>A disk or printer you specified is off line. Put it on line and answer the question again.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

(continues)



**Table 6-3. FIXUP Error Messages, Verbosity 1**

| Message                                                                                                                | Description and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>DISK ERROR, DEVICE n<br/>STATUS s, RETRIES n,<br/>LDU ID = id,<br/>LOGICAL ADDRESS = n<br/>PHYSICAL ADDRESS = n</i> | <p>FIXUP encountered a disk error. It retries up to 20 times (24 octal) before aborting. You might want to note the disk status code <i>s</i> for later reference in the Peripherals manual (see Preface). Even if FIXUP can correct the error and continue, there may be a potential bad block at logical address <i>n</i>; you may want to run a Disk Formatter Partial format later to check (or enter the bad block). (The number <i>n</i> is octal.)</p> <p>If FIXUP cannot correct the error in 20 retries, it aborts. Make sure the disk unit is write-enabled if this applies; if not, write-enable the unit and rerun FIXUP. If the unit <i>is</i> write enabled, see the <i>FATAL DISK ERROR</i> message, next, for recovery action.</p>                                                                                                                        |
| <i>Disk is not mirrored</i>                                                                                            | You specified a mirrored LDU but the disks in the LDU are not mirrored. Rerun FIXUP, specifying only one image.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>DPJn is not part of a mirrored set of images</i>                                                                    | One of the images you specified is mirrored but the other is not. Rerun FIXUP, specifying the correct images, or specify only one image.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <i>FATAL DISK ERROR</i>                                                                                                | <p>If this message follows a <i>DISK ERROR</i> message, it means that FIXUP hit a new bad block (or that the disk unit was not write-enabled).</p> <p>If not write-enabled, write-enable the unit and run FIXUP again. Otherwise, run a Disk Formatter Partial format, with read-only surface analysis, on the LDU. The Formatter should find a new bad block at logical address <i>n</i>. Answer <i>Y</i> to the <i>UPDATE BAD TABLE</i> question. Then, run FIXUP again.</p> <p>If this <i>FATAL</i> message does NOT follow a <i>DISK ERROR</i> message, it means that FIXUP couldn't read the same block twice. This means hardware problems in the disk controller or unit. Try FIXUP again. If it fails the same way, MV/ADES diagnostics may be needed on the disk unit (with a scratch pack in the unit, if removable); contact your DG support organization.</p> |
| <i>FILE file IS NOT A DISK UNIT</i>                                                                                    | The name you entered is not a disk unit name. Respecify.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <i>FILE ACCESS DENIED</i>                                                                                              | You do not have write access to the disk unit you specified. Abort FIXUP, turn Superuser on, and try again.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <i>FILE CLOSED (FILE pathname)</i>                                                                                     | FIXUP found this file open and has closed it.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

(continues)

**Table 6-3. FIXUP Error Messages, Verbosity 1**

| Message                             | Description and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>FILE DELETED (FILE filename)</i> | <p>FIXUP deleted this file. Possible reasons: the File Information Block data was inconsistent; "delete on close" was specified when the file was opened; the file was a link entry with bad directory information; or a data block in the file's parent directory was unreadable.</p> <p>If you want the file, load it from backup media when AOS/VS is running.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>FILE DOES NOT EXIST</i>          | <p>The file does not exist. Try adding the @ prefix to the devicename. Perhaps the unit was not identified to VSGEN (stand-among FIXUP only).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>FILE REBUILT (file filename)</i> | <p>FIXUP rebuilt this file, which means that FIXUP tried to rejoin the file with its File Name Block, ACL block, or other descriptor block.</p> <p>If filename is a normal AOS/VS filename, then FIXUP gave the file its original name. But if the association between filename and file was bad, and FIXUP could not let the file keep its original name, then FIXUP assigned a filename of the form</p> <p>?AAAAAAAAAC</p> <p>The next file rebuilt in this directory could be renamed ?AAAAAAAAD, the next ?AAAAAAAAD, and so on.</p> <p>If the FIXUP log shows one or more <i>FILE REBUILT (FILE ?AAAA...)</i> messages, you should check the files from AOS/VS as follows. Get into the pertinent directory, and type</p> <p>) FILES/AS/S ?AAA- )</p> <p>If only one ?AAA- filename appears, check the FIXUP log for an <i>INVALID FILENAME DELETED</i> message before the <i>FILE REBUILT</i> message, in the same directory. The invalid filename, if shown, is usually the original filename. If so, you can rename the ?AAAAAAAAC file to the invalid filename.</p> <p>If more than one ?AAA- filename appears from the FILES command, check the FIXUP log for multiple <i>INVALID FILENAME DELETED</i> messages. The ?AAA- original filenames are usually the invalid filenames. You can rename the ?AAA- files to the invalid filenames, as appropriate. Don't worry if you see duplicate ?AAA- filenames after the FILES command; just rename each ?AAA- file until you have renamed them all. (FIXUP might have needed to create duplicate ?AAA- names, but renaming the files will make them accessible as usual.) Any file to which FIXUP assigns a new name retains its original type, creation date, and creation time.</p> <p>Lastly, a file mentioned in a <i>FILE REBUILT</i> message may be missing its ACL or User Data Area. Check and correct if needed from AOS/VS.</p> |

(continued)

**Table 6-3. FIXUP Error Messages, Verbosity 1**

| Message                                                                               | Description and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>FILE(S) MAY BE MISSING</i>                                                         | <p>FIXUP found one or more multiply-allocated blocks in this directory, and deleted these; so filenames that FIXUP cannot know about may have been deleted.</p> <p>When AOS/VS is up, check for missing files in this directory (perhaps using the last dump listing); load the missing file(s) from backup media.</p>                                                                                                                                                                                                                                                                                                       |
| <i>FIXUP CHECKSUM ERROR</i>                                                           | <p>Microcode is bad, or the FIXUP or script disk file is unstable. Try reloading microcode via a cold start. If you're trying to use a script file (/SCRIPT=), skip it and run an interactive FIXUP session.</p> <p>If this error recurs, you must load FIXUP from tape or diskette. For tape, get an AOS/VS system tape, mount it on unit 0, type RESET ↵ and BOOT 22 ↵ (or 62 ↵ for an MTD unit); then type 1 ↵ and run this FIXUP on the LDU.</p> <p>For diskette, get AOS/VS system diskette number 1, insert it in unit 0, type RESET ↵ and BOOT 64 ↵; then type DPJ10 ↵, ↵, and FIXUP ↵; and run FIXUP on the LDU.</p> |
| <i>FIXUP INTERNAL ERROR -- message</i>                                                | <p>Run FIXUP again. If this message recurs, reload microcode (power off and on for MV/8000s, a Y ↵ answer to the <i>uCODE ALREADY LOADED...</i> question for other machines). Then run FIXUP again. If it fails again, contact your DG support organization.</p>                                                                                                                                                                                                                                                                                                                                                             |
| <i>INCORRECT DISK FORMAT REVISION NUMBER OF n, m<br/>FIXUP'S REVISION NUMBER IS n</i> | <p>If <i>n</i> is not <i>m</i>, this message means that the Disk Information Block (DIB) is bad, and this disk cannot be fixed. A Disk Formatter Full format is required to make the disk usable by AOS/VS.</p>                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>INCORRECT FORMAT FOR DISK INFORMATION BLOCK</i>                                    | <p>The Disk Information Block (DIB) for one of the disks in the LDU is bad. A Disk Formatter Full format is required to make the disk usable by AOS/VS.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <i>INSUFFICIENT MEMORY FOR<br/>BIT MAP, FIXUP NEEDS<br/>nK WORDS MORE.</i>            | <p>There is not enough main memory for FIXUP to rebuild the LDU bit map. Check the CPUID (Chapter 11) and correct if needed to specify the amount of memory in the machine. Then run FIXUP again.</p>                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <i>INVALID FILE NAME<br/>DELETED (FILE filename)</i>                                  | <p>FIXUP found inconsistencies in the filename-file structure; and it has dissociated the filename from the file. The filename is stored outside the file, so the file itself has <i>not</i> been deleted.</p> <p>Later, within this directory, FIXUP will either reassign <i>filename</i> to the original file, or it will assign a filename of the form ?AAAAAAAAC to the file. If the latter, this message will be followed by a <i>FILE REBUILT</i> message. Proceed as described under the <i>FILE REBUILT</i> message, above.</p>                                                                                      |
| <i>INVALID FIRST LOGICAL ADDRESS, FILE EMPTIED</i>                                    | <p>The starting logical address for this file is too great for the LDU. FIXUP zeros the logical address, effectively emptying the file. Later, from AOS/VS, load the file (or the contents of the directory, if the file named in the message is a directory) from backup media.</p>                                                                                                                                                                                                                                                                                                                                         |

(continued)

**Table 6-3. FIXUP Error Messages, Verbosity 1**

| Message                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Description and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>LDU (DPJn,...) has been selected for FIXUP</i>                                                                                                                                                                                                                                                                                                                                                                                                                       | FIXUP has selected the specified image for fixing. (FIXUP selects the more recent and consistent image, and leaves the mirror in an unsynchronized state.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>LDU sequence number mismatch - not a valid mirror</i>                                                                                                                                                                                                                                                                                                                                                                                                                | You specified two or more multiple-disk LDUs, but then typed the corresponding disk units in each LDU in an inconsistent order. Rerun FIXUP, specifying the disk units in the right order.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>Mirror should be specified</i>                                                                                                                                                                                                                                                                                                                                                                                                                                       | In a multi-disk LDU configuration, you specified a mirrored pair for the <i>Disk unit name</i> prompt but not for a subsequent prompt. Specify both images of the mirror.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Mirror should not be specified</i>                                                                                                                                                                                                                                                                                                                                                                                                                                   | In a multi-disk LDU configuration, you specified a single image for the <i>Disk unit name</i> prompt but then specified two images for a subsequent prompt. Specify only one image.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>Mirror synchronization was in progress - FIXUP cannot run on these disks</i>                                                                                                                                                                                                                                                                                                                                                                                         | You attempted to run FIXUP, and both images have the synchronization-in-progress bit set. Run a Disk Formatter Full format to reclaim the disks. (This error is highly unlikely.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <i>Mirror synchronization was in progress - FIXUP cannot run on LDU-id</i>                                                                                                                                                                                                                                                                                                                                                                                              | You attempted to run FIXUP, but one image was in the process of being synchronized at the time of the failure. Specify the other image of the mirror.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <i>Mirrored LDU is not synchronized</i>                                                                                                                                                                                                                                                                                                                                                                                                                                 | FIXUP will fix the files on the preferred image.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <p><i>NAME BLOCK ADDR. =n</i><br/> <i>ACL BLOCK ADDR. =n</i><br/> <i>SYSBOOT ADDR. =n,...</i><br/> <i>BITMAP AREA ADDR. =n</i><br/> <i>OVERLAY AREA ADDR. =n</i><br/> <i>unit REMAP ... ADDR. =n.</i></p> <p>Followed by one of the these messages:</p> <p><i>The NAME BLOCK message</i><br/> <i>The ACL BLOCK message</i><br/> <i>SYSBOOT message</i><br/> <i>The BITMAP area message</i><br/> <i>The OVERLAY area message</i><br/> <i>unit REMAP area message</i></p> | <p>This abort sequence of messages means that one of the LDU disk's Disk Information Block (DIB) has bad information. (All <i>n</i> numbers are octal.)</p> <p>If one of the messages suggests moving the BITMAP, OVERLAY, or REMAP areas, note all addresses, then run a Disk Formatter Partial format and move the area to a free space on the LDU (or, for REMAP area, to a free space on the disk). Then run FIXUP again. If FIXUP succeeds, you should dump all LDU material and run a Disk Formatter Full format on the LDU; then reload the LDU material. If a Disk Formatter Partial format cannot move the offending area, then the LDU cannot be fixed; a Full format is needed.</p> <p>If the addresses and sizes that FIXUP reports seem reasonable, try FIXUP again. If it fails again, reload microcode (described under <i>FIXUP INTERNAL ERROR</i> message) and try FIXUP again. If it fails again, contact your DG support organization.</p> |

(continued)

**Table 6-3. FIXUP Error Messages, Verbosity 1**

| Message                                                                                                                              | Description and Action                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>NEW SIZE = #n BLOCKS,<br/>#n BLOCKS RECOVERED</i>                                                                                 | FIXUP has calculated a new size for the LDU. If you chose the option to shrink directories, FIXUP also reports the total number of blocks reclaimed on the LDU.                                                                                                                                                                                                                                                |
| <i>NOROOM TO REBUILD FILE,<br/>CHECK FOR A FILE MISSING</i>                                                                          | FIXUP could not find a valid filename for this file, and tried to create a new filename. But FIXUP could not find an unused "slot" for the new name, so it had to delete the file. If FIXUP reported an <i>INVALID FILE NAME DELETED (FILE filename)</i> message for this directory, the invalid filename may be the file FIXUP deleted. Check from AOS/VS; then load the missing file from backup media.      |
| <i>Not a valid mirror</i>                                                                                                            | You specified a mirror for FIXUP to fix, but FIXUP has determined that the images are not normally mirrored. Specify the correct set of images.                                                                                                                                                                                                                                                                |
| <i>ONLY 602MB MODEL 6214<br/>DISKS MAY BE IN THIS<br/>LDU, DEVICE unit</i>                                                           | Any LDU that includes a 602-megabyte model 6214 disk can include <i>only</i> such disks. The Disk Formatter enforces this restriction. Retry FIXUP and be sure you enter the correct disk unit names. If FIXUP fails again, the LDU cannot be fixed; a Disk Formatter Full format is needed.                                                                                                                   |
| <i>PART OF FILE MAY BE<br/>MISSING</i>                                                                                               | FIXUP found one or more multiply-allocated file elements in this file, and has deleted them. From AOS/VS, see if the file has the correct length and content. If it is not intact, load it from backup media.                                                                                                                                                                                                  |
| <i>QUEUEING CANCELLED -<br/>FIXING OF REMAINING<br/>REQUESTS MUST BE<br/>CONFIRMED</i><br><br><i>May I continue<br/>fixing [n] ?</i> | The last LDU you specified has been fixed (unless FIXUP aborted), but FIXUP encountered a noteworthy error on it. If the log shows that only a few errors (like recoverable disk errors or one or two file deletes) occurred, type Y ) to have FIXUP fix the next LDU(s). If there are many serious errors, there may be disk controller hardware problems; and you may want to have FIXUP stop by pressing ). |
| <i>RENAMED TO newfilename<br/>(FILE oldfilename)</i>                                                                                 | The file named in <i>oldfilename</i> didn't hash correctly. FIXUP renamed it to <i>newfilename</i> , of the form ?AAAAAAAAC. You can rename the file to its original name later, from AOS/VS. (If, from AOS/VS, you see duplicate ?AAA-filenames in this directory, rename the FIXUP-renamed files as described in the <i>FILE REBUILT</i> message, above.)                                                    |
| <i>REPAIR IN DIR pathname<br/>-- message</i>                                                                                         | This message precedes one of several other messages shown in this table. Read message and take the action described.                                                                                                                                                                                                                                                                                           |
| <i>REPAIR IN FILE pathname<br/>-- message</i>                                                                                        | This message precedes one of several other messages shown in this table. Read message and take the action described.                                                                                                                                                                                                                                                                                           |
| <i>Script file already exists. Re-<br/>place old copy [n]</i>                                                                        | This occurs when you want to build a script file whose name already exists. If you want to edit this file, type Y ). If you want to keep the file as is and create a different file, press ); FIXUP will terminate and you can specify a different script filename (/BUILD=filename switch).                                                                                                                   |
| <i>Script file does not exist. Enter<br/>script filename [console]:</i>                                                              | The script file whose name you specified with the /SCRIPT= switch does not exist. If you remember the correct filename, type it and press ). If you can't remember the name, just press ) and FIXUP will lead you through an interactive session, then do the fix.                                                                                                                                             |

(continued)

**Table 6-3. FIXUP Error Messages, Verbosity 1**

| Message                                                         | Description and Action                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>SCRIPT FILE HAS BEEN CORRUPTED</i>                           | FIXUP cannot use the script file you specified. Run an interactive session.                                                                                                                                                                                                                                                                          |
| <i>Script file must be in the root</i>                          | For standalone use, a script file must be in the root directory. Run an interactive FIXUP session, then move the script file to the root from AOS/VS.                                                                                                                                                                                                |
| <i>The xxxx BLOCK ...</i>                                       | See the <i>NAME BLOCK</i> message.                                                                                                                                                                                                                                                                                                                   |
| <i>The LDU is not mirrored as stated in script file</i>         | You ran FIXUP using a script file for input, but the disk is not mirrored. Either build a new script file, or run FIXUP interactively.                                                                                                                                                                                                               |
| <i>The LDU selected for fixing differs from preferred image</i> | You ran FIXUP using a script file for input. FIXUP aborted because the LDU selected in the script file is less recent than the LDU FIXUP has determined needs fixing. Rerun FIXUP interactively, specifying the other image.                                                                                                                         |
| <i>TOO MANY DISKS IN USE</i>                                    | An LDU cannot include more than eight disks, but you have entered more than eight disk unit names, and FIXUP has verified that each disk has the same LDU ID.<br><br>Retry FIXUP, making sure that you enter only the correct disk unit names for the LDU. If this message recurs, this LDU cannot be fixed; a Disk Formatter Full format is needed. |
| <i>TRANSIENT FILE (FILE filename DELETED)</i>                   | FIXUP has deleted transient file "filename". A transient file is a file that would have been deleted anyway in the course of normal system operations (further defined in section "What FIXUP Does").                                                                                                                                                |
| <i>USER DATA AREA DELETED FILE filename)</i>                    | FIXUP found inconsistencies in this file's User Data Area (often used for printer formatting) and it has deleted the User Data Area.<br><br>From AOS/VS, you can either LOAD/DELETE the file from backup media or recreate the User Data Area with the FCU utility (in directory :UTIL:FORMS).                                                       |
| <i>Warning — disk is normally mirrored</i>                      | You specified only one image of a mirrored LDU. In order to determine which image is "preferred," FIXUP needs to know about both images. Continue if you know the image you have specified is more recent, or rerun FIXUP and specify both images.                                                                                                   |

(concluded)

## Power Failures

Unless your computer has a backup battery, it will lose the contents of volatile memory on a power fail. On a brownout (serious power drop) or overtemperature condition, the computer may cut its own power. In either case, without battery backup, microcode must be reloaded, and someone must run FIXUP on all initialized LDUs when full power returns.

There are two types of backup battery. One type (model 8746) provides full backup (power to the entire CPU chassis, IACs, MCPs, and fans). The other provides partial backup (power to main memory and SCP). Each type can provide power for only a limited time.

With full backup, AOS/VS will try to restart all critical devices (like disks and IACs) when power returns; if this succeeds, it will continue running as before the power fail. For full backup to work, all the following conditions must be true:

- The CPU must have a full backup battery;
- power must return before the battery is exhausted;
- BBU with full backup and auto restart must have been chosen at VSGEN;
- the CPU LOCK switch (if any) must have been in the ON or LOCK position when power went down. This enables transfer to the battery.

With partial battery backup, AOS/VS will start its ESD routine when power returns. For partial backup to work, the computer LOCK switch (if any) must be in the ON or lock position when power goes down.

### **Power Fail Recovery**

When power returns, look at the system console.

- If the system console shows messages like

*There has been a POWERFAIL*

*Now restarting device n unit n*

*...*

- ) (Returns to AOS/VS CLI prompt or prompt of other program running under CLI.)

This means that your system has full backup, and AOS/VS has fully recovered. The power outage is recorded in the SYSLOG log file, if logging was on at the outage.

If AOS/VS cannot restart a device, it will tell you so. If the device is a disk, you will probably need to run FIXUP on it.

*Any power outage, regardless of recovery, has the following effects:*

1. It eliminates vacuum to magnetic tape units; so if type MTB or MTD units were active on your system, someone must press BOT on them to recreate the vacuum, then press ON LINE.
  2. It invalidates any tape write that was occurring when power went down; the write must be restarted from the beginning.
  3. It takes line printers off line; and someone must put them back on line.
  4. It takes the system clock off line for the duration of the outage; so someone must update the system time, using the TIME command from the master CLI process, PID 2, or from a process with System Manager privilege.
- If the system console is displaying messages like

*Power back to normal*

*Do you want a memory dump (to submit a Software Trouble Report) (Y or N)? [Y]*

This means that someone generated the system and deleted Full BBU. Wait until your disk's READY lamps are lit; and type N ). The ESD program will run as described above. If ESD succeeds, you can bring up AOS/VS immediately as shown under "Warm Start". The power outage is recorded in the SYSLOG log file, if logging was on when power went down. Tape units and line printers will need attention as above.

- If you see the SCP-CLI prompt, try to reset and start at 50:

```
SCP-CLI>      RESET ;
SCP-CLI>      START 50 ;
```

*AOS/VS processing aborted*

*Do you want a memory dump (to submit a Software Trouble Report) (Y or N)? [Y]*

Type N ;. The ESD program will run as described above. If it succeeds, you can restart immediately as shown above under “Warm Start”: RESET, BOOT device-code, etc. If ESD fails, run FIXUP on the LDU.

- If the system console is displaying power up messages like

*Operating System Load Menu*

*1. Continue immediately ...*

*...*

*Enter choice [1]:*

*or*

*MV/4000 READY*

this means that power has stopped to the computer and that contents of volatile memory have gone away. You must cold-start the system; then, run FIXUP on all initialized LDUs as described under “Running FIXUP”. Tape units and line printers will need to be put back on line, and any aborted tape writes restarted.

## What Next?

This chapter described common SCP commands, CPU switches, system startup, and normal shutdown. It also covered abnormal shutdown: deadlocks, panics, and hardware problems — and it showed how to handle these with ESD and FIXUP. In short, this chapter covered the nitty-gritty steps to start, run, stop, and restart the system.

At first light, startup and shutdown seem complex — but they are really not; reset, BOOT device code, wait for time-out, set date/time if asked; and accept the default answers for everything else. On abnormal shutdown, type N ;; if ESD fails, run FIXUP on your LDU(s). On power restore, proceed as usual (with full battery backup), run ESD and warm start (partial backup), or load microcode and run FIXUP (no backup).

Now that you know how to start up and shut down your AOS/VS system, you may want to learn more about PREDITOR, EXEC, other runtime tools, or system management, described in later chapters.

End of Chapter



# Chapter 7

## About the PREDITOR Profile Editor

Read this chapter

- when you want to be more specific than in Chapter 5 about privileges for users on your system;
- when you want to understand the privileges that you can give or withhold from a user.

PREDITOR profiles, along with EXEC, provide the base for the multiuser environment. Profiles allow only authorized persons to use the system, without trespassing on other persons' or system files.

If you created your system's multiuser environment (described in Chapter 5), you already have some experience with PREDITOR. Chapter 5 described how to create a privileged operator profile and many general-purpose user profiles. As a base for the user profiles, the reader edited PREDITOR's default profile, then used the new default values as a basis for each user profile.

*This* chapter describes all PREDITOR commands — alphabetically. These commands allow you to create, edit, delete, and rename profiles, among other things. For ease of use, this chapter duplicates some of the material in Chapter 5. The major sections are

- About PREDITOR
- BYE Command
- CREATE and EDIT Commands, with Comments on Disk Space Control
- DELETE Command
- HELP Command
- LIST Command
- QUESTIONS Command
- RENAME Command
- USE Command
- PREDITOR Error Messages

## About PREDITOR

The PREDITOR program file, PREDITOR.PR, is in directory :UTIL. It is a privileged program: only users with Superuser privilege can run it, but they do not need to turn Superuser on in order to execute PREDITOR.

When it starts up, PREDITOR checks to see if the user directory directory (:UDD) exists. If :UDD does not exist, PREDITOR creates it. Then, for every user profile you create, PREDITOR creates a user directory in :UDD, and the system creates a profile in the user profile directory, :UPD. The user directory and profile have the username you gave to PREDITOR. When you delete, edit, or rename a profile, PREDITOR makes the appropriate changes in file :UDD or has the system change the profile in :UPD.

When a person tries to log on to a console, or submits a batch job, EXEC checks the profile before it creates a user process to serve that person. If there is no valid profile, EXEC rejects the user or job. If there is a valid profile, EXEC creates a user process with the privileges defined in the profile. While the user process runs, it can exercise only these privileges. Thus, profiles are central to multiuser system operation.

### User Access Control List

When you create a new profile or rename an old one, PREDITOR sets the Access Control List (ACL) of the user directory to username,OWARE. This ACL gives the user *all* access privileges to the directory. No one else, except a superuser, can access it at all. This gives the user privacy, security, and unique access to all files and directories that he or she may create.

### Executing PREDITOR

PREDITOR is in directory :UTIL, so, unless the working directory is :UTIL, your search list must include :UTIL. (The UP macro does this for the master CLI and its sons, so you need not do it if the multiuser environment is up.)

To execute PREDITOR, type

```
) XEQ  PREDITOR )
```

*AOS/VS User Profile Editor Rev n date time*

*Command:*

PREDITOR is ready for a command.

If you want to change an answer that you previously gave to PREDITOR, press the uparrow cursor control key ↑ or type ^ (press SHIFT and the 6 key) until you reach the bad entry. Then type the desired answer and proceed. For example,

|                                    |            |                                          |
|------------------------------------|------------|------------------------------------------|
| <i>Use IPC [No] (Y, N, or NL)</i>  | <i>Y )</i> | Type answer.                             |
| <i>Use console: ↑</i>              |            | Press uparrow to correct previous entry. |
| <i>Use IPC [Yes] (Y, N, or NL)</i> | <i>N )</i> | PREDITOR backs up and you change it.     |

If — at any point — you want to return to the *first* PREDITOR question, press CTRL-C CTRL-A.

### Username, Passwords, and Network Access

This section is similar to the section of the same name in Chapter 5. It's repeated here for your convenience.

The username you specify for each user is important. The username is the only trace to the person who's responsible for the account. Usernames persist over long periods of time; they are not often changed (although PREDITOR does have a command to rename a profile).

Generally, your system should have a unique username for every person; more than one user should not use a single account. If, for any reason, you want to place a set of users in a group,

think up a special identifier (like a suffix) for the usernames and make the identifier part of each username. Username groups are further explained in Chapter 16.

If your system will be part of a XODIAC network, your choice of username, password, and password encryption will affect each user's ability to access other network hosts. At some point, you'll need to coordinate names and passwords with other systems. (If you won't be using networking, skip the rest of this section and the next section.)

There are several parts of XODIAC (called agents) that provide different services. The resource management agent (RMA) allows users on one host to access devices and files on another host. The file transfer agent (FTA) can transfer files from one host to another. For access to occur, RMA and FTA require that

- the user have a valid profile on both systems, *with the same username and the same password* on both systems;
- the user have the privilege *Access local devices from remote machines* on the remote host;
- the user have appropriate access (ACL) to the file or device.

Another XODIAC agent, the Virtual Terminal agent (VTA) requires that

- the user have a valid profile (but not necessarily the same username and password) on both systems;
- the user have the privilege *Use virtual console* on the remote system;
- the user have appropriate access (ACL) to the file or device.

Without the first two items for either agent, the user will receive an *invalid username-password pair* message on attempted access.

If you will be using DG's CEO system over a network, be aware that CEO Mail allows different OP passwords on different systems (it doesn't use RMA or FTA). However, if the user wants to use a remote printer from CEO, the OP passwords must be the same on both systems (for remote printing, CEO depends on RMA).

## Password Encryption

With AOS/VS Revision 7.00, PREDITOR can encrypt a password before storing it. From a security standpoint, this is very desirable.

But, if the user will rely on XODIAC, encrypting the password may prevent RMA and FTA access to remote hosts (because, unless both passwords are encrypted, the two password strings won't be identical). If any remote host runs a revision of XODIAC that doesn't support encryption, encrypting the password locally will prevent RMA access to that host. (Unless your XODIAC Release Notice says that your revision supports encryption, assume it is not supported.) Also, if any remote host runs an AOS/VS Revision before 7.00, or runs AOS, encrypting the password will prevent RMA access to that host.

For a CEO user on a network, encrypting the password won't prevent the user from accessing other hosts via CEO Mail. It may prevent a user from using remote printers, since CEO relies on the RMA agent to control access to remote printers.

Once encrypted, a password can't be decrypted. If a password is encrypted and you later decide to have it stored unencrypted, you must edit the profile, think up a new password and type it, and say No to the *Encrypt* question. Then, tell the user the new password. (He or she can change it if desired.)

For a network user, you may decide against encryption, or you may decide to encrypt in the user's profile on all systems (for the latter, all systems must be running AOS/VS Revision 7.00 or later). Or, you might maintain two accounts for the user: one secure local account, with password encrypted, and one general-purpose account, with password unencrypted, to serve for network access. For users who store highly sensitive material, the two-account approach is a good idea, although it involves extra work.

## PREDITOR Username Templates

After profiles have been created, you can edit, delete or list them by *template*. Username templates work much the same way as filename templates: + indicates all characters, – indicates all characters except a period, and \* indicates *one* character. (But you can't use more than one template character at a time.)

PREDITOR does not sort usernames alphabetically. But, if you're editing and PREDITOR presents a profile you don't want to edit, you can press ^ (caret, SHIFT-6) at the *Password* question and PREDITOR will skip to the next username. For example:

) X PREDITOR )

...

Command: Edit )

(Specify Edit.)

Username: A+ )

(Edit profiles that start with A.)

Username: ALLEN

(PREDITOR displays profile name to edit.)

Password change [No]? (Y or NL) ^

(You don't want to edit ALLEN's profile; to skip to the next, press ^.)

Username: ABBY

(PREDITOR displays another profile name.)

Password change? [No] (Y or NL) )

(You *do* want to edit this profile; press ) to continue.)

...

(Edit profiles.)

Used with the LIST command, a template tells PREDITOR to list all values in all matching profiles. With the DELETE command, PREDITOR displays each profile name for confirmation before deleting the profile.

You can cancel any template operation and return to the *Command:* prompt by typing CTRL-C CTRL-A.

## BYE Command — Leave PREDITOR

BYE ) terminates PREDITOR and returns you to the CLI. It works only when PREDITOR is asking for a command. (As with any program, you can exit by aborting with CTRL-C CTRL-B — but a better solution is to use CTRL-C CTRL-A to return to the *Command:* question.)

For example

Command: BYE )

Terminating date time

)

## CREATE and EDIT Commands — Create or Edit a Profile

The CREATE and EDIT commands allow you to create a new profile and edit an existing one. After either command, PREDITOR asks for answers to a series of parameter questions. You can suppress questions temporarily with the QUESTION command.

PREDITOR displays *[default]* values and valid answers (in parentheses) after each question. For the CREATE command, *[default]* is the value in PREDITOR's default profile, unless you edited the !DEFAULT! profile or told PREDITOR to use another profile with a previous USE command. For the EDIT command, *[default]* is the current value in the profile you're editing. For example, it might say

Initial IPC file [:UTIL:LOGON\_CENTRAL.CLI] change? (Y or NL)

which means that the default IPC file for this profile is :UTIL:LOGON\_CENTRAL.CLI and that you can answer Y ) to change it or press ) (NEW LINE) to take the default.

When you edit a profile and change a value, the new value becomes effective the next time the user logs on. In other words, if you change a value while a user is logged on the system, the new value will not take effect until the user logs off and logs on again.

## CREATE/EDIT Questions

When PREDITOR asks for a command, you can answer **CREATE** ↵ (or abbreviation) or **EDIT** ↵ (or abbreviation). Then PREDITOR asks the following series of questions.

### *Username:*

When creating a profile, you must type a username; there is no default. Valid usernames are 1 to 15 valid filename characters long. When editing a profile, you can type a username or a template that includes one template character. PREDITOR templates are described earlier. They work with the **EDIT**, **DELETE**, and **LIST** commands.

If anyone on another DG system will use your system (or vice-versa) over a network (for example, if your local CEO® Electronic Mail and Calendar databases will be shared with remote DESKTOP GENERATION™ system users), the AOS/VS username and password must be the same on all systems. For CEO, the CEO user ID and AOS/VS username must be the same on all systems. If the username and CEO user ID (if any) aren't the same, and the password isn't the same, certain operations (like CEO mail or moving files) won't work.

If a network user's profile is renamed, it must also be renamed on other systems; the CEO profile (if relevant) must be recreated with a new user ID. Thus, in a network, renaming a profile might entail a lot of work. For a password change, if a user changes a password locally, perhaps you can have him/her log on to remote system(s) and change it there also.

For a user who will simply *log on* to another system in the network, the username and password can differ between systems.

As part of itself, PREDITOR contains a default profile under the username of **!DEFAULT!**. You can edit **!DEFAULT!** just as you can any profile to change default values. This can speed up the creation of real user profiles by allowing you to answer most questions with ↵. The new default values you place in **!DEFAULT!** remain only until PREDITOR terminates; then, the original defaults return. **!DEFAULT!** is simply a convenience; no user profile or directory is associated with it.

When you want to edit a profile and can't remember the username, back up to the *Command:* question with ↑. Then type **BYE** ↵ to exit, and display the names of all users by typing

```
) SUPERUSER ON ↵
*) F/S ↵ :UDD:+ ↵
```

... (CLI displays sorted names of all user directories) ...  
\*)

### *Password change? (Y or NL)*

When you create a profile, you must give a password. When you edit one, you can type **Y** ↵ and enter the new password or press ↵ to retain the old one.

Each user must know his or her password to log on. So if you change it, be sure to let the user know. If a user forgets his/her password, you can simply enter a new one; you need not know the old password to change it with PREDITOR. A password must be 6 to 15 characters long and can be any combination of the following characters: upper- or lowercase letters (treated as uppercase), numbers 0 through 9, and all printing characters except uparrow.

By default, a user can change his or her password at log on, by pressing the **ERASE PAGE** key instead of ↵ after typing the old password.

#### *Encrypt password [default]*

PREDITOR can encrypt a user's password before storing it. From a security standpoint, this is desirable because no one — not even a superuser — can figure out an encrypted password.

But if the user relies on a network to other DG systems (your system runs XODIAC), encrypting the password may prevent certain kinds of access to other hosts. Encrypting the password won't affect access to other hosts by CEO Mail, but it may affect CEO access to remote printers. Username, password, and network issues are explained earlier in this chapter.

Once encrypted, a password can't be decrypted. If a password is encrypted and you later decide to have it stored unencrypted, you must edit the profile, think up a new password and type it, and say No to the *Encrypt* question. Then, tell the user the new password and have him or her change it if desired.

Having considered these issues, decide on password encryption. If you want the password encrypted, choose Yes. To take the default, press *;*; to change it, type the new value and *.*

#### *Initial IPC file [default] change? (Y or NL)*

IPC means InterProcess Communication. The IPC file is a file the system will execute when this user logs on. It exists to communicate with the user or user's initial program, to set search list, default access control list, and so on. It's not required but is very useful.

Generally, the most flexible way to handle this is to have one, central, IPC file that executes individual log-on macros in each user's directory. The logon macro in each user's directory can have a specific sequence of CLI commands — which may execute another program like CEO or BASIC.

The central IPC filename can be the same for all users. Only the first 512 characters are displayed, so the central file shouldn't exceed 512 characters. The user logon macro resides in each user's directory, pathname :UDD:username:filename. CLI users can create or edit the user logon macro file as desired, if they don't like the default values imposed by the central macro. Chapter 5, section "Making Life Easier for Users," shows how to create a central logon macro and user macro, and how to put the user macro in user directories.

If you want a user to come up in CEO, you can use the CEO-supplied macro CEO.STARTUP.CLI in user's logon macro. The CEO macro sets the search list to include :UTIL:CEO\_DIR, then chains to the CEO control program, CEO\_CP.PR. By chaining, the macro ensures that when the user leaves CEO, he/she will be logged off the system (without returning to the CLI). Chaining also minimizes the number of processes on the system. To choose this macro, edit the user logon macro to end with  
:UTIL:CEO\_DIR:CEO.STARTUP.CLI *.*

If — instead of the CEO system — you want a user to come up in the CEO Word Processor, specify a different CEO-supplied macro. End the user logon macro with  
:UTIL:CEO\_DIR:CEO.WP.STARTUP.CLI *.*

To select the default IPC file (originally, none), press *.*. Otherwise, type *Y .* and PREDITOR will ask for the new name, 0–63 characters. You must type the full pathname from the root, for example: :UTIL:LOGON\_CENTRAL.CLI *.*

#### *Program [default] change? (Y or NL)*

*Program* is the program the system will execute for the user when he/she logs on or submits batch jobs. If the user is allowed no sons (asked later), he or she will be restricted to this program — which may be just what you want.

The default program, :CLI.PR, is a good general-purpose choice. The CLI allows users to access text editors and build programs in all DG languages. It also allows users to execute

other programs like BASIC changes. Take the default unless you want a non-CLI program run automatically — as for a BASIC user.

For a program other than the CLI, type `Y` and the full pathname, with `.PR` suffix, of the program you want. For BASIC, there is often a BASIC directory off the root or `:UTIL`, if so, answer `Y`, then type `:BASIC.PR` or `:UTIL:BASIC.PR` to have the user come up in BASIC. (To work in BASIC, the IPC file must be a BASIC program.) To ensure that the user stays in BASIC (or other program), you must specify no sons, to the question *sons*, asked later in the dialog.

On a DS/7000-series system, if the user will log on to a pixel-mapped (graphics) console, you can have him/her start in DG's window management program, `DG/VIEW`. `DG/VIEW`'s pathname is `:DGVIEW_UTIL:SYSTEM:DGVIEW.PR`. Windowing is further described in "Windowing with `DG/VIEW`" in Chapter 15.

*Create without block [default] change? (Y, N, or NL)*

A *Create without block* value of Yes (Y) allows the user to have at least two processes running concurrently. By default, the creating (father) process is blocked when it executes the son; this means that the father is eligible to be swapped, which may speed up the system. But if the user needs DG's SWAT debugger (for FORTRAN 77, PL/I, COBOL, C, or PASCAL programs), he or she must have the create without block privilege.

CEO users must have this privilege also; and programmers often need it. Other users usually *don't* need this privilege. Take the default or change it as appropriate.

*Use IPC [default] change? (Y, N, or NL)*

IPC privileges allow a person to use IPC calls, available in assembly language and some higher-level languages. IPC privileges are needed wherever two or more active processes must communicate. For IPC usage to work, a user may also need *Create without block*, if two or more of *that user's* processes are to use IPC.

CEO users must have the USE IPC privilege; most other people don't need it. Take the default or change it as appropriate.

*User console [default] change? (Y, N, or NL)*

A user must have this privilege to log onto a console under EXEC. Without it, he or she may be able to submit batch jobs via a card reader. But nearly all users need this privilege. Take the default or change it as appropriate.

*Use batch [default] change? (Y, N, or NL)*

A user must have this privilege to submit batch jobs via CLI `QBATCH` or `QSUBMIT` commands, or via a card reader. Depending on your system, you may or may not want to encourage batch jobs. Take the default or change it as appropriate.

*Use virtual console [default]? (Y, N, or NL)*

This question, and the next, are meaningful only if your system will run DG's XODIAC networking system. A Yes (Y) value enables the user to log onto your system from a virtual console or use the XODIAC loopback feature.

If this user has (or will have) Superuser privilege, he or she should not have this (virtual console) privilege, or the next privilege. Superuser with either network privilege allows a user to explore the entire system from a terminal on a remote system.

Take the default or change it according to your wishes for this user.

*Access local resources from remote machines [default]? (Y, N, or NL)*

A Yes (Y) value allows a remote user to access files and devices like tapes and printers on your system. This is different from being able to log on, as covered in the previous question. For remote resource access, the user must have a profile with the same username and password encrypted or unencrypted (but not necessarily the same privileges) on *both systems*. Details are in *Managing and Operating the XODIAC<sup>TM</sup> Network Management System*.

As mentioned above, superusers should not have this privilege. Depending on what you want this user to do from a remote system, take the default or change it.

*Change password [default]? (Y, N, or NL)*

In general, users should be able to change their own passwords, per a Yes value. But if this is a GUEST profile, to allow guests to use your system, the password must be public; the value should be No (N) to prevent a guest from changing the password and barring other guests from the system. If this value is No, the only way to change the password is with PREDITOR. Take the default or change it as desired.

*Unlimited sons [default]? (Y, N, or NL)*

A user who can create unlimited son processes has the potential for dominating the system. Each process requires some CPU time and disk I/O. So far as possible, it's a good idea to minimize the number of processes. Generally, this value should be No. Take the default or change it as you wish. If you type Y ), PREDITOR skips the next question.

*Sons [default] change? (Y or NL)*

BASIC and clerical data entry users can get along with few sons: 1 or 2. To limit a user to the program specified in the *Program* question, choose 0 sons. CLI users who want to execute a non-CLI son process from within a son (instead of going back to the CLI to do it) need at least 5 sons. For CEO users also, 5 sons is a good answer. For other users, 3 sons is a good general-purpose value. It will allow a user to develop programs and use the SWAT debugger; it's a minimum for serious application programmers who will use FORTRAN 77, PL/I, COBOL, C, or Pascal.

To take the default, press ). To change it, type Y ); PREDITOR will say *New(0-1023)* and you will type the new number and ).

*Change priority [default]? (Y, N, or NL)*

Processes compete for CPU time, and processes of the same type with higher priority (closer to 0) get preference. But a user process that can change priority can monopolize the system. Also, changing priority might change group status (explained in Chapter 15). So, unless a process *must* be able to change its own (or a son's) priority, the value should be No.

To take the default, press ). To change it, type Y ).

*Change type [default]? (Y, N, or NL)*

Processes can run as one of three types: resident (always in main memory), pre-emptible (generally in main memory, but swappable if blocked), and swappable.

Swappable is the most common type. It is the default for user and other processes. Resident is quite rare — often used only for the AOS/VS peripheral manager and AOS/VS itself. If a



process can change type, it can become resident, and perhaps hobble the system. So, unless you know that a process must be able to change its type, this value should be No. To take the default, press **↓**; to change it, type the new value and **↓**.

#### *Change username [default]? (Y, N, or NL)*

This privilege lets a process create a son with a different username. The ability to change username allows the user to *become* any other user, with OWARE access to that user's files. With the username OP, the user can issue EXEC commands (allowing it to terminate user processes or change priority or type). Also, any user with this privilege can't be traced; he or she can try to break security under any username.

For user files to remain secure, and logging to be useful, every user on your system should have his/her unique username — and be unable to change it. Unless you know a process must be able to change its username, this value should be No. If you want a secure system, do not give users this privilege. To take the default, press **↓**; to change it, type the new value and **↓**.

#### *Access devices [default]? (Y, N, or NL)*

This privilege allows a process to bypass operating system safeguards and define devices (via call ?IDEF), access the devices, and wire pages via privileged hardware I/O instructions. For the privilege to work, the user also needs *Change type* privilege (above) to create a resident process.

Never give this privilege unless the user is a trusted system programmer who needs it to write or debug device drivers. Network and DG/SNA processes need it, but they can be given it from the master CLI (via the PROCESS command with /ACCESSDEVICES switch). Do not give this privilege to users if you want a secure system. To take the default, press **↓**; to change it, type the new value and **↓**.

#### *Superuser [default]? (Y, N, or NL)*

This privilege allows a user process to bypass all file access controls and execute, read, modify, or delete any file on the system. Only people who must bypass ACLs (to create profiles or do backups, for example) should have Superuser privilege. The master CLI needs superuser powers to control the system; but most other users do not need it, and they shouldn't have it.

Superusers can run PREDITOR to change their own profiles; and they can learn other users' passwords from profile files. The Superuser privilege — along with Change username — is the privilege most threatening to system security. Don't give the Superuser privilege to users if you want a secure system. The value should be No. To take the default, press **↓**; to change it, type the new value and **↓**.

#### *Superprocess [default]? (Y, N, or NL)*

This privilege allows a user process to issue process control commands against any process. It can block a process, change process priority, become resident, or terminate any process, including the master CLI, which would bring down the entire system. Unless you know that a process needs Superprocess, the value should be No. Don't give Superprocess to users if you want a secure system. To take the default, press **↓**; to change it, type the new value and **↓**.

#### *System manager privilege [default]? (Y, N, or NL)*

This privilege allows the user to initialize and release job processors (relevant only with a computer that has more than one job processor), and to create and delete process classes and logical processors. System Manager privilege also allows a user process to issue AOS/VS

system calls that change the system date, time, ID (SYSID), and bias factor. Also, the user can start or stop the system log (SYSLOG) and issue EXEC commands. These privileges have significant impact on security (although some expertise is needed to write a program that exploits them).

Use of classes and privileged system calls can affect the performance and security of your system. Generally, the master CLI issues all commands that require the System Manager privilege; do not give it to any other user unless he or she really needs it. (For example, a user needs it to run the optional Class Assignment and Scheduling Package (CLASP)).

To take the default, press **Y**. To change it, type the new value and **Y**.

#### *Modem [default]? (Y, N, or NL)*

If you want this user to be able to log on via a modem, this value should be Yes. Superusers should never be able to use a modem, for the two privileges allow the user to explore the entire system from his own home or wherever a remote console is placed. If a person must be a superuser, give him two profiles — one with Superuser privilege and one with modem privilege. To take the default, press **Y**; to change it, type the new value and **Y**.

#### *Change address space type [default]? (Y, N, or NL)*

This privilege allows the user to execute 16-bit programs in addition to 32-bit programs. There are a lot of 16-bit programs around — including text editors. So, generally, this value should be Yes. To take the default, press **Y**; to change it, type the new value and **Y**.

#### *Change working set limit [default]? (Y, N, or NL) Y*

This privilege allows the user to run programs that change the system default working set limit. By default, AOS/VS adjusts the working set parameters dynamically, based on the process' type, page fault history, and general system overhead.

Certain application programs, under unusual conditions, may need to change the default working set limits. The CONTEST confidence test, described later in the book, *does* need to do this. For the user process that runs such programs, the value must be Yes. Also, if you want to restrict a process's working set or give it a generous minimum working set (later questions), the value must be Yes; otherwise, the profile will be inconsistent and won't work. In other cases, the value should be No. To take the default, press **Y**; to change it, type the new value and **Y**.

#### *Priority [default] change (Y or NL)*

All user processes are created as swappable processes, with the priority given here. We recommend 2, the original default. If a user process needs to change priority or type — of itself or its sons — it can do so if you give it the pertinent *change* privilege above. For the value 2, press **Y** (or type 2 **Y**) and skip to the next question.

If you don't want the default priority, type **Y** **Y**. PREDITOR asks

#### *Let system assign? (Y, N or NL)?*

*Let system assign* means creating the process with its father's (EXEC's) priority. Generally, this is a bad idea, since EXEC is not a typical process and some sites give it a high priority for better queuing performance. But if you want the user process created with EXEC's priority, answer **Y** **Y** to this question.

If you say **N** **Y** or **Y** to this, PREDITOR will ask for the specific priority, range 1–511.

You can specify any priority, range 1–511. If you specify 1, 2, or 3, the user process will be created as a group 2 (heuristically scheduled) process, with first, second, or third priority within group 2. Priority 2, the original default, gives the same results as the default in earlier AOS/VS revisions.

If you want the process to have the highest priority in group 2, specify 1. If you want the process to have the lowest priority in group 2, specify 3.

If you want this user process to be created as a group 1 or group 3 (round-robin scheduled) process, specify a priority that is unique within its group range. If you took the VSGEN defaults, any priority from 4 through 255 is unique and will produce a group 1 process. Any priority from 258 through 511 is unique and will produce a group 3 process.

#### *Max qpriority [default] change? (Y or NL)*

Users type Q-series commands to print files and submit batch jobs. Priority 0 is the default and highest priority for these. If all users have the same QPRIORITY, they will receive equal treatment on their Q-series jobs. Generally — unless you want to prioritize different users' Q-series requests — keep the same value — usually 0. To take the default, press *↓*. To change it, type *Y ↓*; PREDITOR will ask *New(0-255)* and you'll type the new value and *↓*.

#### *Disk quota [default] change? (Y or NL)*

This sets the limit on the size of the user directory that PREDITOR will create and that the system will maintain for this user process. (But this PREDITOR-assigned limit doesn't affect users in CEO.)

A good general-purpose amount of disk space is 15,000 blocks. If this user process will serve CEO, guest, or other casual users, you might want to specify less space (perhaps the original default, 500). If this user process will serve many people (perhaps data entry clerks or students), you might want to specify a larger figure (e.g., 100,000).

If this user process will deal with a large database and its directory will contain the database(s), you might want to allot an entire single- or multiple-disk LDU to it. A model 6061 disk contains about 370,000 blocks; a model 6122 disk contains about 540,000 blocks; a model 6236 disk contains about 690,000 blocks; and a model 6239 disk contains about 1,150,000 blocks.

To take the default, press *↓*. To change the space quota, type *Y ↓*. PREDITOR will then ask *New(0-2147483647)*; and you will type the new quota. Don't use commas in your answer. For more on disk space quotas, see "Disk Space Control," below.

#### *Logical address space - batch [-1 system default] change? (Y or NL)*

Normally, AOS/VS allots pages of memory to each process according to its needs, the needs of other processes, and process types and priorities. This question, and the next, can override system limits and set a new maximum number of memory pages for this user process and its sons.

Under some circumstances, in batch or nonbatch (interactive use) you may want to give a user process a nondefault page limit. Bear in mind that this may slow down the process and/or the system.

Generally, the value should be *-1 system default*. This gives the user process the same limit as its father, EXEC (which in turn gets its limit from *its* father, the master CLI). If you want to specify a different value, type *Y ↓*. PREDITOR will then ask *Let system assign? Let system assign* means the same thing as *-1 system default*, so a *↓* answer yields the original default. If you answer *N ↓* to the *let system assign?* question, PREDITOR displays a range of values from which you can choose (for example, *New(1-32767)*). Type the new value and *↓*.

*Logical address space - non-batch [-1 system default] change? (Y or NL)*

This question allows you to set a nondefault page limit as above, but for interactive use. The same constraints and dialog as above apply.

*Minimum working set size - batch [-1 system default] change? (Y or NL)*

This series of questions allows you to set nondefault lower and upper working set limits — for batch and interactive processes running under this process.

Normally, AOS/VS adjusts the working set parameters dynamically, based on process' type, page fault history, and general system overhead. These questions allow you to keep the working set within specific limits.

Defining a process' working set can be useful if memory contention is heavy, but it can also cause thrashing. So we recommend that you default these questions and rely on AOS/VS' adjustments.

A process' working set does not necessarily relate to the size of its logical address space. In fact, a larger process may require *fewer* pages than a smaller one if it localizes its references. If you *do* set working set limits, take care not to set the maximum too low, since this increases paging I/O and elapsed processing time. Also note that setting the minimum working set size too low can degrade performance throughout the system by increasing page faults.

For this question, generally, the value should be *-1 system default*. If you want to change this, type Y ). PREDITOR will then ask *Let system assign?* A ) answer produces the system default. If you reply N ), PREDITOR will ask *New(1-n)* and you will type the new value and ).

*Maximum working set size - batch [-1 system default] change? (Y or NL)*

This allows you to specify a nondefault *maximum* working set limit for batch processes under this user process. The same constraints as above apply.

*Minimum working set size - non-batch [-1 system default] change? (Y or NL)*

This allows you specify a nondefault minimum working set limit for interactive processes under this user process. The same constraints as above apply.

*Maximum working set size - non-batch [-1 system default] change? (Y or NL)*

This allows you specify a nondefault *maximum* working set limit for interactive processes under this user process. The same constraints as above apply.

*Default user locality [default]?*

This question is important only if you want to use class scheduling on your system. You can create and implement classes with the optional Class Assignment and Scheduling Package (CLASP), described in the *Class Assignment and Scheduling Package* manual; or you can write a program to do it through AOS/VS system calls.

Generally, even if you do use classes, it's a good idea to retain the original default value (-1) for this question. You can allow the user access to other localities in the next question. (But, if you want to make *sure* the user comes up in a nondefault user locality, you can specify that locality number.) To take the default, press ). To change it, type the new value and ).

*Use other localities [default]?*

If you don't you want to use classes, ignore this question and press `↓`. If you *do* want to use classes, decide whether or not you want this user to be able to use other localities. Users can change locality, if privileged, with the `LOCALITY` command or `PROCESS` command with `/LOCALITY` switch. You may want to start the user in the original default locality (`-1`) and change him/her to a different locality, perhaps in the user's log-on macro. If you do allow other localities, the user may be able to enter a privileged class and obtain more than his/her share of processing time, depending on your class definitions.

To take the default, press `↓`; to change it, type the desired answer and `↓`. After a No answer, PREDITOR skips the next question. After a Yes answer, PREDITOR asks

*User locality [0-15]?*

The user will be able to change locality to any locality you specify here. Respond with the numbers of *all* localities you want the user to have, or press `↓` to prevent the user from changing locality. Separate numbers with spaces; for example, type

`1 2 3 ↓`

*User comment [default] change? (Y or NL)?*

You can use this for text comment about the user: full name, date, etc. Or you can take the default by pressing `↓`. To enter or change a comment, type `Y ↓`, then the desired command; for example,

`Y ↓`

*New (0-79 chars):*    `JACK ARMSTRONG. GIVEN MODEM 30 MAY 86 ↓`

*Command:*

You've finished the `CREATE/EDIT` session; and the new/edited profile is ready for its user. An `EDIT` example follows the next section.

## Disk Space Control

PREDITOR's DISK QUOTA sets the maximum amount of disk space for a user not in CEO. This space includes all files and subordinate directories the user may create; it also includes space requirements of all processes run under this user process.

The quota limit should be large enough to allow the user (process) to work effectively. High quotas help prevent users from running out of space — an error situation that requires the system operator to edit profiles and provide more space.

On any LDU, you can allot users more disk space than actually exists. For example, if the LDU contains 370,000 blocks, you can give each of 40 users a quota of 10,000 blocks. This is called *oversubscribing* an LDU. It is possible because the quota is not actually *reserved* for each user; it is a theoretical limit, but is not guaranteed to the user.

The advantage of oversubscribing is that it allows generous disk quotas, which prevents users from running out of disk space and requiring someone to edit their profiles (to increase their disk quotas). There are several disadvantages: 1) users can become careless and saturate the LDU with unimportant files; 2) the LDU may become nearly filled with files, which will slow the system; 3) the LDU may be entirely filled, which will cause all users to get error messages when they try to create files, even though their individual disk quotas haven't been reached. If an LDU contains the SWAP and PAGE directories, and it fills up, the system will panic.

To check the *actual* amount of free space on an LDU, use the CLI command SPACE, with the LDU master directory name as an argument; for example type SPACE :J. If 10% or less of the total LDU space remains, you may want to free some — by moving files to another LDU or dumping files, then deleting them from this LDU; or by telling users to clean up their directories.

When you *edit* a profile, don't reduce the disk quota below the amount of space the user is actually using. If you do this, the user won't be able to log on. When you wish to reduce a disk quota, use the SPACE :UDD:username J command before running PREDITOR see how much space is occupied; this is the minimum disk quota you should specify to PREDITOR for this user.

## EDIT Example

The following example shows several editing changes in the profile of user JACK.

) X PREDITOR ↓

*User Profile Editor Rev n date time*

Command: EDIT ↓

Username: JACK ↓

Password change? (Y or NL) ↓

Encrypt password [No] change? (Y, N, or NL) Y ↓

Initial IPC file [:UDD:JACK:LOGON.CLI] change? (Y or NL) ↓

Program [:CLI.PR] change? (Y or NL) ↓

Create without block [No]? (Y, N, or NL) Y ↓

Use IPC [No]? (Y, N, or NL) Y ↓

Use console [N]? (Y, N, or NL) ↓

Use batch [Yes]? (Y, N, or NL) ↓

Use virtual console [Yes]? (Y, N, or NL) ↓

Access local resources from remote machines [Yes]? (Y, N, or NL) ↓

Change password [Yes]? (Y, N, or NL) ↓

Unlimited sons [No]? (Y, N, or NL) ↓

Sons [3] change? (Y or NL) Y ↓

New (0-1023): 5 ↓

Change priority [No]? (Y, N, or NL) ↓

Change type [No]? (Y, N, or NL) ↓

Change username [No]? (Y, N, or NL) ↓

Access devices [No]? (Y, N, or NL) ↓

Superuser [No]? (Y, N, or NL) ↓

Superprocess [No]? (Y, N, or NL) ↓

System manager privilege [No]? (Y, N, or NL) ↓

Modem [No]? (Y, N, or NL) Y ↓

Change address space type [Yes]? (Y, N, or NL) ↓

Change working set limit [No]? (Y, N, or NL) ↓

Priority [2] change? (Y or NL) ↓

Max qpriority [0] change? (Y or NL) ↓

Disk quota [15000] change? (Y or NL) Y ↓

New (0-2147483647): 20000 ↓

Logical address space - batch [-1 system default] change? (Y or NL) ↓

Logical address space - non-batch [-1 system default] change? (Y or NL) ↓

Minimum working set size - batch [-1 system default] change? (Y or NL) ↓

Maximum working set size - batch [-1 system default] change? (Y or NL) ↓

Minimum working set size - non-batch [-1 system default] change? (Y or NL) ↓

Maximum working set size - non-batch [-1 system default] change? (Y or NL) ↓

Default user locality [0] change? (Y or NL) ↓

User comment [JACK ARMSTRONG 30 NOV 83] change? (Y or NL)? Y ↓

New (0-79 chars): JACK ARMSTRONG. GIVEN MODEM 30 MAY 86 ↓

Command: BYE ↓

*Terminating date time*

)

## DELETE Command — Delete a User Profile

PREDITOR's DELETE command deletes a user profile — preventing the user from using the system. Optionally, it also deletes the user directory.

PREDITOR asks for a username, then asks for confirmation of the profile delete, and then asks if you wish to delete the user directory. If you reply Y ↵, PREDITOR deletes the user directory and all its subordinate directories. You can use a template for the username. If you do, PREDITOR will prompt you to delete corresponding users' profiles and directories, one user at a time.

You would use this command whenever you wanted to terminate someone's ability to use the system — perhaps because this person had left the organization or was no longer a suitable timesharing user. For the record, you might want to keep a DUMP copy of the profile (:UPD:username) and/or selected files (template :UDD:username:#). Note, however, that PREDITOR does not resolve links. For example, if a user's directories are on a separate disk (like UDD1), and username is a link in UDD, PREDITOR will delete the link, not the directories on UDD1.

If you care about security, you should dump the directory and then delete it. This will prevent anyone from creating a profile with the same username, which would give the new user OWARE access to the old user's files.

To delete a CEO user's documents, see *Managing the CEO® System*.

To delete a DG/VIEW windowing user's files, you must use the CLI DELETE command to delete the DG/VIEW directory associated with the user. (Turn on Superuser and then type

\*) DELETE :DGVIEW\_UTIL:USERS:username:# ↵

### DELETE Dialog and Example

```
Command:  DELETE ↵
Username:  SIMON ↵
Delete user 'SIMON'? (Y or N)      Y ↵
User deleted
Delete user directory ':UDD:SIMON'? (Y or N)      Y ↵
User directory deleted
Command:
```

## EDIT Command — Edit an Existing Profile

See the CREATE command.



## HELP Command — Describe PREDITOR Commands

HELP gives summary information on all PREDITOR commands.

### HELP Dialog and Example

COMMAND: HEL )

*The legal commands are:*

*Bye*

*Create*

*Delete*

*Edit*

*Help*

*List*

*Question (turn questions on or off)*

*Rename (rename a profile & user directory)*

*Use (use another profile as !DEFAULT!)*

*Command:*

## LIST Command — Display Values in a Profile

The LIST command asks for a username, then displays all the current values in a profile. It's useful when you want to know every value in a user profile. The LIST command allows using a template for the username. If you do, PREDITOR displays the profiles of users who match the template.

## LIST Dialog and Example

Command: LIST )  
Username: JACK )  
Encrypt password [Yes]  
Initial IPC file [:UDD:JACK:LOGON.CLI]  
Program [:CLI.PR]  
Create without block [Yes]  
Use IPC [No]  
Use console [Yes]  
Use batch [Yes]  
Use virtual console [Yes]  
Access local resources from remote machines [Yes]  
Change password [Yes]  
Unlimited sons [No]  
Sons [5]  
Change priority [No]  
Change type [No]  
Change username [No]  
Access devices [No]  
Superuser [No]  
Superprocess [No]  
System manager privilege [No]  
Modem [Yes]  
Change address space type [Yes]  
Change working set limit [No]  
Priority [2]  
Max qpriority [0]  
Disk quota [20000]  
Logical address space - batch [-1 system default]  
Logical address space - non-batch [-1 system default]  
Minimum working set size - batch [-1 system default]  
Maximum working set size - batch [-1 system default]  
Minimum working set size - non-batch [-1 system default]  
Maximum working set size - non-batch [-1 system default]  
Default user locality [0]  
User comment [JACK ARMSTRONG. GIVEN MODEM 30 MAY 86]  
COMMAND:

## QUESTION Command — Suppress or Restore PREDITOR Questions

The QUESTION command turns off display of any or all PREDITOR questions. The questions you suppress remain suppressed until you re-issue the QUESTION command or leave PREDITOR.

When you type QUESTION, PREDITOR displays each question individually, in the CREATE/EDIT order. Type ) if you want PREDITOR to ask the question; type N ) to suppress the question. Instead of the usual [default] value, PREDITOR displays [Y], to indicate that by default it *will* display the question.

QUESTION is handy when you wish to change only a few parameters for many users on the system. You can suppress all the irrelevant questions with QUESTION, then edit all the profiles you want quickly.

**CAUTION:** Don't create a new profile with questions suppressed; such a profile may be unusable. Suppress questions only when you plan to edit profiles.

## QUESTION Dialog and Example

In the following example, the person running PREDITOR wants to edit only the Create without block, disk quota, and user comment values for users SAM, F77, and others. The QUESTION command helps speed this up.

```
Command:    QUESTION ↓
Password [Y]? (Y, N, or NL)      N ↓
Encrypt password [N]? (Y, N, or NL)  ↓
Initial IPC file [Y]? (Y, N, or NL)  N ↓
Program [Y]? (Y, N, or NL)        N ↓
Create without block [Y]? (Y, N, or NL)  ↓
Use IPC [N]? (Y, N, or NL)        N ↓
Use console [Y]? (Y, N, or NL)     N ↓
Use batch [Y]? (Y, N, or NL)      N ↓
Use virtual console [Y]? (Y, N, or NL)  N ↓
Access local resources from remote machines [Y]? (Y, N, or NL)  N ↓
Change password [Y]? (Y, N, or NL)  N ↓
Unlimited sons [Y]? (Y, N, or NL)    N ↓
Change priority [Y]? (Y, N, or NL)  N ↓
Change type [Y]? (Y, N, or NL)     N ↓
Change username [Y]? (Y, N, or NL)  N ↓
Access devices [Y]? (Y, N, or NL)  N ↓
Superuser [Y]? (Y, N, or NL)       N ↓
Superprocess [Y]? (Y, N, or NL)    N ↓
System manager privilege [N]? (Y, N, or NL)  ↓
Modem [Y]? (Y, N, or NL)          N ↓
Change address space type [Y]? (Y, N, or NL)  N ↓
Change working set limit [Y]? (Y, N, or NL)  N ↓
Priority [Y]? (Y, N, or NL)        N ↓
Max qpriority [Y]? (Y, N, or NL)   N ↓
Disk quota [Y]? (Y, N, or NL)      ↓
Logical address space - batch [Y] (Y, N, or NL)  N ↓
Logical address space - non-batch [Y] (Y, N, or NL)  N ↓
Minimum working set size - batch [Y] (Y, N, or NL)  N ↓
Maximum working set size - batch [Y] (Y, N, or NL)  N ↓
Minimum working set size - non-batch [Y] (Y, N, or NL)  N ↓
Maximum working set size - non-batch [Y] (Y, N, or NL)  N ↓
Default user locality [0]? (Y, N, or NL)  ↓
User comment [Y]? (Y, or NL)?      ↓

Command:    E ↓
Username:    LEE ↓
Create without block [No]? (Y, N, or NL)  Y ↓
Disk quota [15000] change? (Y or NL)    Y ↓
New (0-2147483647):    25000 ↓
User comment [LEE WILLIAMS 30 NOV 84] change? (Y or NL)?  Y ↓
New (0-79 chars):      LEE WILLIAMS, BLOCK, 25,000 BLOCKS,30 MAY 86 ↓

Command:    E ↓
Username:    F77 ↓
Create without block [Yes]? (Y, N, or NL)  ↓
Disk quota [50000] change? (Y or NL)      ↓
New (0-2147483647):    200000 ↓
User comment [F77 PROJECT 30 NOV 84] change? (Y or NL)?  Y ↓
New (0-79 chars):      F77 PROJECT UP TO 200,000 BLOCKS 30 MAY 86 ↓
Command:
```

## RENAME Command — Rename a Profile

The RENAME command renames a user profile and its associated user directory. Within the profile, only the username changes; the password and all other values remain unchanged.

RENAME also changes the ACL for the user directory to `new-username,OWARE` — giving the new username all access privileges to the directory. This may cause problems if the user is logged on under the old name — so you should rename a profile only when the original username is not logged on.

All files and subordinate directories within the user directory retain their old ACLs — preventing access by the new username. After renaming a profile, either you or the user should update these ACLs via the CLI by typing

```
) DIR :UDD:username )
) ACL/V # new-username,OWARE )
... (CLI verifies new ACLs of all directories and files) ...
)
```

If you (not the user) change the ACLs, you will need to turn Superuser on first.

You might use the RENAME command if a user didn't like his or her assigned username, or if a more explicit or descriptive username was desirable. For a network user, renaming a profile may prevent access to other hosts (explained earlier under "CREATE/EDIT" questions).

### RENAME Dialog and Example

```
Command:  RENAME )
Username:  SALLY )
New username:  SAL )
Command:  B )
Terminating date time
) SUPERUSER ON )
*) DIR :UDD:SAL )
*) ACL/V # SAL, OWARE )
... (Verification) ...
*) SUPERUSER OFF )
) DIR/I )
)
```

## USE Command — Use another Profile as !DEFAULT!

Normally, PREDITOR displays the values in its !DEFAULT! profile as defaults for CREATE and EDIT questions. The USE command tells it to use the values in *another profile* for these defaults.

During a PREDITOR session, you can edit !DEFAULT! to change the defaults — but these changes remain only until PREDITOR terminates. User profiles, on the other hand, remain stable. So, when you create a new profile that will be similar to an existing one, you can simply USE the existing one and change only the username, password, and possibly a few other values. PREDITOR continues to use the values in the existing profile until it terminates or until you tell it to use another profile.

The USE command doesn't affect the existing profile; the values in it simply serve as defaults.

## USE Dialog and Example

This example shows existing user JACK's profile used to help create a profile for user BARBARA.

) X PREDITOR ↓

*AOS/VS User Profile Editor Rev n date time*

Command: USE ↓

Username: JACK ↓

... (PREDITOR displays values in JACK's profile) ...

Command: CREATE ↓

Username: BARBARA ↓

Password change? (Y or NL) Y ↓

New (6-15 chars): BARB ↓

Encrypt password [Yes] change? (Y, N, or NL) ↓

Initial IPC file [:UDD:JACK:LOGON.CLI] change? (Y or NL) Y ↓

New (0-63 chars): :UDD:BARBARA:LOGON.CLI ↓

Program [:CLI.PR] change? (Y or NL) ↓

Create without block [Yes]? (Y, N, or NL) N ↓

Use IPC [No]? (Y, N, or NL) ↓

Use console [Yes]? (Y, N, or NL) ↓

Use batch [Yes]? (Y, N, or NL) ↓

Use virtual console [Yes]? (Y, N, or NL) ↓

Access local resources from remote machines [Yes]? (Y, N, or NL) ↓

Change password [Yes]? (Y, N, or NL) ↓

Unlimited sons [No]? (Y, N, or NL) ↓

Sons [5] change? (Y or NL) ↓

Change priority [No]? (Y, N, or NL) ↓

Change type [No]? (Y, N, or NL) ↓

Change username [No]? (Y, N, or NL) ↓

Access devices [No]? (Y, N, or NL) ↓

Superuser [No]? (Y, N, or NL) ↓

Superprocess [No]? (Y, N, or NL) ↓

System manager privilege [No] change? (Y, N, or NL) ↓

Modem [No]? (Y, N, or NL) Y ↓

Change address space type [Yes]? (Y, N, or NL) ↓

Change working set limit [No]? (Y, N, or NL) ↓

Priority [2] change? (Y or NL) ↓

Max qpriority [0] change? (Y or NL) ↓

Disk quota [20000] change? (Y or NL) ↓

Logical address space - batch [-1 system default] change? (Y or NL) ↓

Logical address space - non-batch [-1 system default] change? (Y or NL) ↓

Minimum working set size - batch [-1 system default] change? (Y or NL) ↓

Maximum working set size - batch [-1 system default] change? (Y or NL) ↓

Minimum working set size - non-batch [-1 system default] change? (Y or NL) ↓

Maximum working set size - non-batch [-1 system default] change? (Y or NL) ↓

Default user locality [0] change? (Y or NL) ↓

User comment [JACK ARMSTRONG 9 MAR 84] change? (Y or NL)? Y ↓

New (0-79 chars): BARBARA CLEAVES, 30 MAY 86 ↓

Command:

## PREDITOR Error Messages

While you are operating PREDITOR, you may receive one or more of the error messages shown in Table 7-1.

**Table 7-1. PREDITOR Error Messages**

| Message                               | Meaning and Action                                                                                                                                                                                                                                 |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>?1 to 15 characters needed</i>     | The username must be from 1 to 15 characters. Try a username with the correct number of characters.                                                                                                                                                |
| <i>?Illegal character in string</i>   | You typed a character that PREDITOR can't understand. Retype the entry without the questionable character.                                                                                                                                         |
| <i>?Name in use for a non-profile</i> | The username you typed is the same as the name of a nonprofile file in directory :UPD. To recover, try another username. (Generally, :UPD should be reserved for PREDITOR-created files.)                                                          |
| <i>?Pathname must start at root</i>   | All filenames you give to PREDITOR must be full pathnames from the root directory (:); for example, :UDD:JACK:LOG-ON.CLI. Retype the entry as a full pathname.                                                                                     |
| <i>?Type H for help</i>               | Your entry was not a PREDITOR command. Type H ) to display all commands.                                                                                                                                                                           |
| <i>?User directory already exists</i> | The username you specified already has a user directory (but not a valid profile). Use the EDIT command to produce a valid profile, or use the DELETE command to delete the existing profile and directory.                                        |
| <i>?Username already in use</i>       | The username you specified is in use, with a profile and directory. Try another username.                                                                                                                                                          |
| <i>?Username does not exist</i>       | The username given doesn't exist. Back up to <i>COMMAND:</i> with CTRL-C CTRL-A and leave PREDITOR with BYE ). Then check all user directory names by typing<br><pre>) SUPERU  ON ) *) F/AS/S  :UDD + ... (CLI displays sorted names) ... *)</pre> |
| <i>You can't delete !DEFAULT!</i>     | Then XEQ PREDITOR and try the command again.<br>The !DEFAULT! profile is part of PREDITOR and you can't delete it.                                                                                                                                 |

## What Next?

This chapter described all PREDITOR commands and how to use them. You may want to try the profile(s) you've worked with — or have users log on and try them.

You may want to learn more about another major multiuser tool, EXEC, described in the next chapter; about other runtime tools, described in Chapter 9; about backup, described in Chapter 10; or about System Management, described in Chapters 15 and 16.

End of Chapter

# Chapter 8

## EXEC and User Processes

Read this chapter

- when you want to learn about the EXEC program or any of its commands;
- when you want to learn how user logon, batch, or device queues work;
- when you want to learn how to handle user tape mount and dismount requests.

EXEC — a program in :UTIL — supervises the AOS/VS multiuser environment. If you created your system's multiuser environment (described in Chapter 5) you have some experience with EXEC. Chapter 5 had the reader start up EXEC, initialize EXEC queues, enable user consoles, log on as a user, check EXEC's spool and batch functions, and log off. Then it showed how to edit the DG-supplied UP and DOWN macros so that EXEC could be brought up via UP and shut down via DOWN.

This chapter tells all about EXEC — its functions, commands, and operator and user messages. The major sections are

- What EXEC Does
- Creating and Terminating the EXEC Process
- Pertinent CLI Commands
- EXEC Command Overview
- General Commands to EXEC
- About User Log On
- About Batch and Spooling
- About Spooling
- About User Tape Mount Requests
- EXEC Commands — Listed Alphabetically
- EXEC Messages

Appendix B, near the end of this book, is a concise, alphabetical summary of all EXEC commands. There's also a reference card of EXEC commands.

## What EXEC Does

When it is running, EXEC can do the following things.

1. Log users on and off. When a user tries to log on, EXEC checks for a valid profile; then, if the username and password that the user types match those in a profile, EXEC creates a user process, with parameters defined in the profile, for that user. When the user process terminates, EXEC logs the user off.
2. Manage batch and spool queues. EXEC maintains a batch input, list, and output file for each batch request; it has four batch streams to handle batch requests. EXEC also interprets and spools output to devices like line printers. Users queue batch and printing requests with CLI Q-series commands — and EXEC manages them with little or no operator intervention.
3. Help manage user requests to mount and dismount tapes on tape units.

EXEC has commands that control all these functions. But usually — after the UP.CLI macro brings it up — EXEC runs practically by itself. All EXEC files are in directory :UTIL. These include

- program and overlay files, EXEC.PR and EXEC.OL;
- program file for ring 6, EXECVS.PR (this is loaded by EXEC.PR);
- line printer manager program, XLPT.PR;
- forms control utility, FCU.PR;
- queue compacter program, QCMP.PR;
- card reader program, STACKER.PR.

The system expects to find EXEC files in directory UTIL, so don't move them.

## Creating and Terminating the EXEC Process

The UP.CLI macro includes the PROCESS command that creates EXEC and EXEC commands to enable consoles and start queues. You can TYPE or QPRINT file :UP.CLI to see them. But, for completeness, we will show the PROCESS command here. It is

**PROCESS/DEFAULT/DIRECTORY=@/NAME=EXEC EXEC**

where

**PROCESS** is a CLI command that creates a new process (just as XEQ does, but PROCESS is more versatile).

**/DEFAULT** Gives the new process all the privileges of the father process. The father is nearly always the master CLI, PID 2, which has the privileges that EXEC needs.

**/DIRECTORY=@** Makes the peripheral directory (:PER, shorthand @) the home directory of the EXEC process. This is necessary because all the device entries EXEC needs are in :PER.

**/NAME=EXEC** Gives the EXEC process the simple process name EXEC so that the system can access it by this process name.

**EXEC** is the program name to execute; here, EXEC.

When EXEC starts up, it checks for another EXEC process; if an EXEC is already running, the new EXEC will terminate with an error message. When ready, EXEC says

*From Pid n : (EXEC) REV n READY*

*From Pid n : (EXEC) hours:minutes:seconds*



EXEC is ready for CONTROL @EXEC (CX) commands — many of which follow the PROCESS command in the UP.CLI macro.

The master CLI, PID 2, is usually EXEC's father. The user processes EXEC creates are EXEC's sons. The process hierarchy looks like Figure 8-1.

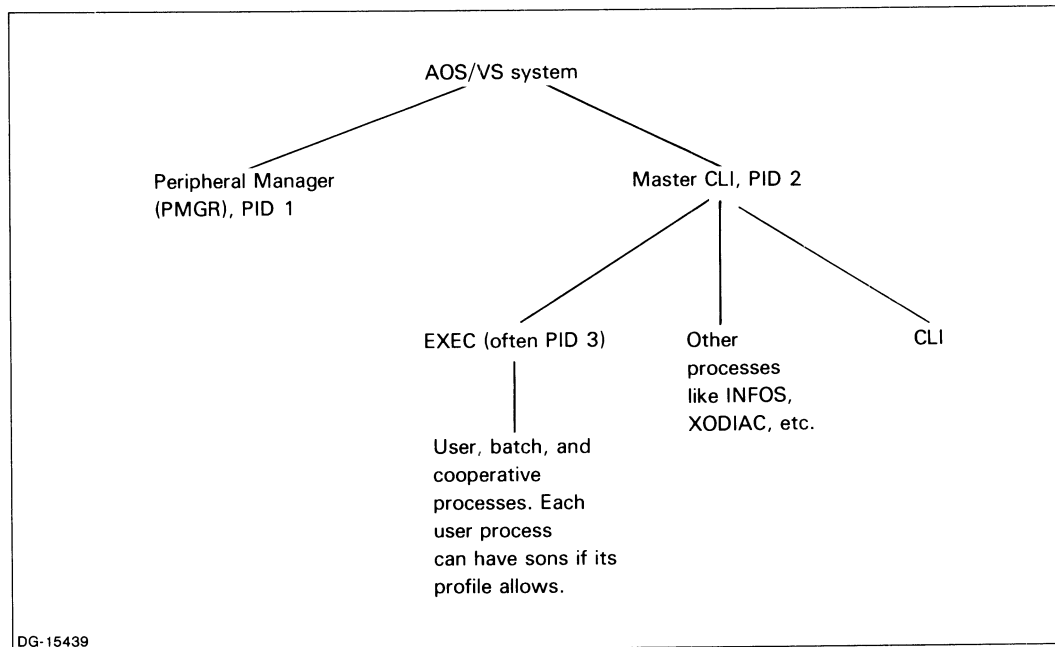


Figure 8-1. Process Hierarchy (Tree)

## Terminating EXEC

As with creation, the TERMINATE command that terminates EXEC is in a macro: DOWN.CLI. Another command in DOWN.CLI — CHECKTERMS — relates to TERMINATE, so we'll explain both. They are

TERMINATE /2=ERROR OP:EXEC

CHECKTERMS

where

**TERMINATE** is a CLI command that terminates a process. The target process must be a son of the issuing process unless Superprocess is on.

**/2=ERROR** tells the CLI to stop executing commands in the macro if an error occurs on the **TERMINATE** (otherwise, it might continue with the macro on some kinds of error, which would be undesirable).

**OP:EXEC** is the full process name of the EXEC process. The master CLI is the father; EXEC is the son.

**CHECKTERMS** tells the CLI to save and display messages that the system may display after it terminates a process (check termination messages).

Normally, you would pause EXEC queues and warn users before bringing down EXEC via the DOWN macro. Terminating a process terminates all its sons; and each user process created by EXEC is a son of EXEC. Users might lose work and be a bit upset if their processes died suddenly.

## Pertinent CLI Commands

While EXEC runs, you'll use some or all of the CLI commands shown in Table 8-1 (given more detail in the CLI manual). You can also use some other macros described in Chapter 5.

**Table 8-1. Process-Oriented CLI Commands**

| Command                           | What it Does                                                                                                                                                                                                                                                                                                                                     | Example                                  |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| ACL                               | Sets the access control list for one or more files; further described in Chapter 9, "Other Runtime Tools."                                                                                                                                                                                                                                       | ) ACL/V + OP,OWARE )                     |
| BYE                               | Terminates the current CLI or SED text editor process. The process' father (from which the process was executed) gets control. If this is a user process, BYE logs the user off. If there is no father, as with the master CLI, BYE starts system shutdown.                                                                                      | ) BYE )<br><i>PROCESS ...TERMINATED</i>  |
| CONTROL @EXEC cmd<br>or<br>CX cmd | CONTROL @EXEC tells the CLI to pass an IPC message of "cmd" to EXEC. The "cmd" is one the the EXEC commands described in this chapter. CX invokes macro CX.CLI which contains the characters<br><br>CONTROL @EXEC %-%<br><br>allowing you to type CX instead of CONTROL @EXEC. If this macro doesn't exist, create it as described in Chapter 5. | ) CONTROL @EXEC STAT )<br>) CX STAT )    |
| EXECUTE program                   | Creates a process; same as XEQ.                                                                                                                                                                                                                                                                                                                  | See XEQ.                                 |
| FILESTATUS template               | Describes filenames in any directory. Handy switches are /AS (for an assortment of information), and /S (for an alpha sort). If you get an <i>ACCESS DENIED</i> message, turn Superuser on and try again.                                                                                                                                        | ) F/AS/S :UTIL:EXEC + )                  |
| HELP [command]                    | Gives help on CLI topics or commands.                                                                                                                                                                                                                                                                                                            | ) HELP )<br>) HELPV ACL )                |
| PROCESS arguments                 | Creates a process; described in previous section.                                                                                                                                                                                                                                                                                                | ) PROC/PRI= 1/DEF PROG )                 |
| QBATCH, QPRINT                    | These are <i>user</i> commands that place requests on EXEC batch and spool queues. To use them, a person needs a user profile. So, even if you are the system manager or operator, you must have a profile. Chapter 5 has the reader create a privileged profile named OP.                                                                       | ) QBATCH X MYPROG )<br>) QPRINT MYFILE ) |

(continues)

**Table 8-1. Process-Oriented CLI Commands**

| Command                | What it Does                                                                                                                                                                                                                        | Example                                                                    |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| QDISPLAY               | Describes the status of all batch and spool queues. For more information, include the /V switch.                                                                                                                                    | ) QDIS /V ↓                                                                |
| RUNTIME [ <i>pid</i> ] | Describes how long a process has been running, and its CPU and I/O usage. The <i>pid</i> is the process ID; if you omit it, the command describes the current process.                                                              | ) RUN 3 ↓<br>) RUN ↓                                                       |
| SEND user(s)           | Sends a message to one or more user consoles. The user(s) can be a process ID or a template like @CON- to specify all consoles. The BROADCAST macro, described in Chapter 5, is easier and somewhat more elegant than "SEND @CON-". | ) SEND @CON13 Log off ↓<br>) SEND @CON- Log off ↓<br>) BROADCAST Log off ↓ |
| TREE [ <i>pid</i> ]    | Describes a process' family tree: process IDs of father, self, and son(s) if any.                                                                                                                                                   | ) TREE 3 ↓<br>) TREE ↓                                                     |
| TERMINATE process      | Terminate a process, shown in the previous section. The "process" can be a full process name like OP:EXEC, a simple process name like EXEC, or a Process ID like 3.                                                                 | ) TERM 20 ↓                                                                |
| WHO [ <i>pid</i> ]     | Describes the username associated with a process ID.                                                                                                                                                                                | ) WHO 4 ↓<br>) WHO ↓                                                       |
| ?                      | Invokes a CLI macro, ?.CLI, that contains the pseudomacro [!pids]; describes all users on the system. Creating this macro is described in Chapter 5.                                                                                | ) ? ↓                                                                      |

(concluded)

## EXEC Command Overview

EXEC has a help feature that you can use by typing

```
) XHELP ↓
```

or

```
) XHELP cmd ↓
```

where *cmd* is an EXEC command.

EXEC's help messages are not tutorial, but they can be very useful when you have forgotten a command word or the correct syntax of a command.

EXEC commands are special in that any process with the username OP can issue them. This can be very important if — as is often true — the CLI running on the system console is not the master CLI, PID 2. The UP.CLI macro has an EXECUTE CLI (or EXECUTE LOCK\_CLI) command, which runs a son CLI on the system console. This son CLI may not have the privileges of its father — which means that the system operator may not be able to use this CLI to control the system. But *any* CLI with a username of OP can issue EXEC commands. So it doesn't matter which CLI the operator uses — if its username is OP, EXEC will obey the operator's EXEC commands.

Aside from XHELP, each EXEC command begins CONTROL @EXEC or CX. There are a lot of EXEC commands, but in daily routine, you will need only a few. Table 8-2 shows these frequently used EXEC commands.

## Command Abbreviations

As with the CLI, you can abbreviate any EXEC command to its shortest unique string. For example, instead of CX STATUS, you could type

```
) CX STAT )
```

Don't be afraid to try abbreviations; at worst you'll get a harmless *NOT UNIQUE* error message.

## EXEC Command Response Messages

EXEC is a very talkative program, describing practically everything it does.

After you type a command to it, EXEC will acknowledge the command with either a

*From Pid n : (EXEC) ...*

message or an error message. Error messages and recovery are described near the end of this chapter.

By default, EXEC sends all messages to the system console — the console connected to the master CLI or its son. But if you have logged on as OP on a different console, EXEC will acknowledge your commands on that console.

EXEC always displays messages about user MOUNT requests. But you can make other EXEC messages brief or verbose, or you can silence EXEC, with the EXEC BRIEF, VERBOSE, or SILENCE commands. SILENCE is especially useful if your system console is a hardcopy console.

If EXEC logging is on (EXEC LOGGING command), copies of all messages that you see on the system console will be sent to EXEC's log file.

## Often-used EXEC Commands

Table 8-2 shows the most popular EXEC commands, alphabetically. In this table, and throughout this chapter, we assume that macro CX.CLI exists in directory :UTIL. This macro allows operators to type CX cmd ) instead of CONTROL @EXEC cmd ).

**Table 8-2. Often-used EXEC Commands**

| EXEC Command | Explanation                                                                                                                                                                                                                                                                  | Example                                                                                                                          |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| ALIGN        | Pauses EXEC's printer-managing process (XLPT); or continues process XLPT. Useful when someone wants to align the paper in the printer.                                                                                                                                       | ) CX ALIGN @LPB ↓<br>) CX ALIGN/CONT @LPB ↓                                                                                      |
| CANCEL       | Cancels a batch or printing request that is enqueued but not yet active. To stop an active request, use FLUSH.                                                                                                                                                               | ) CX CANCEL 445 ↓                                                                                                                |
| CONTINUE     | Continues (resumes processing in) a batch stream (1-4) or device queue. Useful after EXEC startup (within UP.CLI macro) or after a stream or device has been paused.                                                                                                         | ) CX CONTINUE 2 ↓<br>) CX CONTINUE @LPB ↓                                                                                        |
| DISABLE      | Disables one or more user consoles for user log on. Useful when you plan to shut down EXEC, and don't want users logging on; also useful when you wish to free one or more EXEC-enabled consoles for use by another program, like DG/SNA or TPMS.                            | ) CX DISABLE @CON8 ↓                                                                                                             |
| ENABLE       | Enables one or all user consoles for user logon via EXEC, primarily used within UP.CLI macro.                                                                                                                                                                                | ) CX ENABLE @CON45 ↓<br>) CX ENABLE/ALL ↓<br>) CX ENABLE/TRIES=2& ↓<br>&) /STOP/FORCE @CON5 ↓                                    |
| FLUSH        | Flushes (kills) the job that a batch stream or device queue is processing. To cancel a request <i>before</i> it becomes active, use CANCEL.                                                                                                                                  | ) CX FLUSH 3 ↓                                                                                                                   |
| FORMS        | Allows you to specify a file to be used for special form printing; e.g., bills.                                                                                                                                                                                              | ) CX PAUSE @LPB ↓<br>) CX FORMS BILLS @LPB ↓<br>) CX CONT @LPB ↓                                                                 |
| MOUNTED      | In response to user mount request, this tells EXEC that a tape is mounted on a tape unit.                                                                                                                                                                                    | ) CX MOUNTED @MTB1 ↓                                                                                                             |
| OPERATOR     | Tells EXEC that an operator is on or off duty. Unless the operator has given ON notice to EXEC, users will get error messages from their MOUNT and from batch jobs submitted with the /OPERATOR switch.                                                                      | ) CX OPERATOR ON ↓<br><br>) BROADCAST Lunchtime ↓<br>) CX OPERATOR OFF ↓<br>(lunch)<br>) BROADCAST Mounts ok ↓<br>) CX OPER ON ↓ |
| PAUSE        | Pauses a batch stream, device queue, or device in an orderly way, after current request is done. It prepares for normal EXEC shutdown or change in device specifications. Later, CONTINUE commands in UP.CLI or typed on the system console will continue normal processing. | ) CX PAUSE ↓<br>) CX PAUSE @LPB ↓                                                                                                |

(continues)

**Table 8-2. Often-used EXEC Commands**

| EXEC Command           | Explanation                                                                                                                                                            | Example                                   |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| SILENCE                | Tells EXEC to keep quiet; it suppresses batch or device queue messages to the system console and EXEC log file, if active. This is useful on hardcopy system consoles. | ) CX SILENCE )<br>) CX SILENCE @LPB )     |
| START                  | Associates a queue and device with an EXEC cooperative process. The CONTINUE command then activates the device. This command is usually issued by the UP.CLI macro.    | ) CX START LPT @LPB )<br>) CX CONT @LPB ) |
| STATUS,<br>SPOOLSTATUS | Displays information about batch or spool queues. CLI command QDISPLAY/V is also handy for this.                                                                       | ) CX STATUS )<br>) CX SPOOLSTATUS )       |
| XHELP                  | Displays information about all EXEC commands or any command; omit the leading CX.                                                                                      | ) XHELP )<br>) XHELP ALIGN )              |

(concluded)

**EXEC Commands by Function**

EXEC manages four types of function: general, user log on, batch and spooling, and user mount requests. Table 8-3 shows all EXEC commands, arranged by function. The commands are described in alphabetical order, later in this chapter.

**Table 8-3. EXEC Commands by Function**

| Function Category | EXEC Command                                                   | Brief Description                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General           | LOGGING<br>MESSAGE<br>PROMPTS<br>XHELP                         | Turns EXEC logging on or off.<br>Writes a text message to the log file.<br>Adds or removes time of day from EXEC message display.<br>Describes all EXEC commands or a specified command (omit the leading CX).                                                                                                                                                                              |
| Logon             | CONSOLESTATUS<br>DISABLE<br>ENABLE<br>TERMINATE                | Displays console-user status.<br>Disables idle EXEC consoles for user logon.<br>Enables consoles for user logon.<br>Kills the user process associated with a console.                                                                                                                                                                                                                       |
| Batch/ Spool      | ALIGN<br>BINARY<br>BRIEF<br>CANCEL<br>CLOSE<br>CONTINUE<br>CPL | Stops or continues the line printer (used to align it).<br>Puts a letter-quality printer or line printer in binary mode.<br>Tells EXEC to make batch or spool messages brief.<br>Cancels a request that is waiting in a queue.<br>Closes a device queue to user requests.<br>Continues a paused batch stream or device queue.<br>Changes the maximum number of printed characters per line. |

(continues)

**Table 8-3. EXEC Commands by Function**

| Function Category          | EXEC Command                                                                                                                                                                                                      | Brief Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Batch/Spool<br>(continued) | CREATE<br>DEFAULTFORMS<br>DELETE<br>ELONGATE<br>EVEN<br>FLUSH<br>FORMS<br>HEADERS<br>HOLD<br>LIMIT                                                                                                                | Creates a device queue.<br>Sets new printer CPL and LPP parameters.<br>Deletes a device queue.<br>Turns LP2/TP2 elongated printing on or off.<br>Turns even pagination on or off for a printer.<br>Flushes (kills) an active batch or device request.<br>Specifies a file to be used for printer format control.<br>Changes the number of printed header pages.<br>Holds (suspends) a batch or spool request.<br>Enforces user- or operator-defined limits on CPU time (batch) or printed pages (spool).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                            | LPP<br>OPEN<br>PAUSE<br>PURGE<br>PRIORITY<br><br>QPRIORITY<br><br>RESTART<br><br><br>SILENCE<br>SPOOLSTATUS<br>STACK<br>START<br>STATUS<br>STOP<br>TRAILERS<br>UNHOLD<br>UNLIMIT<br>UNSILENCE<br>VERBOSE<br>XBIAS | Changes the maximum number of printed lines per page.<br>Opens a device queue to user requests.<br>Pauses one or more batch streams or devices.<br>Deletes entries in a stopped device queue.<br>Sets a new priority and/or type for batch streams and cooperative processes (XLPT).<br>Sets a new range of batch/print priorities that will be accepted by a batch stream or device.<br>Restarts device queues after abnormal EXEC termination (batch restarts automatically).<br><br>Suppresses all EXEC messages except user mount requests.<br>Displays queue-device association and status.<br>Tells EXEC to accept batch jobs in stacked format.<br>Associates a queue and device with a cooperative process.<br>Displays batch stream or device status.<br>Dissociates a device from a queue (opposite of START).<br>Changes number of printed trailer pages.<br>Negates HOLD command.<br>Negates LIMIT command.<br>Negates SILENCE command.<br>Tells EXEC to make batch/spool messages verbose.<br>Sets a new EXEC small job versus large job bias factor. |
| Mount                      | DISMOUNTED<br>MOUNTED                                                                                                                                                                                             | Tells EXEC that a person has physically dismounted a tape.<br>Tells EXEC that a person has physically mounted a tape on a unit.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                            | MOUNTSTATUS<br>OPERATOR<br>PREMOUNT<br><br>REFUSED<br><br>UNITSTATUS                                                                                                                                              | Displays MOUNT and mount request status.<br>Tells EXEC that an operator is on or off duty.<br>Tells EXEC that a person has physically mounted a tape before a MOUNT request occurred.<br>Tells EXEC and a user that you refused the user's MOUNT request<br>Describes the mount status of tape units.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

(concluded)

## About User Log On

A console that's turned on and enabled by EXEC displays the log-on banner, which looks like this:

```
**** AOS/VS REV 7.00 / Press NEW-LINE to begin logging on ****
```

Or it displays a tailored log-on screen. ("Tailoring the Log-on Screen" in Chapter 5 explains how to create one.)

To log on, a person presses NEW LINE on an enabled console; EXEC then prompts for a username and password. Users cannot log on under EXEC unless they have valid user profiles, created with PREDITOR. EXEC compares the username-password pair the user types in with the pair in the user's profile.

When — and only when — the person types a valid username and password, EXEC tells AOS/VS to create a user process for that person and logs the user on. The operating system uses the parameters in the profile when it creates the user process, and it enforces these thereafter.

Parameters in the profile include initial IPC file, program to be executed for the user, number of sons, Superuser, Superprocess, and System Manager specifications, and the amount of disk space allowed, among other things. All these issues are covered in the previous chapter.

The initial IPC file is often in the user's initial directory, where the user can edit it as desired. Another file — LOGON.MESSAGE — is in :UTIL; as each user logs on, EXEC automatically displays the first 512 characters of this file on each user's screen. Examples of creating initial IPC files and LOGON.MESSAGE are given in Chapter 5.

While the user process runs, EXEC records console use, pages printed, device time used for MOUNT requests, and privileged-user logons. It places this information in the system SYSLOG file if system logging is on. SYSLOG is different from EXEC's own log file.

When a user terminates his/her initial program (as by typing BYE ) to the CLI), EXEC terminates the user process; the console is then free for other users. Naturally, a privileged process like the master CLI or EXEC can terminate the user process whenever it wants, but this is unpleasant for the user and should be done only if necessary.

### Log-on Errors

EXEC expects the user profile and user directory created by PREDITOR to be intact. If the user directory was somehow deleted, or its ACL changed, or if the profile was tampered with, the user may receive an error message and be advised to call the system manager.

Should this problem occur, run PREDITOR on the profile of this username. PREDITOR will then automatically rectify file problems. (But if the directory was inadvertently deleted, the user's files will need to be reloaded from backup media.)

### Log-on Commands

EXEC log-on commands are CONSOLE STATUS, DISABLE, ENABLE, and TERMINATE. These are summarized in Table 8-3 (earlier), and detailed in the alphabetical section, later in this chapter.

## About Batch

This section gives some background on batch.



## Batch Processing

When someone wants to run a program, he/she can run it interactively from a console, or in batch.

Running a program interactively is fast, but makes the console unavailable until the program ends. Also, if many processes are running interactively, system performance may suffer. Users run programs interactively via XEQ or PROCESS commands to their CLIs, or via macros that contain XEQ or PROCESS.

Running a program in batch may take a little more time; but the console remains available. Also, the system may run more efficiently. Anyone with a user profile and the USE BATCH privilege can use batch. An easy way to do it is to type the QBATCH command, followed by the desired XEQ or PROCESS command, to the CLI. An easier way — which eliminates walking to and from the line printer — is to use the BATCH and CHEK macros described in Chapter 5.

Another way to use batch, if a user's job is on punched cards, is to give the card deck(s) to the system operator for processing.

### Batch Details

Each time EXEC comes up, it creates three batch queues (if they do not already exist): BATCH\_INPUT, BATCH\_LIST, and BATCH\_OUTPUT. These are the input, list, and output files for batch requests.

For each job a user submits, the CLI creates an input file with the needed commands in the user's directory; the filename ends in .JOB. Then the CLI notifies EXEC and EXEC places the request in the BATCH\_INPUT queue (in directory QUEUE) under the full input file pathname.

The job comes up for processing. EXEC creates temporary output and list files, with pathnames :QUEUE:username.OUTPUT.seqno and :QUEUE:username.LIST.seqno, where seqno is the sequence number. Then, EXEC creates a CLI process to run the job; and the process runs, taking its commands from the .JOB file in the user's directory. If any program involved in the job writes to the console (as with a CLI WRITE command, error condition, or BASIC or FORTRAN PRINT statement), the text goes to the temporary output file. The listing file text (if the user specified any) goes to the temporary list file. When the job finishes, EXEC prints and deletes the output file and list file (if any). Finally — unless an error aborted the batch job — EXEC deletes the .JOB input file from the user's directory.

Instead of EXEC's temporary output and list files, users can specify other files with QBATCH switches, if they want. All files written by the job (except EXEC's temporaries) go to the same directory as they would have if the job had been run interactively.

To handle requests in the batch input file, EXEC has up to four batch *streams*. As each request comes up, EXEC assigns it as a job to an available stream. If more than one batch stream is running, then more than one batch job can run at a time. An EXEC CONTINUE command is needed to activate each stream; these are usually part of the UP.CLI macro. The default UP.CLI macro continues only stream 1, but you can edit UP.CLI to continue more streams if you want. Or, you can type CX CONTINUE commands to run other streams. You can also pause any batch stream using EXEC's PAUSE command.

EXEC processes batch requests according to their queue sequence number and queue priority. Requests with the highest priority (closest to 0) are processed first. Requests with the same priority are processed on a first-in, first-out basis.

By default, all batch streams accept requests of any priority. You can assign each stream a specific priority range using the CX QPRIORITY command. *Users* can assign priority to batch requests with QBATCH/QSUBMIT switches. If you set a priority range for a stream, the stream will accept only those requests with priorities in your specified range. You can use the CX XBIAS command to control apparent request priorities.

An example will help show how batch works. Assume that user Jack types

```
) QBATCH XEQ MASM/L MY_PROGRAM )  
  QUEUED, SEQ=454  
)
```

This sets up a macroassembly to run in batch (a compile would be similar). The CLI creates a temporary input file ending in .JOB in Jack's working directory; and it enqueues the request as sequence number 454 in the BATCH\_INPUT queue. When the request is ready to run, EXEC creates a user process to run it. The new process gets input from the .JOB input file. The assembly occurs. The batch output file (:QUEUE:JACK.OUTPUT.454) shows the commands used and assembly errors (if any). The list file, produced by the MASM/L switch, shows the assembly listing. All three files — input, output, and list — are deleted after the assembly.

The system places the object file from the assembly in the directory from which Jack typed the QBATCH command. The end result is that, with a little extra time, Jack got the same result as from an interactive assembly — except that assembly errors were printed instead of being displayed on his console. By using the BATCH and CHEK macros (Chapter 5), he could have checked for assembly errors without going to the printer.

For batch processing to occur, EXEC must be running and at least one batch stream must have been continued. Also, the batch output and list queues must have been started on the line printer spool queue, described next. Every batch user process, like every console user process, is subordinate to EXEC.

## Batch Jobs in Stacked Format

Batch jobs submitted to a card reader must be in stacked format. Job control cards must precede and follow each user's card deck, as follows.

|           |                                                                                                                                                        |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| card 1    | \$\$\$JOB[/switches] username                                                                                                                          |
| card 2    | \$\$PASSWORD password                                                                                                                                  |
| cards 3-n | commands to CLI that make up job                                                                                                                       |
| card n+1  | \$\$END                                                                                                                                                |
| .         | .                                                                                                                                                      |
| .         | .                                                                                                                                                      |
| .         | .                                                                                                                                                      |
| card m    | end of file card (all holes in first column punched). Users don't insert this; you (the operator) should insert it after the last user's \$\$END card. |

No CLI commands are involved in card processing. The system operator issues the EXEC command CX STACK, then the operator, or user, places the user's card deck in the card reader. (The STACK command is described in this section of the chapter.)

Then, EXEC creates a co-operative process that runs program STACKER.PR. The Stacker reads all cards from the one following the password up to, but not including, the end card, into a temporary disk file in directory :QUEUE. When it reads the end card, the Stacker enqueues the disk file it just created to run as a batch request. After the the job runs, EXEC deletes the temporary file. EXEC also deletes this file if the batch job aborts.

The Stacker can process multiple jobs with one STACK command if the operator removes individual user END OF FILE cards between the user card decks. There should be one END OF FILE card at the end of the last job to stop the STACKER cooperative process.

No card may have \$\$ in its first two columns except the \$\$\$JOB, \$\$PASSWORD, and \$\$END cards. If a job contains any other \$\$ entry, EXEC will not queue or process the job. An appendix in the CLI manual gives details on submitting jobs to the card reader.

## Batch and Spool Commands

Many EXEC commands relate to both batch and spooling. The batch commands are

BRIEF, CANCEL, CONTINUE, HOLD, LIMIT, OPEN, OPERATOR, PAUSE, PRIORITY, QPRIORITY, SILENCE, STACK, START, STATUS, STOP, UNHOLD, UNLIMIT, UNSILENCE, VERBOSE, and XBIAS.

These are summarized in Table 8-3 (earlier) and are detailed later in this chapter.

## About Spooling

In the multiuser environment, processes compete for the use of slow input or output devices, like line printers and plotters. Processes can send and receive data faster than devices; and EXEC ensures that this data moves in an orderly way. When a process wants to use a device, EXEC enqueues the process's request and writes the data involved to disk. Then when the request comes up, EXEC directs AOS/VS to send it to the device.

Storing information temporarily on disk for later processing is called spooling. EXEC provides spooling to all slow I/O devices. For printer spooling, EXEC uses its printer manager program, XLPT.

The spooled devices include

- Card readers;
- Line printers;
- Digital plotters;
- Hard-copy consoles;
- Asynchronous communication lines connected via modems to remote consoles;
- Asynchronous communication lines connected to other systems in XODIAC networks;
- Synchronous communication lines working through a process like HASP II (HAMLET), DG/SNA, or XODIAC.

## Spool Queues

EXEC places all user requests that involve spooled devices in spool queues, where they are handled by an EXEC cooperative process — usually an XLPT printer manager process. Requests can come from batch jobs or directly from users through the CLI commands QPRINT, QBATCH, QPLOT, QSUBMIT, QFTA, and QSNA.

As in batch, EXEC queues spool requests according to priority and sequence number. Those with the lowest priority number have the highest priority and are processed first; those with the same priority are processed on a first-in, first-out basis. Many users can issue Q-series commands simultaneously. You can use the EXEC XBIAS command to give small jobs priority over large ones, or vice-versa.

As in batch, EXEC stores each spool queue request as a temporary file in directory QUEUE; and it deletes the temporary file after the spooled device has processed the request.

Also as in batch, an operator process can hold or cancel a spool queue entry via EXEC HOLD and CANCEL commands; or it can FLUSH an active entry. Users can hold or cancel their own queue entries using the CLI commands QHOLD and QCANCEL. They can use QCANCEL (not FLUSH) to cancel an entry being processed.

## Creating and Opening Queues

Before users can access a spool queue, the queue must be created, opened, and started on a device; then the device must be continued. The EXEC commands CREATE, OPEN, START, and CONTINUE do these things, as follows

|                        |                                                           |
|------------------------|-----------------------------------------------------------|
| CREATE type queueName  | Creates the queueName of type.                            |
| OPEN queueName         | Opens queueName as an entry in the peripherals directory. |
| START queueName device | Starts the queue and device on a co-operative process.    |
| CONTINUE device        | Activates the device.                                     |

If you created your own multiuser environment in Chapter 5, you typed these commands to create line printer and perhaps digital plotter queues. You need not recreate these queues; but whenever you want to bring the multiuser environment up, all needed queues must be started and continued. The UP.CLI macro should do this for you; if not, you will probably want to edit UP.CLI so that it *does* start and continue all needed queues. The remainder of this section, and the next, will give you the background you need.

The CLI command QPRINT accesses the queueName LPT, and the QPLOT command accesses the queueName PLT. If a print or plot queue has a name other than these, users must use the /QUEUE switch to access the queue.

If your system has one or more letter-quality printers, you can create queues named LQP, LQP1, and so on for these. For example, for a letter-quality printer on console line 13 (@CON15), you might type

```
) CX CREATE PRINT LQP )
) CX OPEN LQP )
) CX START LQP @CON15 )
) CX HEADERS @CON15 0 )
) CX BINARY @CON15 CLEANUP_FILE )
) CX CONTINUE @CON15 )
```

BINARY mode is needed for CEO users. CLI users can access the letter-quality printer via QPRINT/QUEUE=LQP... commands.

If your system has a third or fourth line printer or plotter, you will need to create a queue name for each. For example, assume that you have a third line printer and want to create a queue — say LPT2 — for it. You'd use the following commands.

```
) CX CREATE PRINT LPT2 )
) CX OPEN LPT2 )
) CX START LPT2 @LPB2 )
) CX CONTINUE @LPB2 )
```

And users could access the queue via QPRINT/QUEUE=LPT2 ... commands.

A queue cannot have the same name as a printer — because both names are files in :PER.

## Queues, Printers and XLPT Processes

Spool queues and printers are managed by cooperative processes based on the XLPT program. There is one XLPT process for each printer. Each XLPT process is created, for one queue and printer, by EXEC's START command. For example,

|                     |                                                                          |
|---------------------|--------------------------------------------------------------------------|
| CX START LPT @LPB   | Creates XLPT process to manage printer @LPB on queue LPT.                |
| CX START LPT1 @LPB1 | Creates an XLPT process to manage printer @LPB1 on queue LPT1.           |
| CX START LQP @CON25 | Creates an XLPT process to manage a letter-quality printer on queue LQP. |

After a process has been started for a queue and printer, the CONTINUE command activates the printer. For example, the following commands activate the printers above.

```
CX CONTINUE @LPB
CX CONTINUE @LPB1
CX CONTINUE @CON25
```

There are special instructions you can give in the START command. For example, you can specify 8-bit character handling.

If a printer is uppercase only, you must use START with the UPPER argument. If it is laser document printer (type LPE), you must use START with the /NL switch. Both UPPER and /NL are described under EXEC's START command.

You can start a single queue on two or more printers; for example

```
) CX CREATE PRINT EITHER )
) CX OPEN EITHER )
) CX START EITHER @LPB )
) CX START EITHER @LPB1 )
) CX CONTINUE @LPB )
) CX CONTINUE @LPB1 )
```

This command sequence creates queue EITHER, which sends output to either printer. Users can access this queue via QPRINT/QUEUE=EITHER ... commands.

Instead of a printer, you can specify a disk file in the START command. For example, assume you wanted to divert LPT queue output from your first line printer to a disk file. You'd create the disk file in :PER, stop the printer, start the old queue on the disk file, then continue the disk file, just as if it were a device. For example:

```
) SUPERUSER ON )
*) CREATE :PER:LPTFILE )
*) CX STOP @LPB )
*) CX START LPT @LPTFILE )
*) CX CONTINUE @LPTFILE )
```

Now all QPRINT output will go to file @LPTFILE.

A queue name cannot be the same as its associated device name (because, as you can see, both are entries in :PER).

Any user can check queue status by typing the CLI command QDISPLAY. The operator can also use QDISPLAY, or the EXEC command SPOOLSTATUS.

Normally, the commands to start queues and printers, and to continue printers, are in the UP.CLI macro — and the queue-device\_XLPT mechanism runs by itself. But knowing about them is important if you need to reorganize queues while EXEC is running.

EXEC allows up to 32 queues, including the three permanent batch queues. It allows up to 256 total queue entries at one time. If a user tries to submit an entry when there are 256 entries outstanding, he/she will receive an error message.

## Communications and Network Queues

If you have certain optional DG communications or network products, you will probably need to create EXEC queues for them.

DG's IBM emulators — DG/SNA and HASP II (HAMLET) — and XODIAC networking agent FTA need EXEC queues to run properly. The name of the HASP II queue should be HAMQ; the name of the SNA\_RJE queue should be SNQ, and the name of the FTA queue should be FTQ.

To *create and open* the HASP II queue, you'd type

```
) CX CREATE HAMLET HAMQ )  
) CX OPEN HAMQ )
```

Then you'd start and continue the queue according to the HAMLET documentation (or Release Notice). You might choose to start the HAMLET process, and put the EXEC START and CONTINUE commands in the bisync up macro (mentioned with the GSMGR process in Chapter 5; for HAMLET to work, GSMGR must be running). After the HAMQ is continued, users can access the queue via QSUBMIT/QUEUE=HAMQ... commands.

To *create and open* the DG/SNA (SNA\_RJE) queue, you'd type

```
) CX CREATE SNA SNQ )  
) CX OPEN SNQ )
```

When you start and continue the SNQ, it must be associated with the SNA\_RJE *process* name (not a device name). So the SNA\_RJE process must be running. The sequence of commands goes as follows:

|                            |                                                                           |
|----------------------------|---------------------------------------------------------------------------|
| CONTROL @SNA_RJE START ... | CONTROL command creates SNA_RJE process.                                  |
| CX START SNQ @SNA_RJE_EXEC | Start queue on process name (the “_EXEC” suffix was added by the process) |
| CX CONTINUE SNQ            | Continue the queue.                                                       |

Users can now access the SNA\_RJE queue using the CLI command QSNA.

Later, to pause the queue, you'd pause the process name: @SNA\_RJE\_EXEC. You could then kill the process with a CONTROL @SNA\_RJE STOP command. For convenience, you might choose to put the SNA-creating process and EXEC commands in an SNA up macro; and put the terminating commands in an SNA down macro.

For XODIAC FTA, to *create and open* the FTA queue, you'd type

```
) CX CREATE FTA FTQ )  
) CX OPEN FTQ )
```

EXEC commands to start and continue the FTQ on the FTA process are included in the XODIAC macro UP.NETWORK.CLI; and there are commands to terminate the FTA process in DOWN.NETWORK.CLI.

When the FTA process is up and running, and the queue FTQ has been started on it, users on the network can enqueue file transfers with the CLI command QFTA.

Communications and networking products have other, non-EXEC queues, CONTROL @name commands, and program files, described in their own manuals. We describe the queues above in *this* book because they are EXEC queues.

## Spool Queue Parameters

Sometimes, you may want to change spool queue parameters like priority, lines per page, or forms. To do so, pause the device associated with the queue before changing the parameter. Then make the change and continue the device. For example, to change LPT's queue priority range, type

```
) CX PAUSE @LPB )  
) CX QPRIORITY @LPB 127 255 )  
) CX CONTINUE @LPB )
```

These commands tell EXEC to pause the print device named @LPB, to change the priority of the device to a high-priority value of 127 and a low-priority value of 255, and to continue the device. During a pause, users are allowed to submit jobs to the queue; however, EXEC does not instruct the device to process the jobs until you continue the device.

This is the kind of thing you might do at runtime, instead of in the UP.CLI macro.

## The Queue Compression Program

EXEC stores all the temporary files used in batch and spooling in directory :QUEUE; then it deletes them. It stores the entry *names* in file Q, which expands to hold each new entry name.

The queue compression program, QCMP, is a utility that repacks the queue file and can delete unused files in :QUEUE. QCMP can delete all files/directories that don't have entries in the queue file — *so don't let anyone use directory :QUEUE for file storage.*

QCMP cannot run while EXEC is running; if you try to run it while EXEC is up you'll get a *CAN'T OPEN* error message. Usually, QCMP is executed via the UP.CLI macro before EXEC is brought up. But you can execute QCMP while EXEC isn't running via the form

```
XEQ  QCMP[/YES][/L[=pathname]]
```

The /YES switch tells QCMP to delete unused files; otherwise QCMP asks for confirmation before it deletes the files. /L[=pathname] sends output to the @LIST file, or the file named in pathname if you include =pathname. If you omit /L, output goes to the system console.

QCMP repacks the queue file. Then, if you omitted the /YES switch, it asks

*MAY I DELETE UNUSED FILES IN :QUEUE?*

Type Y ↵ or YES ↵ if you want to delete unused files; type N ↵ or NO ↵ if you do not. If you type Y ↵ or used the /YES switch, QCMP will say either

*NO UNUSED FILES FOUND.*

or

*DELETED FILES:↵*

... (Filenames deleted) ...

Note that QCMP deletes user files in :QUEUE.

If you type N ↵ to the QCMP query, QCMP says

*I WOULD HAVE DELETED:*

... (Filenames) ...

When QCMP finishes, it says

*REPACKING COMPLETE, n BLOCKS FREED*

The *n* is the number of disk blocks reclaimed from :QUEUE.

## FORMS Directory

If your installation prints data on special forms, you need a directory called :UTIL:FORMS. Chapter 5 had the reader create this directory. You can check it, and its access control list (ACL) by typing

```
) FILES/AS  :UTIL:FORMS ↵
:UTIL FORMS DIR date size
) ACL/V    :UTIL:FORMS ↵
FORMS OP,OWARE +,RE
)
```

The ACL of OP,OWARE +,RE gives the operator all access and users read and execute access to :UTIL:FORMS. Read and execute access lets users read the names of the form types in the FORMS directory and use them. If you give users append access, they can add their own forms. If you give users owner or write access, they can delete forms or change the ACLs of current forms. To give them append access, you'd type

```
) ACL/V    :UTIL:FORMS  OP,OWARE  +,REA ↵
:UTIL:FORMS
)
```

To create and use forms control files in FORMS, either you or a user must

- Get into directory FORMS (DIR :UTIL:FORMS ).
- Create a forms file with a filename; e.g., PAYCHECKS. If needed, change the ACL for the finished forms file so that pertinent users can access it with QPRINT/FORMS= commands.
- Execute the Forms Control Utility program (XEQ FCU ). This is an interactive program that assigns printer format specifications to existing files; it has a help feature (H). Give FCU the C command and the new filename, e.g., PAYCHECKS. The FCU dialog is described in the CLI manual.
- Test the form by pausing EXEC, putting the paper form in the printer, typing the EXEC FORMS command as described later in this chapter, continuing the printer. Then type QPRINT/FORMS=formname datafilename ).
- If the form prints as desired, you're done. If not, edit the form file with FCU and try the QPRINT command again. Repeat these steps until you're satisfied with the printing.

For example, suppose your installation has three-part paper forms, available to all users, and check forms only for the users with usernames PAYROLL and ACCOUNTING. To create these forms, you might do the following.

- Create the files and ACLs by typing

```
) PUSH )
) DIR :UTIL:FORMS )
) CREATE 3_PART_FORMS )
) ACL 3_PART_FORMS OP,OWARE +,R )
) CREATE PAYCHECKS )
) ACL PAYCHECKS OP,OWARE ACCOUNTING,R PAYROLL,R )
) POP )
)
```

(PUSH and POP save the old environment and restore it — returning you to the original directory after the operation.)

- Insert format specs in the two form files with FCU.
- Pause EXEC; issue EXEC FORMS command; put forms in printer and test as described above.

When a user wants to print on a specific form, he/she types the QPRINT command with the /FORMS=formname switch. EXEC holds these jobs until you insert the specified form in the appropriate printer and issue EXEC's FORMS command. Printing requests without the /FORMS= switch are printed as usual on this printer until you issue the EXEC FORMS command to this printer.

There's an easier method than those described above to produce special form printing — but it requires you to relinquish forms control. A *user* can run FCU on a file with text that requires special formatting, then print the file using a standard QPRINT command (without /FORMS=). The file will then print in the special format without operator action; you won't need to pause the printer or specify a forms file.

With FCU, users can specify nondefault tab settings, a nonstandard number of lines per page, and channel numbers for program use. The FCU settings must be within the EXEC's default form limit for the printer, typically 66 lines per page and 80 characters per line.

FCU stores its specifications in a file's User Data Area (outside the file itself). Thus, FCU specs serve only to control the printer; they don't affect text in the file.



## Printer and Character Control

EXEC's printer manager program, XLPT, may do a lot of character interpretation as it directs text to printers — as follows.

- **Formatting and forms control.** XLPT follows form specs created by FCU, allowing the system operator and users to print on special forms, as described above. Aside from specific form definition, you can use EXEC's LPP and CPL commands to specify default lines per page and characters per line for printing.
- **Binary printing.** The XLPT process can print in two modes, normal and binary. In normal mode, it skips unprintable characters, and it formats the text to fit the form specified on the target printer.

In binary mode, XLPT does no formatting and passes all characters (including unprintable ones) to the printer. This mode allows users to send control information to printers; it is used extensively by DG's CEO system. You can enable and disable binary mode with EXEC's BINARY command.

After a file is printed in binary mode, a cleanup file should be printed. A cleanup file returns the printer to a known state, so that the next printing job can start from scratch sending its control characters (if any). A cleanup file may contain nothing more complex than a form feed. You can create cleanup files easily for CEO with a utility program supplied with CEO.

## Spool and Batch Commands to EXEC

Many EXEC batch and spool commands relate to both batch and spooling. The commands are ALIGN, BINARY, BRIEF, CANCEL, CLOSE, CONTINUE, CPL, CREATE, DEFAULT-FORMS, DELETE, ELONGATE, EVEN, FLUSH, FORMS, HEADERS, HOLD, LIMIT, LPP, OPEN, OPERATOR, PAUSE, PURGE, PRIORITY, QPRIORITY, RESTART, SILENCE, SPOOLSTATUS, STACK, START, STATUS, STOP, TRAILERS, UNHOLD, UNLIMIT, UNSILENCE, VERBOSE, and XBIAS.

These are summarized in Table 8-3 (earlier) and detailed in the alphabetical section, later in this chapter.

## About User Tape Mount Requests

This section describes user tape mount requests, tape labeling, and the use of labeled tapes. The related EXEC *commands* appear in the next section.

User mount requests include a broad range of system operations. Often, timesharing users will want to have the system operator/manager (you) mount tapes for them. Also — when you dump files for backup — you will probably want to log on *as a user* so that EXEC's MOUNT and batch features will be available to you. In either case, you will want to know something about labeled tapes.

User tape mount requests are often used for system backup — generally by the system operator *acting* as a user. If your system does not have a tape unit, tape mount requests are irrelevant to you. For backup, you'll use labeled diskettes, which are managed by the CLI, not EXEC. For backup on diskettes, see "Backup Using Dump — with Diskettes" in Chapter 10.

## Tape Labeling

Magnetic tapes are either *labeled* or *unlabeled*. An unlabeled tape contains no label information. A labeled tape has information — including a volume ID (valid) for the tape, and a filename and expiration date for the tape fileset.

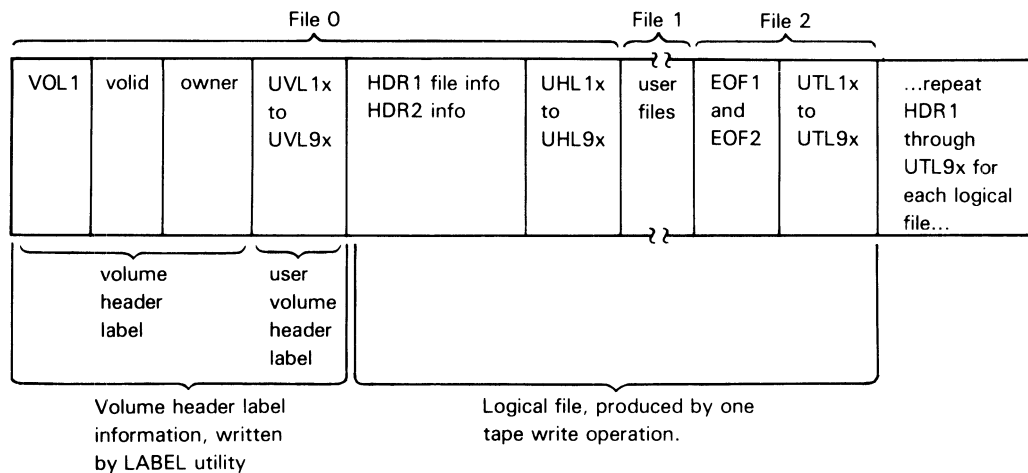
## Components of Labeled Tape

There are several different kinds of labels written to a labeled tape. The most important ones are

- the volume header label (contains the volid and is created by the LABEL utility); and
- the first file header label (HDR1, created by the system when it writes material to the tape).

Generally, the other labels are useful only if you have application programs that specifically read and write them, via the ?OPEN system call or higher-level language equivalent.

A labeled tape, after it has been labeled via LABEL and after disk-based material has been written to it, has the structure shown in Figure 8-2.



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Figure 8-2. Information on a Labeled Tape

The fields shown on the tape have the following meanings.

- VOL1** is a fixed string that means "volume type 1". The LABEL utility always writes VOL1 on every tape.
- valid** is the volume ID assigned by a person using the LABEL utility (X LABEL unitname valid I). The reserved length is 6 characters; the valid can't exceed 6 characters.
- owner** is the owner field, whose contents users may specify with the LABEL /OWNER= switch. This is optional. The reserved length is 14 characters.
- UVL1x to UVL9x** are user volume labels users can specify with the LABEL /UVL=x switch. On the tape, each UVL field begins with the characters UVLx, followed by the text of x as given with the /UVL=x switch. These labels are optional. They are useful only if your application programs can read them. The maximum length you can specify for a user volume label is 76 characters.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HDR1 file info | <p>HDR1 is written by the system during the write operation. It contains the following items. All items are created and used by the operating system only, unless noted otherwise.</p> <ul style="list-style-type: none"> <li>• filename for the fileset, as supplied by the person who started the tape write. (This name has no relationship to the individual files actually written to the tape.) For example, the command<br/> <code>) DUMP/V TAPE:FILE5 # )</code><br/> creates the filename FILE5 on tape. The maximum filename length is 17 characters;</li> <li>• fileset ID;</li> <li>• file section number;</li> <li>• file sequence number;</li> <li>• generation number and version number;</li> <li>• creation date;</li> <li>• expiration date (the default is 90 days from the creation date; the DUMP or DUMP_II /RETAIN switch can override the default);</li> <li>• block count (always 0 in HDR1);</li> <li>• operating system ID (as set by SYSID command, or the default).</li> </ul> |
| HDR2 info      | <p>In DG format (default), the system always writes this label. In non-DG format, it's written only if a user program opened the tape using an extended packet on the ?OPEN call. HDR2 contains the record format specifier (a one-letter code), block length (buffer size), and a code for record length.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| UHL1x to UHL9x | <p>are user header labels. These are optional. The only way to have them written is via the ?OPEN system call or higher-level language equivalent. They are useful only if you have application programs that read and write them.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| user files     | <p>This is the disk-based information copied in the tape write. It includes all information written by any <i>single</i> CLI command or program write statement. For example, if the command is DUMP, the <i>user files</i> will include all files dumped.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| EOF1 and EOF2  | <p>At the end of each logical file written, the system writes a label with EOF1 and EOF2. It writes an EOV1 and EOV2 label at the end of each reel. (There is no EOV label if the file fits on a single reel.) EOF1 and EOV1 each record the number of blocks written; this number serves as an error check when the tape is read.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| UTL1x to UTL9x | <p>are optional user trailer labels, written after the EOF or EOV label.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## DG, ANSI, or IBM Format?

By default, labeled tapes are written in DG format. To write labeled tapes that will be read on a DG, ANSI, or IBM (EBCDIC) system, proceed as follows.

- If the destination system is a DG system (AOS, AOS/VS, etc.), use the LABEL program without the /I switch. To write to the tape, you can use any CLI command or the default format in any write statement.
- If the destination system is an IBM system (EBCDIC), use LABEL with the /I switch. You can then write to the tape using the CLI command DUMP with the /IBM switch.

- On an IBM system, you can then load the tape and use it with IBM syntax. (You can read labeled tapes produced on an IBM system with the CLI command LOAD with the /IBM switch.
- If the destination system is an ANSI-based, non-DG system, use LABEL without the /I switch. To write to the tape, you can't use CLI commands. You must use a program that either opens the labeled tape (?OPEN call to @LMT:valid:filename) for ANSI format; or use a program that employs the high-level language equivalent of ?OPEN/?WRITE to specify ANSI format.

## Unlabeled Versus Labeled Tape

The whole approach to labeled tape differs from the approach to unlabeled tapes. For example, typical I/O to unlabeled and labeled tape might look like this.

### Unlabeled Tape

```
DIR :
DUMP @MTB0:0 +
DUMP @MTB0:1 UDD:SALLY:#
DUMP @MTB0:2 UDD:JACK:#
.
.
.
```

(LOAD sequence would be the same, with LOAD instead of DUMP).

### Labeled Tape

```
MOUNT/VOLID=xxx TAPE PLEASE
DIR :
DUMP :UDD:OP:TAPE:USERS UDD:#
.
.
.
```

(LOAD sequence would be the same, with LOAD instead of DUMP.)

The labeled approach won't work on unlabeled tapes. But the unlabeled approach *can* work on labeled tapes, because the tape labels are individual tape files.

Although labeling tapes requires extra effort, labeled tapes offer many advantages. These include the the following:

- Users can create multivolume tape files without worrying about the physical ends of the tapes. One file can extend across many tape volumes.
- The tape itself contains information about material stored on it: user label text, filename, and expiration date.
- Users can create tapes to be read on other operating systems, like an IBM system or a system that uses ANSI-standard labeled tapes.
- Users have control over the amount of time each tape file will be retained, via the DUMP and DUMP\_II /RETAIN= switch. The system will not overwrite files dumped to a labeled tape until the retention period has passed or until the tape is relabeled.
- DG data management programs — INFOS® II and DG/DBMS — have logging utilities that expect labeled tapes.

## Planning and Assigning Tape Labels

Generally, tape labeling must be consistent to be worthwhile. There's a big difference between typing

1. DUMP/V @MTB0:3 +.F77 )  
and
2. DUMP/V MYTAPE:F77\_SOURCES +.F77 )

The first approach is hardware oriented; people must know the unit number and tape file number they want. The second approach is software oriented; people can use any link name and a real filename up to 17 characters instead of the unit and file number. But if people try to use both the labeled and unlabeled approaches, they may get confused.

This means that the use of labels must be planned, usually by the system manager, administrator, operator, or someone in authority. You may not want to let users create their own labels, because then you will have to keep track of their labels and tapes. If your installation lets users do their own labeling, there should be a standard for the labels — and you, the operator, will have to administer a filing system for the user-labeled tapes so that you can find them easily. If users can't create their own labels, you may want to prepare a stockpile of blank, labeled tapes for them. You can do this with the LABEL utility.

The industry standard length of labeled tape volume IDs (*volids*) is 6 uppercase alphanumeric characters. So the volids chosen should be 6 characters or less, yet be as descriptive as possible. You might choose an arrangement in which the leading characters specify the *usage type* for the tape, and the trailing characters are numbers that give the tape sequence. For example,

volids GP0000 through GP9999 are for General Purpose (GP) user use;

volids DB0000 through DB9999 are for DataBase (DB) archiving.

Or, you could use the date and sequential numbers; e.g., 130100, 130101, etc. for 13 January. Or, if you alternate daily dumps, use a suffix A or B. If you have multiple AOS/VS systems, you may want to include a short system identifier.

After deciding on the volids, you can use the LABEL utility to prepare prelabeled tapes for each use type. For example,

Put a new tape on unit MTB0.

```
) X LABEL /UVL=1ST_USER_VOLUME @MTB0 GP0000 )
```

Dismount tape and put another new tape on unit.

```
) X LABEL /UVL=2ND_USER_VOLUME @MTB0 GP0001 )
```

and so on. A tape labeled with the LABEL program has the label at the beginning, but users can ignore it: users write to the tape and read from it by linkname and filename. The tape label includes the volume ID, UVL text (if any), and system name and revision. If the tape has been written to, the label also contains the expiration date and fileset ID. Labels written by LABEL are in ASCII, so you can use the CLI command TYPE to read them; e.g., TYPE @MTB0 ). (All LABEL utility syntax and switches are further described in the CLI manual.)

If you're planning to dump at a nondefault density, be sure to label the tape using the same density. For example, use the /DENSITY= switch to the LABEL utility:

```
) X LABEL /DENSITY=6250 @MTD0 VOL1 )
```

```
) MOUNT /VOL=VOL1 MYTAPE )
```

```
) DUMP /V/L=LFILE /DENSITY=6250 MYTAPE )
```

NOTE: If you run a locked LOCK\_CLI on the system console, it will not obey an X LABEL command. You must either unlock it or use another console to label tapes.

After using LABEL to label a tape, you may want to write the label name on a paper tape label and stick it on the tape reel. Later, when someone needs a blank tape, you can get the next sequential reel and mount it on a unit, then tell the person what the volid is with the SEND command. After the person is done with the tape, you can file the tape with the person's name so that you can find it easily when desired.

After a labeled tape has been written to, the system won't allow the material on it to be overwritten until the retention period (default 90 days) has passed. The DUMP command and DUMP\_II utility have a /RETAIN= switch that can select a different number of days. For example, if a user types

```
) DUMP/V/RETAIN=14 TAPE:SOURCES +.PL1)
```

then the system won't overwrite file SOURCES until 14 days have passed. However, anyone can overwrite the *label* (with new retention period and other information) by relabeling the tape with the LABEL program.

This gives people great control over backup periods and can be very helpful for file backup.

## User MOUNT and DISMOUNT Requests

A *user* — in this context — means a user process, run for anyone with a valid profile. The system operator can issue a “user mount request” if logged on to a user console. A user mount request won't work if it originates at the system console, or any console not “owned” by EXEC.

A user mount request must *come from* a user process — but EXEC will honor it only if someone is available to mount tape. So, someone must have typed CX OPERATOR ON ) at the system console.

To request a tape mount explicitly, a user issues the CLI command MOUNT. One of the arguments to MOUNT is the filename that will become the *linkname*. EXEC then displays a mount message on the system console and you must respond to it. The user can't issue any more commands until you do respond. You can either physically mount the tape and tell EXEC where you mounted it; or you can refuse the request. If you mount the tape, EXEC gives the user process exclusive access to it, and creates the linkname in the user's initial directory. The user can access the tape with the linkname. When the user's tape read or write is done, or on an error, or on a user DISMOUNT command, EXEC deletes the linkname file, rewinds the tape, prints a *DISMOUNT* prompt at the system console, and restores the old tape ACL; you must physically dismount the tape and tell EXEC you dismounted it.

EXEC creates, and later deletes, the user-specified linkname in the user's *initial working directory*. This means that the user must access the tape from the initial directory, or use a pathname to the link [e.g., :UDD:JACK:MYTAPE] in all references to the tape. Otherwise, from outside the initial working directory, the user will get a *DIRECTORY DOES NOT EXIST* or *FILE DOES NOT EXIST* error message. We say all this to help you resolve user confusion: if you don't issue mount requests, you may never see a user linkname.

### Unlabeled Tape MOUNT Example

A sequence for an unlabeled tape might go like this:

1. User Jack has logged on to AOS/VS under EXEC. On his console, he types

```
) MOUNT MYTAPE Please mount a scratch tape -- ring in. )
```

MYTAPE is the linkname; it could be any legal filename.

2. EXEC responds to Jack's command by displaying the following message to you on the system console:

```
From Pid n (EXEC): ** UNIT MOUNT **  
From Pid n : MID=n USER=JACK PID=n  
From Pid n : REQUEST IS 'Please mount a scratch tape -- ring in'.  
From Pid n : RESPOND: CONTROL @EXEC MOUNTED @UNITNAME  
From Pid n : OR: CONTROL @EXEC REFUSED
```

The MID (mount ID) identifies each request; MIDs accumulate as users make requests.

If you don't want to mount a tape, type CX REFUSED ); Jack will then get a refused message on his console. You might send a message to Jack's PID explaining why you refused. Otherwise, get a blank tape with ring in, physically mount it on a free unit (say MTB1), and type

```
) CX MOUNTED @MTB1 )
```

3. The CLI prompt now returns to Jack's console. Jack can access the tape by linkname; e.g., MYTAPE:0 for the first file, MYTAPE:1 for the second. In a program, he could open and read or write to it just like any other file.

When he is done with it, he types

) DISMOUNT MYTAPE Please file under Jack: Tape 1. Thanks. ↓

4. EXEC responds by displaying the following to you on the system console:

*From Pid n : (EXEC) \*\* UNIT DISMOUNT \*\*  
 From Pid n : UNIT(S) ARE @MTBI  
 From Pid n : REQUEST IS 'Please file under Jack: Tape 1. Thanks.'  
 From Pid n : RESPOND CONTROL @EXEC DISMOUNTED*

As you can see, EXEC gives pretty clear instructions. (If Jack forgetfully logged off without typing a DISMOUNT command, EXEC would tell you so; but your response would be the same.)

5. Remove the tape from the unit. You may want to file it where you can find it again if Jack asks for it. Then type

) CX DISMOUNTED ↓

### Labeled Tape MOUNT Example

Users request labeled tape mounts by adding the /VOLID= switch to the MOUNT command.

A sequence in which a user writes to a multiple-volume fileset might go like this:

1. User Database is logged on to AOS/VS under EXEC. On her console, she types

) SEND 2 I want to do a dump. Need at least three 2400-ft. blank & ↓  
 &) tapes. Please tell me the tape volids to use. ↓

2. The system console then displays the message that user Database typed — and you find out who typed it:

*From Pid 8 : I want to do a dump. Need at least three 2400-ft. blank  
 tapes. Please tell me the tape volids to use.*

) WHO 8 ↓  
 PID 8 DATABASE 008 :CLI.PR  
 )

You note that 2400-ft. tape volids DB0056, DB0057, DB0058, and DB0059 are available. (The extra volume can do no harm). So you type

) SEND 8 Use volids DB0056 DB0057 DB0058 DB0059 ↓

3. User Database sees the message

*FROM PID n Use volids DB0056 DB0057 DB0058 DB0059.*

And she types

) MOUNT /VOLID=DB0056 /VOL=DB0057 /VOL=DB0058 /VOL=DB0059 & ↓  
 &) TAPE Rings in and HIGH density please. ↓

4. Now EXEC takes notice of the MOUNT command and displays

```
From Pid n (EXEC): ** UNIT MOUNT **
From Pid n : MID=n USER=DATABASE PID=8
From Pid n : VOLID(S) ARE: DB0056, DB0057, DB0058, DB0059
From Pid n : REQUEST IS 'Rings in and HIGH density please.'
From Pid n : RESPOND: CONTROL @EXEC MOUNTED @UNITNAME
From Pid n : OR: CONTROL @EXEC REFUSED
```

5. Now you have a choice. If several tape units are free, you might mount the tapes on them, and type the appropriate CX MOUNTED to one and CX PREMOUNT to the others (as shown under the MOUNTED command). But let's assume you decide to mount only one tape, valid DB0056. Mount it on a unit, say MTB0, and type

```
) CX MOUNTED @MTB0 ;
```

6. User Database's CLI prompt now returns to her console and she can start her tape write. She could write to separate tape filenames, but for simplicity let's say she decides to call her tape file DATABASES. She types

```
) DUMP/V/BUFFER=8192/RETAIN=14 :UDD:DATABASE:TAPE:DATABASES & ;
&) DATAB+ ;
```

(Just to be safe, she uses a full pathname to linkname TAPE.) EXEC now checks the tape to see that the valid is the one that the user requested. The valid is correct, so EXEC does not report an error. If the valid were wrong, EXEC would say **\*\*WRONG VOLUME\*\*** on the *system console*.

User Database's command dumps all disk files that begin with characters DATAB+ to file DATABASES on TAPE. The big buffer size consumes less tape. The number of days to retain the tape file is 14. (In practice, this user would want to batch the dump, but this is an example.)

7. The tape I/O proceeds. When it reaches the end of tape mark on valid DB0056, EXEC starts rewinding the tape and says

```
From Pid n (EXEC): ** NEXT VOLUME **
From Pid n : MID=n USER=DATABASE PID=8,
VOLID=DB0057,UNIT=@MTB0
From Pid n : VOLID(S) ARE: DB0056, DB0057, DB0058, DB0059
From Pid n : REQUEST IS 'Rings in and HIGH density please.'
From Pid n : RESPOND: CONTROL @EXEC MOUNTED @UNITNAME
From Pid n : OR: CONTROL @EXEC REFUSED
```

8. Remove the tape from unit @MTB0. Mount valid DB0057 on @MTB0. Since you're using the same tape unit, @MTB0, you can omit the unit argument and simply type

```
) CX MOUNTED ;
```

9. Before the I/O proceeds on the new volume, the system checks its valid. If it were wrong (here, if it were not DB0057), EXEC would say **\*\*WRONG VOLUME\*\*** and prompt for the correct volume. But the valid is correct, so EXEC says nothing.

The I/O now proceeds on valid DB0057. At the end of tape mark on volume DB0057, EXEC says

```
From Pid n (EXEC): ** NEXT VOLUME **
From Pid n : MID=n USER=DATABASE PID=8,
VOLID=DB0058,UNIT=@MTB0
From Pid n : VOLID(S) ARE: DB0056, DB0057, DB0058, DB0059
From Pid n : REQUEST IS ....
```

Once again, you dismount the tape on MTB0, mount a new volume (this time, DB0058) and type CX MOUNTED ;.



10. Again the system checks the new volume's valid. It's correct, so I/O proceeds to the third volume.

Somewhere in the middle of this tape volume, the dump is done. All files that Database specified have been copied to tape. The CLI prompt returns to Database's console. (Her console would have been tied up by the DUMP command, which is why she probably would have used batch.)

She types

```
) DISMOUNT TAPE Thanks. )
```

11. EXEC displays on the system console:

```
From Pid n : (EXEC) ** UNIT DISMOUNT **  
From Pid n : MID=n USER=DATABASE PID=8  
From Pid n : REQUEST IS 'Thanks'  
From Pid n : RESPOND CONTROL @EXEC DISMOUNTED
```

12. Remove the tape from its unit. File the three tapes wherever you file this type of labeled tape. These tapes will remain read-only until 14 days have passed or until you relabel them via the LABEL program. The extra tape, DB0059, can go back into the stockpile of labeled tapes.

13. Then tell EXEC that the unit is free by typing

```
) CX DISMOUNTED )
```

If Database (or anyone) wished to reload the entire file on the three volumes, she could generally follow the procedure above. The person might need to have Superuser on, and would need to type LOAD/BUFFER=8192... instead of DUMP/BUFFER=8192... . Any linkname could be used, but tape volumes DB0056, DB0057, and DB0058 would be essential.

Any load recreates the entire directory/file structure, as it was dumped, from the working directory. This can lead to duplication and user confusion. Therefore, only sophisticated users, and/or people in authority, should do loads from multiple-volume filesets. But the example makes the point.

### Volume ID (valid) Lists

In his or her MOUNT command, a user can specify a list of tape volume IDs (valids) with /VALID= switches. If /VALID switches are omitted from MOUNT, tape I/O is restricted to one volume.

On a write (like a dump), a user can specify enough volume IDs to hold the disk-based material, or tell EXEC to extend the valid list, or both. If the amount of material to be written won't fit on the valid(s) specified, and the /EXTEND switch was omitted, EXEC will abort the tape write. Then, sad to say, the write must be restarted from the beginning. To avoid this situation, a user can be generous with the valid list (the system will use only the valids it needs), and/or use the MOUNT /EXTEND switch. If the latter, EXEC will prompt the operator to mount another tape if one is needed.

For example, assume user Sam issues this command:

```
) MOUNT /VALID=VOL1 /VALID=VOL2 /EXTEND TAPE Please extend to VOL3 & )  
&) etc. if needed )
```

Someone at the system console gets EXEC's mount prompt, mounts a tape with valid VOL1, and types CX MOUNTED @MTn ).

Sam then issues this command:

```
) DUMP /V/L=DUMP_LIST /BUFFER=8192 :UDD:[!USERNAME]:TAPE:FILES # )
```

The dump proceeds through VOL1; EXEC then rewinds the tape and prompts for VOL2. The person at the system console mounts a tape with valid VOL2 and types the CX MOUNTED command. The dump continues through VOL2. If the dump completes on VOL2, EXEC rewinds the tape and prompts for a dismount. But let's assume that — at the end of VOL2 — more material remains to be dumped. EXEC displays on the system console

```
** EXPLICIT LABELED MOUNT ** NEXT VOLUME
MID= n, USER=n, PID=n, EXEC SUB-TREE= n
EXTEND VOLID LIST
REQUEST IS 'Please extend to VOL3 etc. if needed'
UNITS ARE: @MTBn
CURRENT VOLUME: ****, ALL VOLUME(S): vol1, vol2
RESPOND: CONTROL @EXEC MOUNTED @UNITNAME VOLID
OR: CONTROL @EXEC REFUSED
```

Naturally, the person at the system console can refuse the request. But, having come this far, let's assume the person wants to fulfill it. He mounts a blank tape, labels it via X LABEL @MTxn VOL3 (as user Sam asked), and types CX MOUNTED @MTxn VOL3. The dump then proceeds on VOL3. If needed, it can continue through VOL4, VOL5, and so on. When all the specified material has been dumped, EXEC issues a **\*\*WAITING TO BE DISMOUNTED\*\*** message at the system console. The person at the system console dismounts the last tape, types CX DISMOUNTED and the dump is done.

MOUNT/EXTEND has the advantage of allowing the operator to extend tape writes (up to the 128-character valid list limit) — and it has no disadvantages. You may want to encourage people to use it as a matter of course, and/or use it yourself.

### Implicit Mount Requests

To help with labeled tape operations, the system maintains a file named @LMT in the peripherals directory. While any labeled tape is mounted, EXEC maintains the user's linkname to file @LMT:first-valid. For example, during Database's dump above, the name TAPE would be linked to file @LMT:VOL1.

Even when a labeled tape is *not* mounted, users can use pathname @LMT:valid to request a labeled tape. This type of "on the fly" request is called an implicit mount request.

For example, assume all tape units are idle. User Sackville types

```
) LOAD/V @LMT:GP0076:MY_SOURCE.F77 )
```

As with an explicit MOUNT command, the CLI prompt does not return to the user's console until you — the operator — take action.

After Sackville's LOAD command, EXEC displays on the system console:

```
From Pid n (EXEC): ** UNIT MOUNT **
From Pid n : MID=n,USER=SACKVILLE,PID=n, VOLID=GP0076
From Pid n : RESPOND: CONTROL @EXEC MOUNTED @UNITNAME
From Pid n : OR: CONTROL @EXEC REFUSED
```

There is no *REQUEST IS* line, but otherwise the message is the same as any labeled MOUNT message. You can decide to mount the volume, in which case you'll find it, mount it, and type CX MOUNTED @unitname. Or you can refuse the request with CX REFUSED. If you mount the tape, the user's I/O will occur; then EXEC will prompt for a **\*\*UNIT DISMOUNT\*\***. Remove the tape and type CX DISMOUNTED.

Users can specify only one volume in an implicit mount request. If more volumes are needed (on a write), EXEC will prompt for them as if the user had typed a MOUNT/EXTEND command. Generally, if users or their programs may use implicit mounts, they should tell you beforehand so that you can have the pertinent volume(s) ready.

## Specific Volume Requests

All material written by write operation (the DUMP or COPY command) makes up a single dump file (logical file). To read any part of this logical file, the system must read sequentially from the beginning — through multiple tape volumes if needed — until it arrives at the desired part.

There *is* a way to add a logical file to the end of a fileset, or to read from a logical file that starts on a tape other than the first tape in the dump fileset — without reading all preceding tape volumes. The LOAD and DUMP switch /SPECIFIC allows you to do this, by telling EXEC to start at a specific volume ID. For example, assume the commands

```
*) MOUNT/EXTEND/VOLID=VOL1/VOL=VOL2/VOL=VOL3 XTAPE Please )
... (EXEC prompts for VOL1; tape is mounted and EXEC notified) ...
*) DIR : )
*) DUMP/V :UDD:[!USERNAME]:XTAPE:USERS UDD:# )
... (Dump proceeds to the middle of the second tape volume, VOL2) ...
*)
```

This DUMP command creates a logical file named USERS, containing all user directories and files. File USERS begins on VOL1 and ends on VOL2. At the end of the last volume, VOL2, the system rewinds the tape.

Let's say that the next step is to dump system (not user) material. You could use a new, different tape fileset. But (to use /SPECIFIC) let's assume you want to use the tape fileset that holds file USERS. Instead of having the tape dismounted, you'd type something like

```
*) DUMP/V/SPECIFIC @LMT:VOL2:SYSTEM #\UDD:# )
... (EXEC prompts for VOL2; tape is mounted and EXEC notified) ...
```

The system spins tape VOL2 to the end of the preceding logical file (USERS) then starts dumping all non-UDD material to a logical file named SYSTEM. Let's say the dump proceeds to the third tape volume, VOL3. Then the system rewinds the tape.

At this point, you have two logical files, USERS and SYSTEM, on a three-volume fileset. If — later — you want to read a dumped disk file from file USERS, you'll need to start at the first volume. But if you want to read a dumped disk file from file SYSTEM, you must use the /SPECIFIC switch to avoid reading the first volume. For example, to retrieve file :UTIL:LINK\_ERMES.CLI, you could type

```
*) DIR : )
*) LOAD/V/SPECIFIC @LMT:VOL2:SYSTEM UTIL:LINK_ERMES.CLI )
... (EXEC prompts for VOL2 on the system console) ...
```

Then you mount and the system starts reading the specific volume VOL2. Doing it the other way would have required VOL1 to be mounted and read. The other way might look like this:

```
*) MOUNT/EXTEND/VOLID=VOL1/VOL=VOL2/VOL=VOL3 ZTAPE Buster )
... (EXEC prompts for VOL1; tape is mounted and EXEC notified) ...
*) DIR : )
*) LOAD/V [!USERNAME]:ZTAPE:SYSTEM UTIL:LINK_ERMES.CLI )
```

Here, the system would need to read through VOL1 before reading VOL2, which is where logical file SYSTEM begins.

This technique, with the /SPECIFIC switch, is useful only if your site does multiple writes (like multiple dumps) to the same tape fileset.

If you use DUMP/SPECIFIC to start a dump to a second logical file, you must use LOAD/SPECIFIC to load from that logical file (use LOAD without /SPECIFIC to load from the first logical file).

You can discover the files on each volume by keeping a user log (CLI LOGFILE command at user console) during a dump; all the filenames dumped *and* CX MOUNTED commands will be recorded in this user log file. Then, you can print and delete the user log file. From the printout, you can tell which files are on each tape volume.

## User Programs and Labeled Tapes

Users are not restricted to DUMP and LOAD with labeled tapes; user programs can also access labeled tapes. Such a program must open linkname:tape-file (if the user issued a MOUNT command before running the program). Or a program can open @LMT:volid:file, for an implicit mount. In either case, the program must open the tape file for either input or output, not both (this is true for all tape I/O). The program must write/read sequential fixed- or variable-length records; it cannot write/read data-sensitive or dynamic records.

If users want to create their own labels, they should use the standard formats described in the *AOS/VS Programmer's Manual*.

Generally, the mount/dismount procedure will be smoother if users request explicit mounts via the MOUNT command before they run programs that need the volume(s). Implicit mounts can be tricky in such situations.

## Using MOUNT and Label Tapes in Batch

Batch is ideal for large labeled tape dumps and loads. Such batch requests free the user console for other work and they can be queued for a time when workload is light. However, labeled tape I/O *does* require that an operator be on duty — which anyone can ensure by applying the /OPERATOR switch to the QBATCH or QSUBMIT command. Such jobs will not start if the operator is off duty (EXEC OPERATOR OFF command).

If you, as the system operator, want to DUMP or LOAD via labeled tapes, you should log on to a user console and do it in batch. EXEC will prompt for tape volumes and help with tape I/O. (Using EXEC on the system console involves some restrictions; it's simpler to do it from a user console.)

Figures 10-1 and 10-2, in Chapter 10, show backup macros shipped with AOS/VS that use batch.

## Mount/Dismount Summary and Pointers

- The CLI command MOUNT requests you, the system operator, to mount a tape. The MOUNT command must be issued by a user process and/or a user console; it won't work from the system console. A person must be acting as operator (using the CX OPERATOR command). The CLI prompt will not return to the user's console or batch process until someone tells EXEC that the tape is mounted (CX MOUNTED) or refuses the request (CX REFUSED).
- Whenever you, as operator, see a **\*\*UNIT MOUNT\*\*** message, you can get the (specified) tape, mount it on an idle tape unit, and type CX MOUNTED @unitname ). Or you can refuse the request via CX REFUSED ).
- If EXEC's MOUNT message includes a valid, the request is for a labeled tape. You must find a tape with the specified valid, and mount it; or refuse the request. *Make sure that that valid is correct*; if you are uncertain, use TYPE @unitname ) to verify the valid. If the request needs multiple volumes, you can eliminate some UNIT MOUNT prompts by mounting all volumes needed (or as many as possible), then typing MOUNT for the first volume and PREMOUNT for the others. Then EXEC will manage the tape volumes without operator intervention.
- You can use the LABEL utility to create tape labels, at any time — even when EXEC is prompting you with a **\*\*UNIT MOUNT\*\*** request.
- You can use EXEC's MOUNTSTATUS command to keep track of mount requests. And you can use the UNITSTATUS command to see which tape units are mounted and premounted.

- If you get confused, or if EXEC seems unwilling to let go of a tape unit, you can always solve the problem by having the user who issued the request log off. This prompts EXEC to sever all connections with the unit and all you need type is **CX DISMOUNTED** .
- Within any labeled tape fileset, writes must occur sequentially, from one volume to the next. If you set up multiple filesets with different linknames (e.g., TAPE1, TAPE2, TAPE3), then you can dump to each fileset simultaneously — saving time if you have multiple tape units. If you have only one fileset, you can dump to only one volume at a time.
- Any user (including yourself) can specify *more* volumes than needed for a tape write — e.g., a dump. When all specified material has been written to tape, the user **DISMOUNT** command will write an EOF trailer on the current tape volume. The fileset write will be complete and you can ignore “extra” volids specified.

Or, any user can apply the **/EXTEND** switch to the **MOUNT** command. If so, if the user's tape I/O needs more tape volumes than the user specified, EXEC will prompt the operator to label another tape and mount it.

But if a user specifies *too few* volumes, and omits **/EXTEND**, tape file space will be exhausted. No EOF trailer can be written; EXEC will display a **NO MORE VOLIDS...** error message on the user's console; and the fileset will be incomplete. And — generally — the write must be redone from the beginning. This can be a real bummer at the end of a 10-volume dump. So, generally, users should be generous in the valid lists, or they should use **MOUNT/EXTEND**, or both.

- A user can start a labeled tape read or write on a specific volume with the **LOAD** or **DUMP** command and **/SPECIFIC** switch. The mount can be explicit or implicit. If explicit (**MOUNT/VOLID=...**), the **LOAD** command must use the form **@LMT:first-valid:fileset-name** (not tape linkname) to access the tape.
- A 2400-foot tape, at high density (1600 bpi), dumped with a buffer size of 8192 bytes, can hold about 39 megabytes of disk-based information. A 1000-foot tape can hold about 16 megabytes. Either tape can hold slightly more with a bigger buffer size, if you want to generate a system with a maximum tape buffer size larger than 8K. On an MTB tape unit, a 2400-foot tape takes about 12 minutes to fill (**DUMP\_II** program) or 20 minutes to fill (**DUMP** command). On an MTC tape unit, a 1000-foot tape may take about the same amount of time (12 or 20 minutes).
- Batch processing is ideal for multivolume labeled tape I/O.
- An essential part of the **MOUNT/DISMOUNT**/labeled tape business is planning and implementing the labels and organizing the tape library.

## Mount Commands to EXEC

The EXEC mount commands are **DISMOUNTED**, **MOUNTED**, **MOUNTSTATUS**, **OPERATOR**, **PREMOUNT**, **REFUSED**, and **UNITSTATUS**.

These are summarized in Table 8-3 (earlier) and detailed in the alphabetical section, next.

## EXEC Commands — Listed Alphabetically

This section describes all EXEC commands, in alphabetical order. For an EXEC command summary, see Appendix B or the EXEC summary card.

---

## ALIGN

**Halts or continues the XLPT process so you can align paper.**

---

CX ALIGN *//CONTINUE* @devicename [ */-/n* ]

where

*/CONTINUE* continues the device.

devicename is the name of a spooled device; it begins with @; e.g., @LPB.

*n* is the page number where you want XLPT to restart processing. A positive *n* indicates an absolute page number in the file. A negative *n*, like -1, indicates a page *before* the last page printed.

The ALIGN command tells XLPT to stop printing. If even pagination is enabled (default), printing stops at the first line of the next even-numbered page. To check the page XLPT was printing when the printer stopped, use the EXEC command STATUS @devicename.

When you reissue ALIGN, you can specify where XLPT should restart the job. To restart, use the command

CX ALIGN/CONTINUE @devicename */-/* *[n]*

XLPT keeps track of the previous 32 pages. If you request XLPT to continue printing at -33 pages before the one it was printing when the job stopped, XLPT won't know where the page is in the file. In this case, XLPT must go to the beginning of the file and calculate which page you are requesting. This command may take more time to process.

### Why Use It?

Printer paper may be out of alignment, or the paper may jam. ALIGN stops the printer so you can align paper or do other things with the printer; then resume printing.

### Example

If you are printing a large file on a printer named @LPB, you'd type

) CX ALIGN @LPB ↓

When you have corrected the jam, continue printing by typing

) CX ALIGN/CONTINUE @LPB ↓

This restarts the active job at the page where it stopped. If printing stopped on page 10, however, you might want to restart printing on page 9, instead of on page 11. In that case, you'd type

) CX ALIGN/CONTINUE -1 ↓

XLPT would then restart printing at the page where it stopped, minus one. This would be 10-1, or page 9.

---

## BINARY

**Tells the XLPT process to enable or disable binary mode.**

---

CX BINARY @devicename  $\left\{ \begin{array}{l} \text{filename} \\ \text{OFF} \end{array} \right\}$

where

devicename is the name of a spooled device; it must begin with @; e.g., @CON27.

filename is the cleanup filename. EXEC expects to find this file in directory :UTIL:FORMS.

OFF disables binary mode.

BINARY directs the XLPT cooperative process to enable or disable binary mode on a device. Binary mode is useful when users want to print on a device that interprets characters its own way; for example, a graphics printer or plotter. For such printers, you don't want XLPT to edit special characters that have meaning to the device; you want it to pass each character along as is. This is what binary mode does. Binary mode is not useful for a printer that supports only a Vertical Forms Unit (VFU); for example, LPB-type printers.

In binary mode, the XLPT process does not interpret characters with values 0 through 376 octal; it passes them directly from the file to the device. Since it doesn't interpret these characters, XLPT cannot keep track of page numbers, line numbers, or any other data that requires character interpretation. So, after a file has been printed in binary mode, the printer is left in an unknown state — perhaps with paper positioned in the middle of a page.

Thus, you must supply the name of a cleanup file (filename) when you enable binary mode. The cleanup file can position paper at the physical top of page, restore margins and tabs, and put the printer in its prebinary state. A cleanup file *can* include only a form feed (ASCII 14, CTRL-L) to position the paper at physical line 1 for the next user. The XLPT process sends the cleanup file to the device when you enable binary mode and after the device prints a file in binary. The cleanup file must be in directory :UTIL:FORMS. For printers under the CEO system, you can create cleanup files easily when you define printers in CEO.

To have a file printed in binary mode, a CLI user must append the /BINARY switch to the QPRINT command; for example,

```
) QPRINT/QUEUE=LQP/BINARY MYFILE )
```

If binary mode is not enabled for the device associated with the specified queue, the printed output will report a *BINARY MODE NOT ENABLED* error.

The printer that will process files in binary mode must be paused and idle before you can enable binary mode. After enabling binary mode, you must continue the printer.

There is one character that XLPT does interpret in binary mode: a character with a value of 377 octal. XLPT ignores 377 octal and any character (except 377 octal) that follows the first 377 octal. So, if someone wants to pass a 377 octal to the printer in binary mode, the file must contain two sequential octal 377s.

To see whether binary mode is enabled or disabled, use EXEC's SPOOLSTATUS command.

## BINARY (continued)

### Why Use It?

Binary mode is required for letter-quality printers used by CEO users. It is also required when you need to have all characters printed precisely as they are in the file, without interpretation by the XLPT process.

If a device will be used exclusively in BINARY mode, you may want to put the BINARY command in the UP.CLI macro.

### Example

```
) CX PAUSE @CON26 ;
```

```
From Pid 3 : (EXEC) @CON26 PAUSED
```

```
) CX BINARY @CON26 CLEANUP_26 ;
```

```
From Pid 4 : (EXEC) @CON26 BINARY MODE ENABLED
```

```
) CX CONT @CON26 ;
```

```
.
```

```
.
```

```
.
```

```
) CX PAUSE @CON26 ;
```

```
) CX BINARY @CON26 OFF ;
```

```
) CX CONT @CON26 ;
```



---

## BRIEF

**Tells EXEC to make its batch or spool messages brief.**

---

CX BRIEF  $\left[ \begin{array}{l} \text{stream} \\ @devicename \end{array} \right]$

where

*stream* is a batch stream number; e.g., 1, 2, 3, or 4. If you omit a stream number, the command affects all batch streams.

*devicename* is the name of a spooled device; it begins with @; e.g., @LPB.

When a batch stream or spooled device accepts or processes a request, EXEC sends a message to the system console. This message may be either “brief” or “verbose.” The EXEC BRIEF and VERBOSE commands determine the type of EXEC messages sent. Each time you issue a BRIEF or VERBOSE command, it overrides the current message setting. BRIEF is the default mode.

BRIEF messages include

- the batch stream number or devicename;
- the job sequence number; and
- the user’s username.

### Why Use It?

You may find EXEC messages easier to read if they contain less information. (You can also suppress EXEC’s time of day prompt with the command CX PROMPTS OFF ↓. And you can suppress all batch/spool messages with the CX SILENCE command.)

### Example

```
) CX BRIEF 2 ↓
```

```
.  
. .  
.
```

```
From Pid 3 : (EXEC) STREAM_2 SEQ=446, USR=sackville
```

```
) CX BRIEF ↓
```

```
.  
. .  
.
```

```
From Pid 3 : (EXEC) STREAM_1 SEQ=447, USR=F77
```

```
) CX BRIEF @LPB ↓
```

```
From Pid 3 : (EXEC) @LPB SEQ=448,USR=SALLY
```

---

## CANCEL

**Cancels all waiting queue entries with the given sequence number.**

---

**CX CANCEL** sequence-number

where

**sequence-number** is the sequence number of the queue entry to be cancelled.

The CANCEL command cancels the specified queue entry immediately. It doesn't work for an active entry; use the FLUSH command for this.

The batch input, output, and list for each batch job have the same sequence number. One sequence number removes the output and list files; the input file remains in the user's directory.

The CLI command QDISPLAY lists queue entries and their queue sequence numbers. Active entries are marked with an asterisk (\*) in the display. Entries that the operator has cancelled appear with an F flag in the display.

After you cancel an entry, the batch output file, or the printed output file, will show the message CANCELLED BY OPERATOR. For batch requests, the temporary batch input file remains in the user's directory.

Instead of cancelling entries yourself, you might send a message to the user, asking him or her to cancel it with the CLI command QCANCEL. QCANCEL (unlike EXEC's CANCEL) works with active requests.

### Why Use It?

There may be times when you don't want requests to remain enqueued. For example, there may be many requests or large requests waiting when you want to shut down a stream, device, or EXEC. CANCEL allows you to empty a stream or spool queue quickly.

### Example

```
) QD )  
BATCH_INPUT BATCH OPEN  
535 DA JACK :UDD:JACK:F77:?040.CLI.004.JOB  
.  
.  
.  
) CX CAN 535 )  
From Pid 3 : (EXEC) @LPB USR=JACK  
) QD )  
BATCH_INPUT BATCH OPEN  
.  
.  
.
```

Here, the CANCEL command cancelled the request with sequence number 535. The printer became active because it was printing the batch output file with the message CANCELLED BY OPERATOR.

---

## CLOSE

**Closes the specified queue to user requests.**

---

CX CLOSE queueename

where

queueename is the queue you want to close.

The CLOSE command closes the specified queue and prevents users from submitting more requests to the queue. Once you close the queue, users will get *CLOSED* error messages when they submit requests to the queue. The queue will continue to process requests within it, but no new requests can be added to the queue.

If you try to close a queue that is not open, EXEC gives an error message.

To reopen a queue, you must use the EXEC OPEN command.

The CLI command QDISPLAY will tell you which queues are open and which are closed.

### Why Use It?

Occasionally, you may want a queue to stop accepting requests; perhaps if you want to reorganize it or change it, or if the device involved needs servicing. CLOSE prevents the queue from accepting any more requests. If you wish, you can then use CX CANCEL commands to clean it out.

### Example

```
) CX CLOSE LPT )
```

```
) QPRINT MYFILE )
```

```
WARNING: QUEUE IS NOT OPEN
```

```
)
```

---

## CONSOLESTATUS

**Displays status of each console enabled by EXEC.**

---

CX CONSOLESTATUS [*@consolename*]

where

*@consolename* is the device name for the console; it must begin with @ to specify the peripherals directory; e.g., @CON44.

If you omit an argument, the CONSOLESTATUS command displays the status of all enabled consoles. To check a specific console, give its name as an argument.

For each active console, EXEC displays the username, console name, and process ID; it also tells you whether the console will be disabled when the current user logs off, and if a user is in the process of logging on or off.

### Why Use It?

CONSOLESTATUS is EXEC's version of the ?.CLI macro. But since it shows consolenames first, it's more useful than ?.CLI if you are more interested in console numbers than in the PIDs or users associated with them.

It also tells you the number of log on tries, and other ENABLE settings. And, since it identifies consoles on which someone is logging on or off, it can help you identify noisy console lines.

### Example

) CX CONSOLES ↓

... (status information on all enabled consoles) ...

) CX CONSOLES @CON45 ↓

*From Pid 3 : (EXEC) @CON45 Enabled, Logon Tries=5, Continue Pid=36, User=Sam*

) CX CONSOLES @CON4(6 7 8) ↓

*From Pid 3 : (EXEC) @CON46 Enabled, Logon Tries=5, Continue Console not logged on*

*From Pid 3 : (EXEC) @CON47 Enabled, Logon Tries=5, Continue Log on/off in progress*

*From Pid 3 : (EXEC) @CON48 CONSOLE UNKNOWN TO EXEC*

)

These messages indicate an enabled console in use, not in use, in logon/logoff transition, and a console not enabled by EXEC. The parentheses enclosing 6 7 8 in the last command are a CLI feature to help you write compact command lines.

---

## CONTINUE

**Tells one or more batch streams or devices to continue processing (opposite of PAUSE).**

---

CX CONTINUE  $\left[ \begin{array}{l} stream \\ @devicename \end{array} \right]$

where

*stream* is a batch stream number; e.g., 1, 2, 3, or 4. If you omit a stream number, the command affects all batch streams.

*devicename* is the name of a spooled device; it begins with @; e.g., @LPB.

The CONTINUE command continues a paused batch stream or device.

Continuing one or all batch streams has EXEC continue processing BATCH\_INPUT jobs queued to the stream(s). Continuing a device has EXEC continue processing requests from that device's queue.

If the command works, EXEC responds

*From Pid n : (EXEC) stream-or-device CONTINUING*

If the command fails, EXEC gives an error message.

Issuing the CONTINUE command to an active device or stream has no effect.

### Why Use It?

CONTINUE is needed to restore normal processing whenever you have paused a stream or device. It is also needed after you have started one or more queues on a device. The macro UP.CLI issues several CONTINUE commands as it brings up the multiuser environment.

### Example

```
) CX PAUSE 3 ↓
```

*From Pid 3 : (EXEC) STREAM\_3 PAUSED*

```
) CX QPRIORITY 3 127 255 ↓
```

```
) CX CONT 3 ↓
```

*From Pid 3 : (EXEC) STREAM\_3 CONTINUING*

---

## CPL

**Changes the number of characters per line for a device.**

---

CX CPL @devicename number

where

devicename is the name of a spooled device; it must begin with @; e.g., @LPB.

number is the number of characters per line. It must be an integer between 16 and 255.

The CPL command sets a new number of characters per line (CPL) for this device. It overrides any previous VSGEN, CHARACTERISTICS/CPL, or EXEC CPL settings. The new CPL remains until you change it with EXEC's CPL or bring down EXEC's XLPT cooperative process.

To change a CPL setting:

- Type CX PAUSE to the device.
- When EXEC tells you that the device is paused, type the desired CX CPL command.
- Type CX CONTINUE to the device.

CPL does nothing on a device if an EXEC DEFAULTFORMS or FORMS command is in effect on the device.

### Why Use It?

The default number of characters per line is 80.

On any printer, if a line to be printed exceeds the max CPL characters, it will be truncated to CPL on output unless the user applied the /FOLDLONGLINES switch to the QPRINT command. Having lines truncated is undesirable, and having them folded is often messy. To avoid both, you will generally want the longest possible line to print as in the file — and most printing paper has space for at least 85 characters per line (80 column) or 136 characters per line (132 column). To have more than 80 characters printed, you must use the CPL command.

After deciding on a good CPL for each printer, you may want to specify it in the UP macro, before continuing the printer.

### Example

```
) CX PAUSE @LPB1 )
```

*From Pid 3 : (EXEC) @LPB1 PAUSED [IDLE]*

```
) CX CPL @LPB1 136 )
```

```
) CX CONT @LPB1 )
```

To put the CPL command in the UP macro, you'd simply insert the line

```
CX CPL @LPB1 136
```

before the EXEC CONTINUE command for @LPB1.

---

## CREATE

**Creates a spool queue.**

---

```
CX  CREATE      { PRINT  
                  PLOT  
                  HAMLET } queue  
                  { FTA  
                  SNQ }
```

where

**queue** is the name of the new spool queue.

The CREATE command creates a spool queue for a line printer or other hardcopy printing device (PRINT), plotter device (PLOT), HAMLET process (HAMLET), XODIAC FTA process (FTA), or SNA\_RJE process (SNA). The spool **queue** can contain any legal filename characters. But if the queue is to be accessed by a CLI Q-series command without a /QUEUE= switch, the **queue**s must be

| Queue Type | Queue Name | Accessed by CLI command |
|------------|------------|-------------------------|
| PRINT      | LPT        | QPRINT                  |
| PLOT       | PLT        | QPLOT                   |
| HAMLET     | HAMQ       | QSUBMIT                 |
| FTA        | FTQ        | QFTA                    |
| SNA        | SNA        | QSNA                    |

To access a queue with any other name, users must append the /QUEUE= switch. For example, for a queue named LPT1:

```
) QPRINT/QUEUE=LPT1 MYFILE )
```

Users can submit jobs to a spool queue in three ways. They can

- specify the spool queue pathname as a listing file with the /L= switch; e.g.,  
WRITE/L=@LPT1 Hello ;
- specify the spool queue pathname as an output destination file in a CLI command; e.g.,  
COPY @LPT1 MYFILE ; or
- explicitly type a CLI QPRINT, QPLOT, QPUNCH, QFTA, or QSUBMIT (for HASP II/HAMLET) command; e.g., QPRINT MYFILE .

One CREATE command is needed for each queue in your system. Then, for the new queue, the OPEN, START, and CONTINUE commands are needed to make the queue usable. Users cannot submit jobs to the queue until it is open, and jobs won't be processed until the queue has been started on a device and the device has been continued.

## CREATE (continued)

CREATE and OPEN are generally issued only once, to set up the queue in :QUEUE and :PER. Thereafter, START and CONTINUE commands make the queue available. START and CONTINUE are often in the UP.CLI macro.

Chapter 5 of this book had the reader create and open the needed queues, then edit START and CONTINUE commands into the UP.CLI macro.

### Why Use It?

EXEC, as shipped, contains no spool queue names. Someone must create at least one type PRINT queue name (default LPT) before users can submit batch or printing requests. Other queues may be desirable. The CREATE command allows you to create queues.

### Example

The following commands create, open, and start the default print queue named LPT for the printer LPB:

```
CX CREATE PRINT LPT
CX OPEN LPT
CX START LPT @LPB
CX CONTINUE @LPB
```

The following example shows a create, open, and start for a print queue named PRINTER:

```
) QPRINT/QUEUE=PRINTER MYFILE )
WARNING: QUEUE DOES NOT EXIST: PRINTER
) CX CREATE PRINT PRINTER )
) CX OPEN PRINTER )
) CX START PRINTER @LPB )
) CX CONTINUE @LPB )
) QPRINT/QUEUE=PRINTER MYFILE )
QUEUED, SEQ=566
)
```

The following command lines create, open, and start a HAMLET (HASP II) queue:

```
) CX CREATE HAMLET HAMQ )
) CX OPEN HAMQ )
) CX START HAMQ @SLNO )
```



---

## DEFAULTFORMS

**Sets the characteristics of the default form for a device.**

---

CX DEFAULTFORMS devicename [*form-name*]

where

**devicename** is the name of a spooled device; it must begin with @; e.g., @LPB1.

**form-name** is the name of a file containing formatting commands for printed output. EXEC expects to find this file in directory :UTIL:FORMS.

The DEFAULTFORMS command sets the default form for a device. All files printed on this device will be printed per this form unless a user asks for a special form with the /FORMS= switch.

The new form specifications must be placed in a form file in :UTIL:FORMS. You, or a user, can put printing directives in the form file with the FCU utility, as sketched earlier in the chapter.

If you omit a form-name argument, EXEC uses the following default characteristics for printing files.

- the current setting for lines per page (LPP command); default is 66;
- the current setting for characters per line (CPL command); default is 80;
- the top of form is line 1 if LPP is less than 7; otherwise, the top of form is line 4;
- the bottom of form is the number of lines per page (LPP).

If you use DEFAULTFORMS to set lines per page or characters per line, you cannot use EXEC's LPP or CPL command to change these while the new DEFAULTFORM is in effect. Instead, you must reissue DEFAULTFORMS without a form-name argument; this restores the standard form, allowing LPP or CPL commands to work,

EXEC's SPOOLSTATUS command will tell you if nonstandard DEFAULTFORMS values are in effect.

As with any device parameter change, the device must be paused before EXEC will accept the command.

### Why Use It?

For specific nonstandard printing jobs, you'd use EXEC's FORMS command. But if most or all of a printer's work will be on nonstandard forms, you might want to make the nonstandard form the default form for this printer.

## DEFAULTFORMS (continued)

### Example

```
) CX PAUSE @LPB1 ;
```

*From Pid 3 : (EXEC) @LPB1 PAUSED [IDLE]*

```
) CX DEFAULTFORMS @LPB1 STANDARD_LPBI ;
```

```
) CX CONT @LPB1 ;
```

This sequence sets the standard form for @LPB1 to the specifications in file :UTIL:FORMS:STANDARD\_LPBI (built with the FCU program). Later, to restore the standard form to @LPB1, you'd type

```
) CX PAUSE @LPB1 ;
```

*From Pid 3 : (EXEC) @LPB1 PAUSED [IDLE]*

```
) CX DEFAULT @LPB1 ;
```

```
) CX CONT @LPB1 ;
```

---

## **DELETE**

**Deletes a spool queue (opposite of CREATE).**

---

**CX DELETE** queueName

where

queueName is the name of the spool queue you want to delete.

The DELETE command deletes the specified queue. The queue must be closed, stopped, and empty before EXEC will accept this command. Use the CX CLOSE, STOP, and PURGE commands to do this. You cannot delete the permanent queues, BATCH\_INPUT, BATCH\_OUTPUT, or BATCH\_LIST.

### **Why Use It?**

DELETE can be handy if you have created a temporary queue and want to get rid of it. Generally, you would not want to delete often-used, general-purpose queues like LPT.

### **Example**

The following commands close a print queue, dissociate the queue from whatever devices are processing it, purge the queue of all its entries, and, finally, delete the queue entirely.

```
) CX CLOSE PRINTER )  
) CX STOP PRINTER )  
) CX PURGE PRINTER )  
) CX DELETE PRINTER )
```

---

## DISABLE

**Removes EXEC log on capability from a console.**

---

CX DISABLE      { @consolename }  
                      /ALL

where

@consolename      is the device name for the console; it must begin with @; e.g., @CON40.

/ALL                tells EXEC to disable all enabled consoles.

The DISABLE command removes the EXEC logon capability provided by ENABLE. It prevents users from logging on at the specified console. If a user is logged on to the console, EXEC will not log him or her off; instead, it will wait until the user has logged off before implementing the DISABLE; and it will display a *Will be disabled* message on the system console.

You can undo a DISABLE command to an active console by issuing an ENABLE command to that console before the user logs off.

After EXEC disables a console, it displays the message

--- sysid Console DISABLED from Logging on ---

on that console.

### Why Use It?

Often, you will want to shut the system down, or release a console from EXEC so that another program (like DG/SNA or DATAPREP) can use it. In either case, you don't want people to log on via EXEC. Use DISABLE to handle either situation.

### Example

```
) CX  DISABLE  @CON2 )
```

```
) CX  DISA   @CON4(7 8 9) )
```

*From Pid 3 : (EXEC) Console will be disabled*

*From Pid 3 : DISA @CON47*

*From Pid 3 : (EXEC) CONSOLE UNKNOWN TO EXEC*

*From Pid 3 : DISA @CON48*

*From Pid 3 : (EXEC) FILE DOES NOT EXIST*

*From Pid 3 : DISA @CON49*

```
) CX  ENABLE  @CON47 )
```

*From Pid 3 : (EXEC) Disable cancelled, console enabled*

*From Pid 3 : ENABLE @CON47*

```
)
```

These commands attempt to disable consoles CON2, CON47, CON48, and CON49, then undo the disable on CON47. EXEC returned no message from the first command, meaning that @CON2 was already disabled. The other messages mean that CON47 was in use, that CON48 wasn't enabled, and that CON49 wasn't specified to VSGEN.

```
) CX  DISABLE /ALL )
```

*FROM Pid 3 (EXEC) All consoles will be disabled,*

---

## DISMOUNTED

**Tells EXEC that you have physically dismounted the tape(s) associated with a mount request.**

---

CX DISMOUNTED  $\left[ \begin{array}{l} mid \\ @devicename \end{array} \right]$

where

*mid* is the mount identifier: an integer shown by EXEC for each MOUNT request and displayed by EXEC's MOUNTSTATUS command.

*devicename* is a magnetic tape unit name; e.g., @MTB1 or @MTC0.

The DISMOUNTED command tells EXEC that you have physically removed the tape from the unit. EXEC deletes the user's linkname to the tape unit, and restores the unit's ACL to the setting it had before the mount.

If you omit arguments, the command applies to all tape volumes in the current dismount request. If you give a mount identifier (*mid*), this tells EXEC that *all* tapes associated with the *specified* request have been dismounted; it is handy when you want to specify a request other than the current request.

If you give a device name, this tells EXEC that the tape on a unit has been dismounted. This form is meant for situations where you PREMOUNT a volume, then change your mind and want to dismount it. It's also useful when you have mounted two units for a user, and want to dismount one of them for another user.

If system logging is on (Chapter 9), the log file will record the elapsed time that the user had the tape mounted.

EXEC will prompt you to type the DISMOUNTED command

- when a user who has a tape mounted types the CLI command DISMOUNT ;
- when a user who has a tape mounted logs off without typing the CLI command DISMOUNT ; or
- when a user's I/O is complete after you've followed his or her implicit mount request (e.g., LOAD/V @LMT:GP0076:MY\_FILESET PROG+ ).

When EXEC prompts you to type DISMOUNTED, it may also display a *REQUEST IS* line with additional information from the user. The request line will not appear in an implicit mount request. It will also not appear if the user program terminated before the tape was dismounted or if the user omitted a comment when he or she typed the CLI DISMOUNT command.

## DISMOUNTED (continued)

(EXEC does not check to see that you have actually taken the tape off line and unloaded it — so you can type DISMOUNTED before you physically dismount it. But if you do this, the unit ACL will revert before you have actually removed the tape, possibly allowing someone to write to it.)

### Why Use It?

You must issue DISMOUNTED when EXEC prompts for it to release the tape unit(s) from EXEC's mount mechanism.

Type CX DISMOUNTED @devicename when you have premounted a volume, but have dismounted it before it was been used.

### Example

An unlabeled tape user asks for DISMOUNT:

*From Pid 4: (EXEC) \*\* UNIT DISMOUNT \*\**

*From Pid 4: UNIT(S) ARE: @MTB3*

*From Pid 4: REQUEST IS 'Thanks'*

*From Pid 4: RESPOND: CONTROL @EXEC DISMOUNTED*

Remove the tape from the unit and type

) CX DISMOUNTED )

A labeled tape user asks for a dismount

*From Pid 3: (EXEC) \*\* UNIT DISMOUNT \*\**

*From Pid 3: MID=55,USER=F77,PID=33*

*From Pid 3: UNIT(S) ARE: @MTB2, @MTB3*

*From Pid 3: REQUEST IS 'Done. Please file. Thanks.'*

*From Pid 3: RESPOND: CONTROL @EXEC DISMOUNTED*

Type

) CX DISMOUNTED )

and remove the user's tapes from MTB2 and MTB3. If you premount a tape:

) CX PREMOUNT @MTB2 DB0067 DATABASE )

then change your mind about the premount, remove the tape from the unit and type

) CX DISMOUNTED @MTB2 )

---

## ELONGATE

**Turns elongated printing on or off on an LP2 or TP2 printer.**

---

CX ELONGATE @devicename  $\left\{ \begin{array}{l} \text{ON} \\ \text{OFF} \end{array} \right\}$

where

devicename is the name of a spooled device; it must begin with @ and be the name of a DASHER LP2 line printer or DASHER TP2 console printer.

DASHER LP2 and TP2 printers feature elongated printing that allows you to vary character width. The ELONGATE command turns elongated printing for either of these on or off.

The device must be paused. After you change the setting, type the CX CONTINUE command.

### Why Use It?

If one of these DASHER devices is under control of EXEC's XLPT process, you must use ELONGATE to get elongated printing on it.

### Example

```
) CX PAUSE @LPC ;
```

```
From Pid 4 : (EXEC) @LPC PAUSED [IDLE]
```

```
) CX ELONGATE @LPC ON ;
```

```
) CX CONTINUE @LPC ;
```

```
From Pid 4 : (EXEC) @LPC CONTINUING
```

---

## ENABLE

**Provides EXEC log on capability and parameters on a user console.**

---

CX  $\left\{ \begin{array}{l} \text{ENABLE } //\text{TRIES}=n \left[ \begin{array}{l} /STOP \\ /CONTINUE \end{array} \right] //FORCE @consolename \\ \\ \text{ENABLE/ALL } //\text{TRIES}=n \left[ \begin{array}{l} /STOP \\ /CONTINUE \end{array} \right] //FORCE \end{array} \right\}$

where

**/ALL** tells EXEC to enable all consoles that were identified to VSGEN, and virtual consoles. You must choose either **/ALL** or the specific console (**@consolename**).

**@consolename** is the device name for the console; it must begin with **@**; e.g., **@CON78**.

**/CONTINUE** Tells EXEC to leave the console enabled after someone has failed in *n* tries to log on. After *n* failed tries, EXEC displays *TOO MANY ATTEMPTS...* and locks the console for 10 seconds. On a modem line, it also breaks the connection. Continue is the default value if you omit **/STOP** (or **/CONTINUE**).

**/FORCE** tells EXEC to force the values set by the other switches onto the console whether or not the console is enabled. The log on values will take effect the *next* time someone tries to log on (as usual). The imposition of new values is not visible to anyone who is logged on. If you omit **/FORCE** and a console is enabled, EXEC will return a *Console already enabled* error.

**/STOP** tells EXEC to disable the console if anyone fails to log on in *n* tries (default is 5). On a modem line, it also breaks the connection. No one can log onto the console until it is enabled again.

**/TRIES=*n*** tells EXEC how many log on tries anyone can make before it locks the console for 10 seconds (if Continue is in effect), or disables the console (if Stop is in effect). The valid range is 1 through 10. The default value is 5.

The **ENABLE** command gives the specified console — or all consoles — log-on capability with specific log-on parameters. A user may then log on to the enabled console(s) via EXEC and use the AOS/VS system.

If you omit log-on parameters (**/STOP**, **/TRIES**, etc.), EXEC uses the default parameters. The defaults are *Tries=5* and *Continue*.

When an **ENABLE @consolename** succeeds, EXEC displays on the system console

*From Pid n : (EXEC) Console Enabled, @CONn*

For an **ENABLE/ALL** command, EXEC displays

*From Pid n : (EXEC) Enabling all consoles*

*From Pid n : (EXEC) Enable all complete, n consoles enabled*

In either case, if any console is in use by another console-managing program, EXEC will display an error message. EXEC will also return an error if the console is already enabled — unless you include the **/FORCE** switch in the **ENABLE** command. On **ENABLE/ALL**, EXEC will continue enabling after an error.



After being enabled, each console (if ON LINE) shows the message

*\*\*\* sysid Press NEW-LINE to begin logging on \*\*\**

You cannot enable CON1 — this console does not exist in AOS/VS.

To discover the ENABLE values for a console, use EXEC's CONSOLESTATUS command.

## Why Use It?

ENABLE is needed to give most users access to the system. Usually, the UP.CLI macro enables the desired consoles via ENABLE/ALL or multiple ENABLE commands.

The switches /STOP and /TRIES= are useful if you're concerned with security — over modem lines or with local consoles. Breaking into a system whose remote consoles are enabled with /TRIES=1/STOP is very difficult. You might set up the secure ENABLE values in a special up macro — to run at night — with the /FORCE switch to make sure values are enforced. Before running the macro, you could notify users with the BROADCAST macro.

After running the secure up macro, you might run it again (perhaps every hour) to re-enable consoles that had been disabled by failed log on tries. This would give legitimate users a chance to log on.

## Example

```
) CX ENABLE @CON3 ↓
```

*From Pid 3 : (EXEC) Console enabled, @CON3*

```
) CX ENABLE/TRIES=3/STOP @CON3 ↓
```

*From Pid 3 : (EXEC) Console already enabled, @CON3*

```
) CX ENABLE/TRIES=3/FORCE/STOP @CON3 ↓
```

*From Pid 3 : (EXEC) New logon values in effect*

```
) CX ENABLE @CON(4,5) ↓
```

*From Pid 3 : (EXEC) Console already enabled, @CON4*

*From Pid 3 : (EXEC) Console enabled, @CON5*

```
) CX ENABLE/ALL ↓
```

*From PID 3 : (EXEC) Enabling all consoles*

*From PID 3 : (EXEC) Enable all completed, 40 consoles enabled*

---

## EVEN

**Turns even pagination on or off for a device.**

---

CX EVEN @devicename  $\left\{ \begin{array}{c} \text{ON} \\ \text{OFF} \end{array} \right\}$

where

devicename is the name of a spooled device; it must begin with @; e.g., @LPB.

The EVEN command turns even pagination on or off for the specified device. The default setting is ON. You can check the current setting with EXEC's SPOOLSTATUS command. The device must be paused before EXEC will accept the command.

When EVEN is on, XLPT prints all files as though they contain an even number of pages. If a file has an odd number of pages, XLPT puts out an extra, blank sheet to make the file appear even numbered. This puts all header pages on the same fold of the paper.

When EVEN is off, XLPT will print queued files just as they are, one after the other, with no intervening blank pages.

### Why Use It?

Under some circumstances — perhaps to conserve printer paper — you might want files printed just as they are, with an even or odd number of pages. In most cases, you'll want to stick with the default, ON.

### Example

```
) CX PAUSE @LPB1 )
```

```
From Pid 3 :(EXEC) @LPB1 PAUSED [IDLE]
```

```
) CX EVEN @LPB OFF )
```

```
) CX CONT @LPB1 )
```

---

## FLUSH

**Flushes (terminates) the active request in a stream or queue.**

---

CX FLUSH { stream  
          @devicename }

where

stream is a batch stream number; e.g, 1, 2, 3, or 4.

devicename is the name of a spooled device; it must begin with @; e.g., @LPB.

The FLUSH command tells EXEC to stop processing the active request in a stream or queue; EXEC then starts the next request (if any).

For each flushed job, the batch output or printed file on the printer will show a *TERMINATED BY OPERATOR* message. (On a slow printer such as a letter-quality printer it may take a moment for the buffer to empty and the printer to stop.)

### Why Use It?

Sometimes you will want to stop an active batch or spool request. For example, to

- terminate a job that is looping,
- stop printing a file that you don't want printed; or
- empty queues so you can shut down EXEC.

FLUSH is the easiest way to kill an active request.

### Example

*From Pid 3 : (EXEC) STREAM\_1 SEQ=582 USR=sackville*

*) CX FLUSH 1 ↓*

*From Pid 3 : (EXEC) STREAM\_1 FLUSHING CURRENT JOB*

*From Pid 3 : (EXEC) STREAM\_1 SEQ=583 USR=mammon*

*) CX FLUSH (2,3) ↓*

*From Pid 3 : (EXEC) STREAM\_2 FLUSHING CURRENT JOB*

*From Pid 3 : (EXEC) STREAM\_3 HAS NO CURRENT JOB*

*) CX FLUSH @LPB ↓*

*From Pid 3 : (EXEC) @LPB FLUSHING CURRENT JOB*

This command sequence flushes stream 1 — which then accepts the next request. Then, in one FLUSH command, it attempts to flush streams 2 and 3. Finally it flushes the current @LPB request.

---

## FORMS

**Tells a printer to use special forms for printing.**

---

**CX FORMS** @devicename [*form-name*]

where

**devicename** is the name of a spooled device; it must begin with @; e.g., @LPB1.

**form-name** is the name of a file containing formatting commands for printed output. EXEC expects to find this file in directory :UTIL:FORMS.

The FORMS command directs a printing device to process all requests that specify the special form called form-name. Form-name is the name of a special form, like a paycheck form for a line printer. Someone must have created the form file in the :UTIL:FORMS directory and tailored it with the FCU program (sketched earlier in this chapter).

A user can request any special form by appending the /FORMS=form-name switch to a CLI QPRINT or QPLOT command. After a user does this, EXEC retains the request in the output queue until you type a FORMS command that specifies the form-name. To see which forms await special forms handling, type

) QDISPLAY/V )

When you decide to process output requests that need a special form on any device, follow these steps:

1. Pause the printer with **CX PAUSE @devicename** ). Wait until EXEC tells you that the printer is paused.
2. Insert the desired forms in the printer.
3. Tell the printer XLPT process to use the new form specification by typing  
**CX FORMS @devicename form-name** )
4. Continue the printer (**CX CONTINUE @devicename** ).

The printer will then start printing the forms. It will print *only* those files submitted with QPRINT/FORMS=form-name; other print requests to that printer will wait in the queue.

When the printer finishes the special form requests, it will become idle.

5. Now, type another **CX PAUSE devicename** ).
6. Reinsert the original forms and type  
**) CX FORMS @devicename** )
7. Continue the printer with **CX CONTINUE @devicename** ).

The printer will now process output requests submitted without a /FORMS= switch.

## Why Use It?

Many installations use special printing forms; e.g., for paychecks or invoices. The FORMS command allows you to dedicate a printer to printing all user requests that specify a special form. (You could use DEFAULTFORMS instead if you wanted *all* requests to the printer printed the same way.)

## Example

*From Pid 15 : (PAYROLL) Ready to print paychecks.*

```
) SEND 15 Ok, type QPRINT/FORMS=PAYCHECK_FORM CHECKS ↓
```

*From Pid 15 : (PAYROLL) Ok, typed QPRINT command.*

```
) CX PAUSE @LPB1 ↓
```

*From Pid 3 : (EXEC) @LPB1 PAUSED [IDLE]*

... (Someone puts paycheck forms in printer) ...

```
) CX FORMS @LPB1 PAYCHECKS ↓
```

```
) CX CONTINUE @LPB1 ↓
```

... (Paycheck printing occurs) ...

*From Pid 3 : (EXEC) @LPB1 [IDLE]*

```
) CX PAUSE @LPB1 ↓
```

*From Pid 3 : (EXEC) @LPB1 PAUSED [IDLE]*

... (Someone puts standard paper in printer) ...

```
) CX FORMS @LPB1 ↓
```

```
) CX CONTINUE @LPB1 ↓
```

*From Pid 3 (EXEC): @LPB1 CONTINUING*

Here, the operator receives a message that Payroll is ready to print paychecks. The operator sends Payroll the QPRINT command syntax; Payroll types and verifies the QPRINT command; and the operator pauses the printer. Then, someone puts the blank paycheck forms in the printer and continues the printer. The operator sets the PAYCHECK printing specification with EXEC's FORMS command; and the checks are printed.

After printing, the operator receives the [IDLE] message and pauses the printer again. Someone puts standard paper in the printer; the operator sets standard @LPB form specification; and the printer resumes processing standard printing requests.

---

## HEADERS

**Changes the number of header sheets before each printed job.**

---

CX HEADERS @devicename  $\left\{ \begin{array}{c} 0 \\ 1 \\ 2 \end{array} \right\}$

where

devicename is the name of a spooled device; it must begin with @; e.g., @LPB1.

0, 1, or 2 is the number of header sheets you want.

The HEADERS command sets the the number of header sheets to be printed before the body of each printing request. By default, EXEC provides one header sheet per request.

The header sheet gives a lot of information, including

- Destination (username by default);
- Username;
- Queue name;
- Device name;
- Sequence number;
- Qpriority;
- Lines per page;
- Characters per line;
- Number of copies requested;
- Page limit;
- Switches applied by user;
- Date(s) the file was created, queued, and printed;
- Pathname of file;
- Filename (first eleven characters);
- System identifier (SYSID);
- Revision of AOS/VS and XLPT program.

EXEC's SPOOLSTATUS command describes the number of headers set for a device.

As with CPL, etc., the device must be paused before EXEC will accept the command; and you must continue the device afterward.

### Why Use It?

On a slow printing device (like a letter-quality printer), omitting a header page can speed up processing.

For standard printers: some installations prefer 2 header pages to provide more separation between printing jobs. Others want to save paper, thus specify 0 headers. Generally, the default of 1 page works best.

### Example

```
) CX PAUSE @LPB1 )  
) CX HEADERS @LPB1 2 )  
) CX CONTINUE @LPB1 )  
)
```

---

## **HOLD**

**Suspends a batch stream or spool queue entry until you issue an UNHOLD or CANCEL command.**

---

**CX HOLD    sequence-number**

where

**sequence-number**    is the sequence number of a job in the queue, displayed by the CLI command QDISPLAY.

The HOLD command keeps any batch stream or device from processing the specified queue entry until you issue an EXEC UNHOLD or CANCEL command.

A user can hold or release (unhold) his or her own queue requests with the CLI QHOLD and QUNHOLD commands. If a request is held by both an EXEC HOLD command and a user's CLI QHOLD command, EXEC won't process the request until both hold flags are cleared.

The CLI QDISPLAY command lists queue entries and their sequence numbers. Active entries appear with an asterisk (\*) in the display. (You cannot HOLD an active entry; to stop it, CX FLUSH it.) Entries held by the system operator appear with an E in the display. Entries held by users appear with H in the display.

### **Why Use It?**

Sometimes you will have doubts about a request — perhaps not want to cancel it, but want to think about it. Use HOLD in such situations.

### **Example**

**) CX HOLD 26 )**

This command holds a request with sequence number 26.

---

## LIMIT

**Enforces user- or operator-specified limits of CPU time (batch) or number of printed pages (spool).**

---

CX LIMIT  $\left[ \begin{array}{l} \text{stream [ hh:mm:ss]} \\ \text{@devicename [pages]} \end{array} \right]$

where

*stream* is a batch stream number; e.g., 1, 2, 3, or 4. If you omit arguments, the command imposes a CPU limit of 34:24:32 (considered infinity) on all batch streams.

*hh:mm:ss* is the maximum amount of CPU time in hours, minutes, and seconds that a request in the batch stream(s) may use. The legal range is 0:00:00 to 34:24:32 (infinity).

*devicename* is the name of a spooled device; it must begin with @; e.g., @LPB.

*pages* is the optional maximum number of pages that a request may print. "pages" are projected by EXEC, unless users specify them with the /PAGES switch.

The LIMIT command enforces operator- or user-specified limits on CPU time (for batch streams) or printed pages (for printing requests).

If limiting is not in effect, EXEC processes all batch and spool requests on a first-come, first-served basis, based on priority. EXEC ignores user-defined limits on jobs. Each batch stream can use up to 34:24:32 of CPU time (considered infinity); each printer can print up to 65,535 pages per request.

When you plan to enforce limiting, you should inform users when the LIMIT command is in effect, so they can decide how to submit their requests.

You can undo the effect of the LIMIT command with EXEC's UNLIMIT command. Any LIMIT command remains in effect until you change it, undo it with UNLIMIT, or until EXEC terminates.

### Batch Stream Limiting

Batch stream limiting without a CPU time limit has some value. If you specify limiting without a time limit; e.g.,

) CX LIMIT )

then EXEC sets the default limit of 34:24:32. By itself, this is practically meaningless. But users can give it meaning by specifying their own limits with QBATCH or QSUBMIT switch /CPU=. A user might want to do this if he feared his request would loop — monopolizing the CPU — or if your organization's rules specified short batch times. For example, a user might type

) QBATCH/CPU= 1:00 XEQ MYPROG )

to make sure his job didn't consume more than a minute of CPU time. If stream limiting is enabled and a user specifies /CPU=, EXEC will abort the job if it consumes more than the user-specified limit.



A more useful form of limiting involves specifying a time limit. You can specify different limits for different streams; for example

```
) CX LIMIT (1,2) 1:00 )      (1 minute of CPU time for streams 1 and 2)
) CX PAUSE 3 )              (Pause stream 3.)
)                            (Leave stream 4 alone; no limits.)
```

This sequence restricts streams 1 and 2 to “average” requests, and takes stream 3 out of the action; stream 4 remains unlimited for big requests. Generally, you would want to let users know about this so — for big requests — they could use the /CPU= switch.

If users don’t use the /CPU= switch, and their jobs are accepted by stream 1 or 2 and take more than a minute of CPU time, the jobs will be aborted — a waste of time for both system and user. But if users *do* use the /CPU= switch, EXEC will place requests with /CPU=1:00 or more in stream 4, and place others in stream 1 or 2.

Generally, for any form of batch stream limiting to work well, users must participate by using the /CPU= switch when they submit large batch requests.

To find out if stream limiting is enabled, and the maximum CPU limit, use EXEC’s STATUS command.

## Device Page Limiting

For every printing request, EXEC projects the number of printed pages as follows.

$$\text{pages} = (\text{number-of-bytes-in-file} / 1000) + 4$$

(It uses integer division.) This is the number of pages you see displayed from a QDISPLAY/V command, for requests submitted without the /PAGES switch.

If you limit a device without a pages limit, and users omit the /PAGES= switch from their QPRINT commands, EXEC imposes its own projected number of pages, instead of the number actually in the file. As in batch, limiting without a value is not particularly useful unless users participate. For example, if you say

```
) CX LIMIT @LPB )
```

and users type QPRINT commands without the /PAGES= switch, EXEC will refuse the request if the number of pages it projects is less than the number actually in the file. (This can happen if a user’s pages are very long. If it does, the printed files will show a *PAGE LIMIT EXCEEDED* error message). If users *include* the /PAGES= switch, EXEC will print only the number of pages they specify in /PAGES=. This might be useful in some situations — but basically, whether or not users include /PAGES=, limiting a printer without giving a pages limit has little value.

Limiting a printer can be useful, though, if you specify a page limit — especially if you have more than one printer. For example, assume you have two printers. You can restrict one printer to small printing jobs:

```
) CX LIMIT @LPB 40 )
```

and leave the other printer unlimited. Users can post small printing jobs to @LPB (QPRINT command) and large ones to @LPB1 (QPRINT/QUEUE=LPT1 command).

## LIMIT (continued)

Even with only one printer, device limiting with a page limit can be useful. If users append the /PAGE= switch, and their specified number of pages exceeds the LIMIT, EXEC will hold their requests until a printer that allows their /PAGE= figures becomes available. For example, if you say

```
CX  LIMIT  @LPB  50 )
```

and user F77 wants to print a big file:

```
) QPRINT/PAGES=400  PRODUCT_SUMMARY )
```

EXEC will hold F77's request until @LPB is allowed to print 400 pages. The request can run as soon as you unlimit @LPB or raise its limit to 400 or more. This allows you to favor small or medium requests — perhaps, again, based on time of day.

As with batch, device limiting requires user participation, via the /PAGES= switch.

To find out whether a device is limited, and the maximum pages (if any), use EXEC's SPOOLSTATUS command. You can check EXEC's projected (or the user specified) number of pages with the CLI command QDISPLAY/V.

## Why Use It?

LIMIT gives your site control over requests *before* they are processed; and it can help make the system more efficient by dedicating streams or devices to small or medium jobs. You can use it in conjunction with EXEC's QPRIORITY and XBIAS commands to fine tune your system's batch and spooling mechanism, perhaps based on the time of day. You can change the emphasis quickly — for example, you can impose limiting only during the day, and lift it for big batch runs at night.

Also, LIMIT can help prevent program errors from slowing down the system; for example, it can prevent looping batch or runaway printing jobs from monopolizing the CPU or printer.

## Example

```
) BROADCAST      Batch streams 1-3 limited to 1:00 of CPU time. & )
&) stream 4 unlimited. & )
&) Big batch users please use /CPU=0:10:0 to submit jobs. )
) CX  LIMIT  1:00 )
) CX  UNLIMIT  4 )
) CX  STAT )
... (hours pass while streams run) ...
) BROADCAST  Am unlimiting all streams. )
) CX  UNLIMIT )
)
```

This sequence tells users about the impending LIMIT. (The BROADCAST macro is described in Chapter 5.) The LIMIT commands impose the default CPU time limit on all streams and a 10-minute limit on stream 4. The STATUS command verifies limiting. Later, operator tells users about the impending unlimit, and unlimits all streams.

) SEND @CON- Main printer limited to 50 pages, & )  
&) for fast action print only small files, or print large & )  
&) files and wait. Use QPRINT/PAGES= to this printer. )

) CX LIMIT @LPB 50 )

) CX SPOOLS @LPB )

... (printer prints only those files with less than 50 pages) ...

) SEND @CON- Am unlimiting main printer. )

) CX UNLIMIT @LPB )

Here, the operator tells users about the impending printer limit, limits the main printer to jobs of 50 EXEC-computed pages, then unlimits the main printer.

---

## LOGGING

**Starts or stops EXEC logging to a file.**

---

```
CX  LOGGING  [ /START[/MAX=blocks] [pathname]
               /STOP ]
```

where

*blocks* is the maximum number of 512-byte disk blocks you want the logging file to be. This must be between 1 and 32,767.

*pathname* is the pathname of the file to receive EXEC messages. If you enter a filename only, EXEC will create the file in the directory @ (:PER) and use it as the log file. If the file doesn't exist, EXEC will create it. If it already exists, EXEC will append to it.

If you omit arguments, EXEC tells you whether or not logging is on, and, if so, the pathname of the logging file.

If you use the /START switch, EXEC starts logging all its console messages to the file indicated by *pathname*. The optional /MAX=*n* switch allows you to limit the size of the logging file. If the file exceeds the maximum size limit, EXEC goes back to the beginning of the file and overwrites the information with current log messages. If you omit /MAX=, EXEC doesn't limit the file's size.

The /STOP switch tells EXEC to stop logging messages; it turns off LOGGING.

If you are logging messages to a console, don't disable the console without first turning off LOGGING. If you disable a console log file, logging will stop.

You can write text strings to EXEC's log file with the CX MESSAGE command.

### Why Use It?

An EXEC log can help you keep track of batch and print queue usage, and user MOUNT requests. (But note that EXEC's log file is *different* from the AOS/VS SYSLOG log file. SYSLOG generally is more useful for user accounting information. EXEC puts account-oriented information into SYSLOG, not the EXEC log. SYSLOG is described in Chapter 9, "Other Runtime Tools.")

### Example

```
) CX  LOGGING/START  :UTIL:EXEC_LOG_MAY.86 )
.
.
.
) CX  LOGGING/STOP )
) QPRINT  EXEC_LOG_MAY.86 )
```

---

## LPP

**Sets the number of lines per page (LPP) for a device.**

---

CX LPP @devicename number

where

devicename is the name of a spooled device; it must begin with @.

number is the number of lines per page. This must be an integer between 6 and 144.

The LPP command sets a new number of lines per page for this device. It overrides any previous VSGEN, CHARACTERISTICS/LPP, or EXEC LPP settings. The new LPP remains until you change it with EXEC's LPP or bring down EXEC's XLPT cooperative process.

To change an LPP setting:

- Type CX PAUSE to the device.
- When EXEC says the device is paused, type the desired CX LPP command.
- Type CX CONTINUE to the device.

LPP does nothing on a device where an EXEC DEFAULTFORMS or FORMS command is in effect.

### Why Use It?

The default number of lines per page is 66. You may want to specify fewer lines; perhaps to produce more white space for greater readability. Or, you may want to print a special form in the printer (although you'd usually use EXEC's FORMS or DEFAULTFORMS command for this).

### Example

```
) CX PAUSE @LPB1 ↓
```

```
From Pid 3 : (EXEC) @LPB1 PAUSED [IDLE]
```

```
) CX LPP @LPB1 60 ↓
```

```
) CX CONTINUE @LPB1 ↓
```

```
)
```

---

## MESSAGE

**Sends a message to EXEC's log file.**

---

CX MESSAGE message

where

message is a text string to be entered in EXEC's logging file.

If EXEC is currently logging, the MESSAGE command sends the message to EXEC's log file. EXEC will always echo the message on your console.

The maximum length of the MESSAGE command is 80 characters. Therefore, the text string itself can't exceed 70 or so characters (with space for MES ). However, you can type additional message commands if you want to say more.

If EXEC is not logging messages, it will not record the message in a log file, nor will it report an error.

### Why Use It?

If EXEC is logging messages, you may want to put text messages in its log file for the record.

### Example

```
) CX MESSAGE Running 4 batch streams 11-JUN-86 10am. )  
From Pid 3 : (EXEC) Running 4 batch streams 11-JUN-86 10am.  
)
```

---

## MOUNTED

**Tells EXEC that a tape is physically on a unit and on line.**

---

**CX MOUNTED** *[/MID=*mid*] [@*devicename*] [*valid*]*

where

*/MID=*mid** allows you to select any request in the mount queue. *mid* is an integer — the mount ID of the desired request.

*devicename* is the magnetic tape unit name; it must start with @; e.g., @MTB1.

*valid* is the volume identifier of an existing tape in the mount request.

The MOUNTED command tells EXEC that you have physically placed a tape on a specific tape unit, and that the unit is on line.

Normally, EXEC processes mount requests on a first come, first served basis. If you want EXEC to service the next request, you need type only **CX MOUNTED @*devicename* ↵** — after putting the tape on the unit. If this is the second or subsequent volume of a request and you are using the same unit, you need type only **CX MOUNTED ↵**.

If you want EXEC to select a request that is not the next request, include */MID=*mid**, where *mid* is the mount ID of the request you want.

The MOUNTED command has EXEC create a linkname in the user's initial working directory, to the tape unit (unlabeled tape) or file @LMT:*valid* (labeled tape). EXEC sets the unit's ACL to *username,WARE* or *username,RE* (depending on whether the user said /READONLY on his or her mount command). This prevents anyone else from using the unit.

The unit(s) assigned via the MOUNTED command “belong” to the user until you issue a DISMOUNTED command. Usually EXEC will prompt you for this.

EXEC will prompt you to type the MOUNTED command:

- whenever a user types (or batch job submits) an error-free MOUNT command;
- when the system is ready for the next tape in a multivolume request and you haven't premounted this tape;
- if you mount the wrong volume in a labeled tape request;
- when a user has made an implicit mount request (e.g., **LOAD/V @LMT:FOO:SOURCES ↵**).

With EXEC's UNIT MOUNT prompt, there may be a REQUEST IS line with additional information from the user. The REQUEST line will not appear on an implicit mount request.

### Why Use It?

EXEC's MOUNTED command and users' CLI MOUNT commands are the heart of tape handling in a multiuser system.

You must type **CX MOUNTED ↵**, when prompted, to allow the user to access the tape.

## MOUNTED (continued)

### Example

For an unlabeled mount, Sackville types a CLI MOUNT command without a valid switch. The system console displays

```
From Pid 4: (EXEC) ** UNIT MOUNT **  
From Pid 4: MID=94,USER=SACKVILLE, PID=14  
From Pid 4: REQUEST IS 'Any blank tape. Ring in please.'  
From Pid 4: RESPOND: CONTROL @EXEC MOUNTED @UNITNAME  
From Pid 4: OR: CONTROL @EXEC REFUSED
```

EXEC will repeat this message at intervals until you respond. The CLI prompt won't return to Sackville's console until you *do* respond. So you mount a tape on MTB0 and type

```
) CX MOUNTED @MTB0 )
```

and the user can use the tape.

A labeled tape user asks for a multivolume labeled tape mount, knowing which valids to specify. EXEC prompts you

```
From Pid 4: (EXEC) ** UNIT MOUNT **  
From Pid 4: MID=95,USER=COBOL, PID=32  
From Pid 4: VALID(S) ARE: DB0033, DB0034, DB0035  
From Pid 4: REQUEST IS 'Rings in. Hi-density please.'  
From Pid 4: RESPOND: CONTROL @EXEC MOUNTED @UNITNAME  
From Pid 4: OR: CONTROL @EXEC REFUSED
```

Let's say you mount the tapes on MTB0, MTB1, and MTB2 and decide to use the PREMOUNT command. You type

```
) CX MOUNTED @MTB0 )  
) CX PREMOUNTED @MTB1 DB0034 COBOL )  
) CX PREMOUNTED @MTB2 DB0035 COBOL )
```

The tape I/O will proceed. When it is done, the user will request a dismount and EXEC will prompt you to DISMOUNT the tapes. There are other MOUNT examples in the preceding section, "User Mount Requests".



---

## MOUNTSTATUS

**Displays status of each MOUNT and DISMOUNT request.**

---

CX MOUNTSTATUS [*mid*]

where

*mid* is a mount identifier: the integer number of a mount request in the mount queue.

The MOUNTSTATUS command displays all mount or dismount requests, or displays the mount request with the specified mount identifier (*mid*).

If you omit an argument, EXEC reports each entry on a first come, first served basis with all dismounts coming before mounts. If there are no requests, EXEC says *NO MOUNT REQUESTS*.

### Why Use It?

MOUNTSTATUS is the most convenient way to check existing mount requests. You'll be using it often. (To check the status of *tape units*, use EXEC's UNITSTATUS command.)

### Example

) CX MOUNTSTATUS ↓

*From Pid 3 : (EXEC) NO MOUNT REQUESTS*

Later on:

) CX MOUNTST ↓

*From Pid 3 : (EXEC) \*\* UNIT DISMOUNT \*\**

*From Pid 3 : MID=5*

*From Pid 3 : UNIT(S) ARE: @MTBI*

*From Pid 3 : RESPOND: CONTROL @EXEC DISMOUNTED*

*From Pid 3 : (EXEC) \*\*UNIT MOUNT\*\* WRITE RING OUT*

*From Pid 3 : MID=6, USER=JR, PID=8, VOLID=GP0059*

*From Pid 3 : VOLID(S) ARE: GP0059, GP0060*

*From Pid 3 : REQUEST IS 'Can you mount both - hi density?'*

*From Pid 3 : RESPOND: CONTROL @EXEC DISMOUNTED*

*From Pid 3 : OR: CONTROL @EXEC REFUSED.*

Here, one tape request is awaiting a dismount and another is awaiting a mount. EXEC repeats these messages at intervals even if you don't use the MOUNTSTATUS command.

---

## OPEN

**Opens a queue to users (opposite of CLOSE).**

---

CX OPEN queueName

where

queueName is an existing spool queue you want to open.

The OPEN command opens queueName so that users may submit requests to it. You must create and open a queue before users can submit jobs to it. Use the CREATE and OPEN commands, respectively, to do this. Generally, an output queue must be started on a device, and the device must be continued, before users can access the queue.

Actually, OPEN tells EXEC to create a queueName entry in directory @ (:PER). Users access this queue via CLI commands like QSUBMIT, QBATCH, QPRINT, QPLOT, QPUNCH, or QFTA. User programs can also access the queue by name via program OPEN, WRITE, and READ statements.

The first time EXEC is brought up, someone must open EXEC's BATCH\_INPUT, BATCH\_OUTPUT, and BATCH\_LIST queue; and someone must create and open the print and possibly plotter and networking queues. This was covered in Chapter 5 and at the beginning of this chapter.

The CLI command QDISPLAY describes queues and their open and closed status.

### Why Use It?

Each queue must be opened before it can be accessed; this is usually done the first time EXEC is brought up. Each time you create a new queue you must open it.

Also, if you close a queue for any reason, you must open it to make it accessible to users.

### Example

```
) CX OPEN LQP )  
) CX START LQP @CON25 )  
) CX CONTINUE @CON25 )
```

This sequence opens, starts, and continues the letter-quality printer queue, LQP, on the printer attached to line @CON25.

---

## OPERATOR

**Tells EXEC that an operator is available or not available at the system console.**

---

CX OPERATOR  $\left\{ \begin{array}{l} \text{ON} \\ \text{OFF} \end{array} \right\}$

An operator must be available (ON) for EXEC to process user mount requests or batch requests submitted with the /OPERATOR switch. If an operator is not on duty (OFF), EXEC will reject mount requests with an *OPERATOR NOT AVAILABLE* error message; it will hold the /OPERATOR batch requests in the queue until an operator is available.

The default operator status is OFF.

You (and any user) can tell whether the OPERATOR status is on or off with the !OPERATOR pseudo-macro. For example

```
) WRITE  An operator is [!OPERATOR] duty. )  
An operator is OFF duty.  
)
```

EXEC's OPERATOR command has no relation to the CLI command OPERATOR. The latter command enables the CLI to write and read labeled diskettes, described in Chapter 10.

### Why Use It?

Some EXEC-controlled functions require a person in the role of system operator. For example, if a user requests a tape mount, someone must be available to mount the tape. The OPERATOR command tells EXEC that such a person is available.

If your system is to process user tape mount requests, or batch requests submitted with the /OPERATOR switch, you must issue the CX OPERATOR ON ) command. Later, if you leave the system console and no one is available to handle such requests, you must issue the CX OPERATOR OFF ) command so that user requests will not wait in vain for operator service.

### Example

```
) WRITE  [!OPERATOR ] )  
OFF  
) CX OPERATOR ON )  
)
```

---

## PAUSE

**Tells batch stream(s) or a device to stop processing requests.**

---

CX PAUSE  $\left[ \begin{array}{l} \text{stream} \\ @devicename \end{array} \right]$

where

*stream* is a batch stream number; e.g., 1, 2, 3, or 4. If you omit a stream number, the command affects all batch streams.

*devicename* is the name of a spooled device; it begins with @; e.g., @LPB.

The PAUSE command stops processing when the current request is finished. All incoming requests remain in the queue until you issue EXEC's CONTINUE command.

If you omit arguments, PAUSE pauses all batch streams. To pause a specific stream or device, give its name as an argument. If a stream or device is active (processing a request), EXEC tells you that the pause will occur after the current job is done. Issuing a PAUSE command to a paused device or batch stream has no effect.

### Why Use It?

Often, you will want to stop batch or spool queue processing; for example:

- to suspend output before changing parameters (like priority) for a batch stream or device; or
- before shutting down EXEC.

### Example

To pause all batch streams, you'd type

) CX PAUSE )

*From Pid 3 : (EXEC) STREAM\_1 WILL PAUSE AT END OF CURRENT JOB*

*From Pid 3 : (EXEC) STREAM\_2 PAUSED*

*From Pid 3 : (EXEC) STREAM\_3 PAUSED*

*From Pid 3 : (EXEC) STREAM\_4 PAUSED*

*From Pid 3 : (EXEC) STREAM\_1 PAUSED*

To pause the main line printer, @LPB, type

) CX PAUSE @LPB )

*From Pid 3 : (EXEC) @LPB PAUSED*

---

## PREMOUNT

**Tells EXEC you have mounted a volume before there was a specific request for it.**

---

CX PREMOUNT *[//IBM]* @devicename valid username

where

*/IBM* is the switch indicating that you want the valid argument converted from ASCII to EBCDIC before EXEC compares it to the valid on the tape.

devicename is the magnetic tape unit; it begins with @; e.g., @MTB2.

valid is the volume id of the tape you're premounting.

username is the name of the user you are premounting the tape for.

The PREMOUNT command forms an association between a volume and a unit on behalf of a user.

When you premount a volume, EXEC sets the ACL for that unit to null — meaning that no one but a superuser can use it. Then, when the user's process needs that volume, EXEC changes the ACL to username,WARE or username,RE (depending on whether the user requested /READONLY on the mount). Later, when you dismount the tape, EXEC restores the ACL to its setting before the premount.

If you premount a volume, and then change your mind before I/O to it occurs, type CX DISMOUNTED @unitname ) to sever the connection set by premount. Then dismount the tape.

You cannot premount a volume for implicit mount requests. You must use the MOUNTED command for these.

### Why Use It?

PREMOUNT can be a big timesaver if you have more than one tape unit. When a user requests a multivolume mount, you can MOUNT the first volume on a unit, then PREMOUNT the second and subsequent volumes on other units.

The user process can then access all tapes as needed without operator intervention — even if an operator is not physically present. If you didn't use PREMOUNT, you'd have to mount each tape sequentially, as prompted by EXEC.

### Example

The following command tells EXEC that you've premounted tape volume DB1103 on unit MTB10 for user SORT:

```
) CX PREMOUNT @MTB10 DB1103 SORT )
```

There is another PREMOUNT example under MOUNT.

---

## PRIORITY

**Changes the system priority and process type for batch streams and spooler processes.**

---

CX PRIORITY  $\left[ \begin{array}{l} /PREEMPTIBLE \\ /RESIDENT \\ /SWAPPABLE \end{array} \right] \left\{ \begin{array}{l} \text{stream priority} \\ @devicename priority \end{array} \right\}$

where

*/PREEMPTIBLE* makes the process type pre-emptible.

*/RESIDENT* makes the process type resident.

*/SWAPPABLE* makes the process type swappable. This is the default.

*stream* is the batch stream number; e.g., 1, 2, 3, or 4.

*priority* is an integer specifying the priority of the process. The range is 1 to 511 for any process type. 1 is highest, 511 lowest.

*devicename* is the name of a spooled device; it must begin with @; e.g., @LPB.

The PRIORITY command changes the system priority for batch streams and spooler cooperative processes like XLPT. The default priority for printers and batch streams is 2.

The priority you see as 2 is really 257, which makes it a group 2 process. The number 2 was retained for compatibility with earlier AOS/VS revisions. To change a process *group*, specify a priority that's unique in its group range. For example, priority 4 puts a process in group 1, and priority 259 puts it in group 3, assuming the default groups were chosen at VSGEN.

To change the process *type*, include the switch */PREEMPTIBLE* or */RESIDENT*. */SWAPPABLE* is the default for batch streams and device processes.

To check the current process type and system priority, use CX STATUS for batch streams; or use CX SPOOLSTATUS for device processes.

“Processes and CPU Time” in Chapter 15 explains process and priority concepts.

### Why Use It?

Sometimes, you may want to *favor* printing requests over other processing; if so, give a line printer a high priority, like 1 (or 4, to make it a group 1 process). To favor printing even more, make the process pre-emptible or even resident. The same principle applies to batch streams — you can give certain streams higher priority and/or make them pre-emptible or resident. (But if you give many processes a high priority — or make them pre-emptible or resident — system performance may suffer.)

If you settle on specific nondefault process type and priority values, put the EXEC commands for them in the UP.CLI macro.

EXEC's PRIORITY command combines the functions of the CLI commands PRIORITY and PRTYPE. And it is tailored for EXEC operations. Also, any CLI process with the username of OP can issue it.

### Example

```
) CX STATUS ↓
```

... (batch stream status information, including type and priority) ...

```
) CX PRIORITY/RES 1 1 ↓
```

```
) CX PRIORITY 4 255 ↓
```

```
) CX SPOOLSTATUS @LPB ↓
```

... (spooler status information, including type and priority) ...

```
) CX PRIORITY/PREEMPTIBLE @LPB 4 ↓
```

```
)
```

These commands check stream status with CX STATUS; then make stream 1 resident with a priority of 1 and give stream 4 the lowest priority, 255. Other streams retain the default types and values. Then the operator checks the spoolstatus of @LPB, and makes it pre-emptible with a priority of 4.

---

## PROMPTS

**Turns EXEC's time prompt off or on.**

---

CX PROMPTS  $\left\{ \begin{array}{l} \text{ON} \\ \text{OFF} \end{array} \right\}$

If you set PROMPTS to OFF, only the CLI prompt will appear when EXEC is ready for a command. If PROMPTS is on (default), EXEC displays the prompt

*From Pid n : (EXEC) hours: minutes: seconds*

after each command.

### Why Use It?

Sometimes EXEC's time-of-day prompt can be distracting, especially on a hardcopy console. On the other hand, you may like the prompt as an acknowledgement of your commands.

### Example

```
) CX PROMPTS OFF )  
.  
.  
.  
) CX PROMPTS ON )  
From Pid 3 : (EXEC) 15:33:30  
)
```

EXEC displays the time of day in hours (24-hour clock), minutes, and seconds.



---

## PURGE

**Deletes all entries in a stopped and closed queue.**

---

CX PURGE queueName

where

queueName is the spool queue you want to purge.

The PURGE command deletes all entries in the specified queue. After the command succeeds, the queue is empty. The queue must not be processing a job on any device when you issue this command. It must be closed and stopped before it can be purged. Use EXEC's CLOSE and STOP commands to do this.

### Why Use It?

Sometimes, you'll want to clean out a queue — for example, if it has a lot of useless requests or if you want to delete the queue. Use PURGE in such situations.

To get rid of an individual *request* in a queue, use EXEC's CANCEL or FLUSH instead of PURGE.

### Example

To stop, purge, and restart a queue named LPT:

```
) CX PAUSE @LPB )  
) CX CLOSE LPT )  
) CX STOP LPT )  
) CX FLUSH @LPB )  
) CX PURGE LPT )  
) CX START LPT @LPB )  
) CX OPEN LPT )  
) CX CONTINUE @LPB )  
)
```

Note that on a slow printer such as a letter-quality printer, it may take a moment for the buffer to empty and the printer to stop.

---

## QRIORITY

**Changes the priority range to be accepted by batch stream(s) or a device.**

---

CX QRIORITY  $\left[ \begin{array}{l} \text{stream} \\ @\text{devicename} \end{array} \right] [\text{high-value} \quad \text{low-value}]$

where

*stream* is a batch stream number; e.g., 1, 2, 3, or 4.

*devicename* is the name of a spooled device; it begins with @; e.g., @LPB.

*high-value* is the highest priority value of a request that the stream or device can accept. It must be an integer between 0 (highest) and 255 (lowest).

*low-value* is the lowest priority value of a request that the stream or device can accept. It must be an integer from 0 to 255.

The QRIORITY command displays or changes the range of priority that a stream or device will process.

If you omit arguments, EXEC displays the queue priority for all batch streams. If you specify a stream number or device name, EXEC displays its queue priority.

Users specify queue priority with the /QRIORITY switch. If a user omits a /QRIORITY= switch when submitting a request, EXEC assigns the request a queue priority. This is the median of the highest queue priority and the lowest queue priority indicated by the user's profile. For example, if a user's highest queue priority is 0 (PREDITOR default), then his requests are assigned a queue priority of 127, which is halfway between 0 and 255.

Do not confuse QRIORITY with *process* priority, set with the CLI command PROCESS or PRIORITY, or EXEC's command PRIORITY.

### Why Use It?

Your installation might want to have requests processed in different queues, depending on each request's priority. For example, you could establish different queue priority ranges for two batch streams. This would give users some control over queue processing. Users may request a certain queue priority with the /QRIORITY= switch.

If a user's MAX QRIORITY, set in the profile during the PREDITOR dialog, is less than other users' priorities (i.e., farther from 0), the user's printing requests will have less priority than those of other users. This is so regardless of the EXEC QRIORITY command.

## Example

```
) CX QPRIORITY )
```

... (EXEC displays current batch stream QPRIORITY) ...

```
) CX QPRIORITY 1 0 100 )
```

```
) CX QPRIORITY (2,3) 101 255 )
```

After this sequence, requests submitted with QBATCH/QPRIORITY=0 through QBATCH/QPRIORITY=100 will go to batch stream 1. Requests submitted with QBATCH/QPRIORITY=101 through QBATCH/QPRIORITY=255 will go to streams 2 and 3. Simple QBATCH requests, which generally get priority 127, will also go to streams 2 and 3. Stream 4, if continued, will accept all requests.

For two line printers:

```
) CX QPRIORITY @LPB 0 126 )
```

```
) CX QPRIORITY @LPB1 127 255 )
```

This works the same way as the batch streams described above, except that users use the QPRINT command instead of QBATCH.

---

## REFUSED

**Tells EXEC and a user that you refused a MOUNT request.**

---

CX REFUSED [*mid*]

The REFUSED command tells EXEC to cancel a user mount request (for whatever reason). It also sends the message *REQUEST REFUSED BY SYSTEM OPERATOR* to the user who typed the MOUNT command. The *mid* is the mount ID — you can omit it for the last (or only) request.

### Why Use It?

There may be times when you want to cancel a mount request. This can be your own mount request, or another user's. For the latter, you can also use the SEND command to explain why you refused.

### Example

*From PID 3 (EXEC): \*\* UNIT MOUNT \*\**

*From PID 3 (EXEC): MID=50, USER=DAVE, PID=44, EXEC SUB-TREE PID=44*

*From PID 3 (EXEC): REQUEST IS: HIGH DENSITY- PLEASE*

) CX REFUSED )

) SEND 44 Sorry Dave -- backup time. Try again in 2 hours. Thanks. )

The following messages appear on Dave's terminal:

*ERROR: REQUEST REFUSED BY SYSTEM OPERATOR*

*Sorry Dave -- backup time. Try again in 2 hours. Thanks.*

---

## RESTART

**Restarts printing of the current file — optionally prints a range of pages.**

---

CX RESTART @devicename [start-page] [end-page]

where

**devicename** is the name of a spooled device; it must begin with @; e.g., @CON25.

**start-page** is the first page of the file to be restarted; it must be an integer between 1 and 32767.

**end-page** is the last page of the file to be printed. It must be an integer, larger than the *begin-page*, and be between 1 and 32767.

The RESTART command restarts output of the current file on the specified device. You can specify beginning and ending page numbers for printing. If you omit page numbers, EXEC's XLPT process uses the default start and end page numbers 1 and 32767, respectively. If you specify only one number, XLPT uses it as the start-page number and uses the default value as the end-page number.

If the user included a /NORESTART switch when submitting the request, the RESTART command will not work. The printed file show a *CANNOT RESTART, NORESTART SPECIFIED* message.

You can restart a file any time you want. The XLPT process always writes the current output buffer before restarting the file.

### Why Use It?

Occasionally, a printer may jam or otherwise malfunction in the middle of a job. EXEC's restart command allows you to restart the job, optionally at a specific page. Printing specific pages can be very useful for printing on a slow device (like a letter-quality printer), or for parts of large printing jobs. (An alternative to EXEC's RESTART command is the QPRINT command — whose /BEGIN= and /END= switches allow users to specify a range of pages for printing.)

### Example

To restart printer @LPB and print the entire current file:

```
) CX RESTART @LPB )
```

To restart a letter-quality printer and print pages 39 and 40:

```
) CX RESTART @CON25 39 40 )
```

---

## SILENCE

**Suppresses EXEC messages about batch stream(s) or a device.**

---

CX SILENCE  $\left[ \begin{array}{l} stream \\ @devicename \end{array} \right]$

where

*stream* is a batch stream number; e.g, 1, 2, 3, or 4. If you omit a stream number, the command affects all batch streams.

*devicename* is the name of a spooled device; it begins with @; e.g., @LPB.

The SILENCE commands tells EXEC not to send messages when a job is queued in a batch stream or processed on a device. By default, EXEC prints BRIEF messages, described under EXEC's BRIEF command.

If you omit an argument, EXEC suppresses messages about all batch streams. If you specify a stream or device, EXEC suppresses messages from the stream or device.

SILENCE also suppresses messages to EXEC's log file, if EXEC logging is on.

To restore message output, use the CX UNSILENCE command.

### Why Use It?

If your system console is a hardcopy console, EXEC messages can tie it up and make it difficult to issue commands. Or, you may want to use the system console for something like text editing, and want to avoid distractions. Use CX SILENCE in either of these situations.

### Example

```
) CX SILENCE )
```

```
) CX SILENCE @LPB )
```

... (No EXEC batch or device messages to system console) ...

```
) CX UNSILENCE )
```

```
) CX UNSILENCE @LPB )
```

These commands silence all batch streams and printer @LPB; then the UNSILENCE command restores message output.

```
) CX SILENCE 4 )
```

---

## SPOOLSTATUS

**Displays queue and device information.**

---

CX SPOOLSTATUS  $\left[ \begin{array}{l} \text{queue\textit{name}} \\ \text{@device\textit{name}} \end{array} \right]$

where

*queue\textit{name}* is a spool queue.

*device\textit{name}* is the name of a spooled device; it begins with @; e.g., @LPB.

The SPOOLSTATUS command describes the devices used by a queue, the queues using a device, or both. If you omit arguments, e.g.,

) CX SPOOLS ↓

the command tells you

- each spooled *device\textit{name}* and the *queue\textit{name}*(s) associated with it;
- the CPL, LPP, HEADERS, and TRAILERS settings;
- whether limiting is enabled, and what the limits are, if not the defaults;
- whether or not even pagination or binary mode is enabled;
- if a DEFAULTFORMS command is in effect;
- if a FORMS command is in effect;
- the device bias factor, set with EXEC's XBIAS command;
- the priority range of the device as set by EXEC's PRIORITY command.

If you use a *queue\textit{name}* argument, SPOOLSTATUS tells you which device(s) the queue is associated with.

If you use a *device\textit{name}* argument, SPOOLSTATUS gives most of the information above.

### Why Use It?

SPOOLSTATUS is your primary status checking command for device queues (as STATUS is for batch streams and devices). You will use it often, along with the CLI's QDISPLAY, to see what's happening with queues.

You'll probably use SPOOLSTATUS routinely before and after changing a device specification (as with CPL or FORMS).

### Example

) CX SPOOLSTATUS ↓

... (Information) ...

) CX SPOOLSTAT LPT1 ↓

*From Pid 3 : (EXEC) LPT1 BEING PROCESSED BY @LPB1*

---

## STACK

**Tells EXEC to read card images from an input device or file.**

---

```
CX  STACK  { @devicename  
              pathname }
```

where

**devicename** is the name for the device containing the stacked job; e.g., @CRA. There may be more than one job in stacked format.

**pathname** gives the disk filename that holds the card image records.

The STACK command tells EXEC to stack (enqueue) batch requests from an input source — usually a card reader, but it can be a disk file. EXEC creates a co-operative Stacker process to read the cards and submit the requests.

The format of input cards for each request is shown earlier in this section.

### Why Use It?

You must issue STACK if you want EXEC to read cards as batch requests from a card reader. (If the card images are already on disk, it's possible to text edit the disk file, then submit it as a batch input file with the CLI's QBATCH/M command, instead of using the STACK command.)

### Example

Place cards in reader, turn it on.

```
) CX  STACK  @CRA ↓
```

*From Pid 3 : (EXEC) @CRA CO-OPERATIVE INITIATED*

*From Pid 3 : (EXEC) SEARCHING FOR \$\$JOB*

*From Pid 3 : (EXEC) @CRA-\$JOB USER 1*

*From Pid 3 : (EXEC) @CRA-JOB ENQUEUED*

*From Pid 3 : (EXEC) @CRA-END OF FILE ON INPUT*

*From Pid 3 : (EXEC) @CRA CO-OPERATIVE TERMINATED*

Remove cards from reader.

If the *END OF FILE ON INPUT* message doesn't appear before the *CO-OPERATIVE TERMINATED* message, an error occurred — probably an invalid job card.



---

## START

**Creates a cooperative process to manage a queue and device.**

---

```
CX START [/NL] [/8BIT] queueName @deviceName [UPPER]
```

where

**/NL** tells the XLPT process to print each NEW LINE as carriage return - NEW LINE — as needed on laser printers and some nonstandard printers.

**/8BIT** tells the XLPT process to use all 8 bits when it sends characters to the printer device. Without this switch, XLPT will send only 7 bits. If you have an 8-bit printer and want it to print special (8-bit) characters, you must include this switch. If the device is on a console line (like a letter-quality printer), the line must also have been configured for 8 bits (via the CLI command CHARACTERISTICS or via VSGEN — described in Chapter 4).

**queueName** is the name of the queue you want to start. The queue must already exist. It can be a permanent queue, such as BATCH\_OUTPUT; or it can be a queue created and opened via EXEC's CREATE and OPEN.

**deviceName** is the name of a spooled device; it must start with @; e.g., @LPB1.

**UPPER** tells EXEC to convert all lowercase input to uppercase.

The START command creates an EXEC cooperative process to assume control of a queue and device. The cooperative process is XLPT for printers and XPLT for plotters. An XLPT process is needed for each print device; you must issue a START command for each device you want EXEC to handle. The device is usually a printer but it can be a disk file or mag tape unit.

XLPT can manage more than one queue with a device. The UP.CLI macro makes use of this, by starting queues BATCH\_OUTPUT, BATCH\_LIST, and LPT on device @LPB. Also, XLPT can manage one queue with more than one device. For example,

```
CX START LPT @LPB
CX START LPT @LPB1
```

associates the main print queue with two printers and will send print requests dynamically to alternate printers — allowing the LPT queue to process two requests at once.

For a laser document printer, type LPE, include the /NL switch. This directs the XLPT process to convert each NEW LINE to carriage return-NEW LINE for printing. The additional carriage return is needed for *any* printer that does not automatically position at the start of a line after printing a NEW LINE character. If carriage return is not added to NEW LINE on such a printer, the file may not print properly. In any case, the additional carriage return does no harm. To see if NEW LINE conversion is in force, use the SPOOLSTATUS command.

For a line printer, UPPER turns on case conversion. Without this argument, case conversion is not enabled — and lowercase characters may not print on an uppercase-only printer. To start multiple queues on an uppercase-only printer, include UPPER in the *first* START command; omit it from subsequent START commands to that printer. Include UPPER *only* for a line printer that has only uppercase characters.

*Note* that each printer involved must be ON LINE when the START command is issued; if not, the XLPT cooperative process will terminate abnormally.

When a START command succeeds, EXEC displays

*From Pid n : (EXEC) @deviceName CO-OPERATIVE INITIATED*

*From Pid n : (EXEC) @deviceName [IDLE] PAUSED*

## START (continued)

While the device is paused, you can issue device parameter commands like CPL, FORMS, and HEADERS.

After you start one or more queues on a device, you must continue the device to make it available to users.

## Why Use It?

Someone must start each output queue on a device before the queue can accept requests. Usually, the UP.CLI macro has commands to do this.

But you will need to use START while the multiuser environment is running if somehow the XLPT co-operative process terminates (you can check for XLPT by typing ? ). Or, you may want to change the queue-device arrangement as shown above. Or, if a printer is down, you can pause the printer and stop the printer queue. Then you can start the queue on another device (perhaps a disk or tape file), which you can load and print on another machine.

The START command is also needed for other EXEC cooperative processes, like network queues.

## Examples

The following commands are from an UP.CLI macro:

```
CONTROL @EXEC START (BATCH_<OUTPUT LIST> LPT) @LPB
CONTROL @EXEC CPL @LPB 85
CONTROL @EXEC CONTINUE @LPB
```

The first command line expands to start queues BATCH\_OUTPUT, BATCH\_LIST, and LPT on @LPB; the second command sets 85 characters per line; and the third continues the device. The first and third commands are the ones you should issue if the XLPT process somehow terminates abnormally.

To stop the print queue at the line printer, then start it on a labeled tape volume, you must create a link entry from :PER to the labeled tape; then type the appropriate START command. With a tape labeled VOL1, the sequence could be

```
*) CX PAUSE @LPB1 )
*) CX STOP @LPB1 )

*) CREATE/LINK @PRINT @LMT:VOL1:FILE1 )
*) CX START LPT @PRINT )
```

XLPT will now spool all print requests in the LPT queue to the labeled tape file linked to @PRINT. If more tape is needed, EXEC will prompt the operator for it. To print the file: someone must type, on a user console, COPY/V/IMTR=8192 @LPT @LMT:VOL1:FILE1 ; then, someone must mount the tape and type CX MOUNTED unitname ) on the system console. (The COPY /IMTRSIZE switch is needed because XLPT writes data to tape in blocks of 8192 bytes.)

To start a queue on a letter-quality printer:

```
) CX START LQP @CON15 )
) CX HEADERS @CON15 0 )
) CX BINARY @CON15 CLEANUP_FILE )
) CX CONTINUE @CON15 )
```

These commands start the letter-quality printer (CON15) as queue LQP, for CEO usage, then set it up and continue it. The CEO.PRINTER macro, shipped with CEO, contains these commands.

---

## STATUS

**Describes status of batch streams or devices.**

---

CX STATUS  $\left[ \begin{array}{l} \text{stream} \\ @\text{devicename} \end{array} \right]$

where

*stream* is a batch stream number; e.g., 1, 2, 3, or 4. If you omit a stream number, the command affects all batch streams.

*devicename* is the name of a spooled device; it begins with @; e.g., @LPB.

The STATUS command tells you the active or paused status of batch stream(s) or a device. If the stream or device is active, EXEC displays the

- sequence number;
- user's queue priority;
- username;
- process ID (PID);
- pathname of the source file;
- bias factor as defaulted or set by EXEC's XBIAS command;
- process type and process priority as defaulted or set by EXEC's PRIORITY command; and
- current page being processed and the number of copies left to print (active printers only).

If the device or stream is not processing a job, EXEC displays an *IDLE* message, then describes the EXEC bias factor, process type, and priority.

If you omit arguments, EXEC displays the status of all the batch streams. If you use a stream number or devicename argument, EXEC displays the status of that stream or device.

### Why Use It?

STATUS is the primary status checking command for batch streams and devices. (To check device *queues*, use EXEC's SPOOLSTATUS command.) You'll use the STATUS command often, along with the CLI's QDISPLAY command, to see what's happening with batch queues and devices.

You'll probably use STATUS routinely before and after changing a batch queue specification (as with QPRIORITY); you'll also use it to see what's going on when you plan to shut down EXEC.

The additional information given by STATUS @devicename can be handy when you want to align a device or see how long the current request will take.

## STATUS (continued)

### Example

) CX STAT ↓

*From Pid 3 : (EXEC) STREAM\_4 [IDLE]*

*From Pid 3 : BIAS FACTOR=0 PTYPE=SWAPPABLE PRIORITY=2*

*From Pid 3 : (EXEC) STREAM\_3 [IDLE] PAUSED*

*From Pid 3 : BIAS FACTOR=0 PTYPE=SWAPPABLE PRIORITY=2*

*From Pid 3 : (EXEC) STREAM\_2 [IDLE]*

*From Pid 3 : BIAS FACTOR=0 PTYPE=SWAPPABLE PRIORITY=2*

*From Pid 3 : (EXEC) STREAM\_1 SEQ=3650 QPRI=127 USER=ROGER*

*From Pid 3 : PID=37 PATH=:UDD:DATABASE:?029.CLI.004.JOB*

*From Pid 3 : BIAS FACTOR=0 PTYPE=SWAPPABLE PRIORITY=2*

This is a status report on all streams. Streams 4 and 2 are idle; stream 3 is paused and idle; and stream 1 is active.

) CX STAT @LPB1 ↓

*From Pid 3 : (EXEC) @LPB1 SEQ=3646 QPRI=127 USER=MAG*

*From Pid 3 : PID=6 PATH=:UDD:MAG:RELEASE\_1.50:MYFILE*

*From Pid 3 : CURPAGE=46 COP LEFT=2*

This status report on @LPB1 shows the current page (CURPAGE) and copies left to print (COP LEFT), after other things.

---

## STOP

**Dissociates a queue from a device (opposite of START), stops a device, or does both.**

---

```
CX  STOP  { queueName  
            @deviceName  
            queueName @deviceName }
```

where

**queueName** is the the name of a queue you want to dissociate from its device(s).

**deviceName** is the name of a spooled device; it must begin with @; e.g., @LPB1.

The STOP command dissociates a queue from a device, stops a device, or does both — depending on the form you use.

- **CX STOP queueName** dissociates the queueName from all associated devices. If this is the only queue associated with a device, the device stops and the pertinent EXEC cooperative process (e.g., XLPT) terminates.
- **CX STOP @deviceName** dissociates the device from *all* associated queues, and stops the device. The pertinent EXEC cooperative process terminates.
- **CX STOP queueName @deviceName** dissociates *only the queueName* from the deviceName. This is useful only if there are multiple queues associated with a device and you want to sever *only this* queue from the device; else you would use the first form above.>>)

In all cases, the pertinent device will finish processing an active request. The queue will accept new requests, and will remain open. But the device won't process other requests in the queue (if any), until you issue the appropriate START command.

### Why Use It?

You might use STOP when you want to stop a device and think about the current queue-device situation. Or, you might use it if you want to get rid of a queue (but you must also close and perhaps purge the queue before you can delete it).

If things are okay and you want an orderly shutdown, use EXEC's PAUSE command instead of STOP. To stop an active request, use EXEC's FLUSH command.

To prevent a queue from accepting new requests, use EXEC's CLOSE command.

### Example

To dissociate queue LQP from its device:

```
) CX  STOP  LQP )
```

To dissociate all queues from a device and terminate EXEC's device-handling cooperative process:

```
) CX  STOP  @CON25 )
```

... (Finishes current request) ...

*From Pid 3 : (EXEC) @CON25 COOPERATIVE TERMINATED*

---

## TERMINATE

**Terminates the user process running on a console or a cooperative process associated with a device.**

---

CX TERMINATE     $\left\{ \begin{array}{l} @consolename \\ @devicename \end{array} \right\}$

where

@consolename    is the name of the console on which you want to terminate the process; it begins with @.

@devicename    is the name of a device whose cooperative process you want to terminate.

The TERMINATE @consolename command terminates the user process on the specified console and logs the user off. The console on which you type TERMINATE displays the message

*Console job terminated*

and the user's console displays the messages

*PROCESS n TERMINATED BY OPERATOR COMMAND*

*CONNECT TIME hours:minutes:seconds*

*USER user LOGGED OFF @CONn*

*date time*

You can terminate cooperative processes like XLPT as well as console jobs. But you cannot use EXEC's TERMINATE to terminate a XODIAC File Transfer Agent (FTA) cooperative. Use the DOWN.NETWORK.CLI macro, supplied with XODIAC, to terminate XODIAC agent processes.

### Why Use It?

A time may come when you must terminate a user process to protect other users or the system. You can use EXEC's TERMINATE command for this.

EXEC's TERMINATE mirrors the functionality of the CLI's TERMINATE. However, any process with the username OP can issue EXEC's TERMINATE — even if the target process is a brother process. A process must have Superprocess on to use CLI's TERMINATE to terminate a brother process. An example follows.

### Example

This dialog ultimately terminates the user process on CON5.

|                                    |                                         |
|------------------------------------|-----------------------------------------|
| ) SEND 13 Log off NOW! )           | Warn user.                              |
| ... (a minute or so passes) ...    | Wait.                                   |
| ) WHO 13 )                         | See if PID still exists.                |
| PID 13 ABEL CON5 :CLI.PR           | Still running on console CON5.          |
| ) TERM 13 )                        | Try to terminate it with CLI TERMINATE. |
| WARNING...PROCESS NOT IN HIERARCHY | Doesn't work...                         |
| ) CX TERM @CON5 )                  | Try EXEC's TERMINATE...                 |
| Console job terminated             | EXEC's TERMINATE works.                 |

---

## TRAILERS

**Changes the number of trailer sheets after each printed file.**

---

CX TRAILERS @devicename  $\left\{ \begin{array}{c} 0 \\ 1 \\ 2 \end{array} \right\}$

where

devicename is the name of a spooled device; it must begin with @; e.g., @LPB1.

0, 1, or 2 are the number of trailer sheets you want.

The TRAILERS command sets the number of trailer sheets that follow the output for each printing request on the specified device. By default, EXEC provides no trailer sheet.

Information on each trailer sheet includes

- destination name;
- username;
- queue name;
- devicename;
- number of pages printed;
- system identifier (SYSID).

EXEC's SPOOLSTATUS command describes the number of trailers on a device.

As with the HEADERS command, the device must be paused before EXEC will accept the command; and you must continue it afterward.

### Why Use It?

Your organization might want one or more trailer sheets between each file — for greater separation of printing jobs or to describe the number of pages printed (AOS/VS' SYSLOG, described later, logs pages printed by each user).

### Example

To set the number of trailers on @LPB1 to 1, type

```
) CX PAUSE @LPB1 )  
) CX TRAILERS @LPB1 1 )  
) CX CONTINUE @LPB1 )
```

---

## UNHOLD

**Negates a previous HOLD command.**

---

CX UNHOLD            sequence-number

where

sequence-number    is the sequence number of the request you want to unhold (release).

The UNHOLD command cancels a previous EXEC HOLD command. It does not cancel a *user's* QHOLD or QPRINT/HOLD command — the user must QUNHOLD this, or you can QCANCEL it. Use the CLI command QDISPLAY to check the hold status of a queue entry.

To release a request from HOLD, specify its sequence number.

See EXEC's HOLD command for more information.

### Why Use It?

You must use UNHOLD if you want EXEC to process a request that you previously suspended with the HOLD command.

### Example

To remove the previous operator hold on request 588:

```
) CX UNHOLD 588 )
```



---

## UNITSTATUS

**Displays the status of one or all tape units.**

---

CX UNITSTATUS [*@devicename*]

where

*devicename* is a magnetic tape unit; it must start with @; e.g., @MTB12.

Without an argument, the UNITSTATUS command displays each unit's status. With an argument, it describes a unit. If a unit is mounted, EXEC displays the following.

- the username;
- user process ID (PID);
- the volid(s) for a labeled tape request;
- any premount on the unit.

### Why Use It?

UNITSTATUS is better than MOUNTSTATUS if you are more interested in units than in mount requests. You might use it to decide which unit to use for a premount.

### Example

) CX UNITSTATUS ↓

*From Pid 3 : (EXEC) @MTB0 NOT MOUNTED*

*From Pid 3 : @MTB2 PREMOUNTED USER=ANDERS, VOLID=GP6423*

*From Pid 3 : @MTB1 MOUNTED MID=40, USER=ANDERS,PID=9, VOLID=GP6422*

*.  
.*

---

## UNLIMIT

**Stops limiting on a queue or device (negates LIMIT).**

---

CX UNLIMIT  $\left[ \begin{array}{l} stream \\ @devicename \end{array} \right]$

where

*stream* is a batch stream number; e.g., 1, 2, 3, or 4. If you omit a stream number, the command affects all batch streams.

*devicename* is the name of a spooled device; it begins with @; e.g., @LPB.

The UNLIMIT command negates a previous EXEC LIMIT command. If you omit arguments, EXEC removes the CPU time limit on all batch streams. If you use a batch stream argument, EXEC removes the time limit for that stream. With a devicename argument, EXEC removes the page output limit for the device.

See EXEC's LIMIT command for more information.

### Why Use It?

If limiting is enabled, you must use UNLIMIT to lift the limits. (To set new nondefault time/page limits, use another EXEC LIMIT command.)

### Example

... (Limiting has been enabled on batch streams) ...

... (Hours pass while streams run) ...

) BROADCAST Am unlimiting all streams. )

) CX UNLIMIT )

)

... (Limiting has been enabled on printer @LPB) ...

) BROADCAST Am unlimiting main printer. )

) CX UNLIMIT @LPB )

---

## UNSILENCE

**Restores EXEC display of batch/spool messages.**

---

CX UNSILENCE  $\left[ \begin{array}{l} stream \\ @devicename \end{array} \right]$

where

*stream* is a batch stream number; e.g., 1, 2, 3, or 4. If you omit a stream number, the command affects all batch streams.

*devicename* is the name of a spooled device; it begins with @; e.g., @LPB.

The UNSILENCE command negates a previous EXEC SILENCE command. EXEC will then send a message to the system console each time it queues or processes a request. EXEC will also send a message to its log file if EXEC LOGGING is started. The contents of each message will depend on whether an EXEC VERBOSE or BRIEF command is in effect.

If you omit arguments, EXEC will send messages about all batch streams. If you enter a stream or devicename argument, EXEC will send messages about the stream or device.

### Why Use It?

Having silenced EXEC, you may want to restore its batch or spool messages — especially if you want to log EXEC messages (LOGGING command).

### Example

```
) CX SILENCE ;  
) CX SILENCE @LPB ;  
... (Hours of batch and spool silence pass) ...  
) CX UNSILENCE ;  
) CX UNSIL @LPB ;
```

Here, the operator silences EXEC batch and spool messages, then restores them with UNSILENCE.

---

## VERBOSE

**Tells EXEC to give detailed batch or spool messages.**

---

CX VERBOSE  $\left[ \begin{array}{l} stream \\ @devicename \end{array} \right]$

where

*stream* is a batch stream number; e.g., 1, 2, 3, or 4. If you omit a stream number, the command affects all batch streams.

*devicename* is the name of a spooled device; it begins with @; e.g., @LPB.

When a batch stream or spooled device accepts or processes a request, EXEC sends a message to the system console. This message may be either “brief” or “verbose.” The EXEC BRIEF and VERBOSE commands determine the verbosity of EXEC messages sent. Each BRIEF or VERBOSE command overrides the current message setting. BRIEF is the default setting.

VERBOSE messages include all BRIEF information, plus the user’s process ID (PID) and pathname of the request’s source file.

### Why Use It?

There may be situations where you want to know the pathname of user request source files — especially if EXEC logging is started. Use VERBOSE for this.

### Example

*From Pid 3 : (EXEC) STREAM\_2 SEQ=446, USR=sackville*

) CX VERBOSE )

*From Pid 3 : (EXEC) STREAM\_1 SEQ=447, USR=sackville*

*From Pid 3 : PID=16 PTH=:UDD:F77:NAVY\_TEST:?016.CLI.002.JOB*

Here, you can see the difference between the BRIEF (default, at top) and VERBOSE messages.

---

## XBIAS

**Sets EXEC's bias factor to favor either small or large requests.**

---

CX XBIAS  $\left\{ \begin{array}{l} \text{stream} \\ \text{@devicename} \end{array} \right\}$  bias-factor

where

**stream** is a batch stream number; e.g., 1, 2, 3, or 4.

**devicename** is the name of a spooled device; it must begin with @; e.g., @LPB.

**bias-factor** is an integer, range -32767 through 32767. A positive bias factor favors small batch requests; a negative factor favors large requests.

The XBIAS command sets EXEC's bias for the specified stream or device to a new value. If the bias factor equals 0 (default), biasing is off.

A positive bias factor directs EXEC to favor small requests; the larger the number, the greater EXEC's bias for small requests. A negative factor has EXEC favor large requests; the larger the absolute value of the negative number, the greater EXEC's bias for large requests.

Normally, requests are processed in the order in which users submitted them, depending on priority. Biasing makes favored jobs appear to have been submitted earlier than they really were. When you specify a bias factor, EXEC multiplies it by the cost unit (CPU-seconds for batch, number of pages for devices) for each request. EXEC then adds this signed value to the actual time the request was submitted. EXEC then uses *this* time value when it chooses the next request; and it picks the request that appears to have been submitted earliest.

To check the current bias of batch streams, use EXEC's STATUS command; to check it for devices, use SPOOLSTATUS.

Don't confuse EXEC's XBIAS command with the CLI BIAS command, which pertains to interactive or noninteractive processing. The two are not related.

### Why Use It?

Sometimes, perhaps during a certain period of each day, you might want to favor large or small requests. Or, you might want selected streams or devices to handle large requests, and have others handle small requests.

The bias factor allows you to control whether streams or devices favor small or large requests. To favor small requests, set the desired positive bias; to favor large ones, set the desired negative bias.

You can use XBIAS in conjunction with the other selective control commands (LIMIT, QPRIORITY, etc.) to tailor certain streams and devices for specific kinds of requests.

### Example

To set EXEC's bias factor for batch stream 1 to 100, and for stream 4 to -100, type

```
) CX XBIAS 1 100 )  
) CX XBIAS 4 -100 )  
) CX STATUS )
```

... (EXEC displays XBIAS, among other things) ...

---

## XHELP

### Explains EXEC Commands

---

XHELP *[command]*

where

*command* is an EXEC command.

If you omit *command*, XHELP describes all EXEC commands. If you include *command*, XHELP describes the command.

XHELP is the only command to EXEC that doesn't start with CONTROL @EXEC (CX).

### Why Use It?

XHELP can be extremely useful if you forget a command or correct command syntax.

### Example

```
) XHELP ↓
```

```
... (describes all EXEC commands) ...
```

```
) XHELP ALIGN ↓
```

```
... (describes ALIGN command) ...
```

```
)
```

## EXEC Messages

EXEC is a two-part program, serving both the system operator (username OP), and users. It has one set of messages for the operator, another for people who are logged on as users.

This section describes the messages that you — the operator — or users may receive from EXEC. It has two parts, Operator Messages and User Messages.

The message explanations assume the existence of the macro CX.CLI. CX.CLI should contain the characters

CONTROL @EXEC %-%

and be in directory :UTIL (or some easily accessible directory). If it doesn't exist, create it.

### Operator Messages from EXEC

Table 8-4 explains the EXEC messages that are not self-explanatory. By default, EXEC sends all messages to the active CLI process that has the username OP. If there are multiple active OP CLIs (for example, if you have logged on as OP to a user console), response messages go to the console from which you typed the EXEC command. Some messages are printed on the batch output file or printed file. MOUNT messages *always go to the system console*.

EXEC also send its messages to the EXEC log file if you have enabled logging with the CX LOGGING command. If you have suppressed EXEC messages with CX SILENCE, no batch or spool informational messages will be sent to console or log file. MOUNT messages always appear, even if you have issued CX SILENCE.

This table includes a few pertinent *system* (not EXEC) error messages.

**Table 8-4. Operator Messages from EXEC**

| Message                                                         | Description and Action                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>ABORT: message</i>                                           | An error message; appears on issuing console or batch output listing. The message is another message; check the message column of this table to find it. This may be a system (not EXEC) error message with instructions; if so, follow them.                                                                                                                                                                    |
| <i>ALL CONSOLES ENABLED</i>                                     | Status message from EXEC ENABLE/ALL command; appears on issuing console. EXEC has enabled all user consoles for log on.                                                                                                                                                                                                                                                                                          |
| <i>ARGUMENT UNKNOWN</i>                                         | Error message from EXEC command, appears on issuing console. Re-enter with correct argument.                                                                                                                                                                                                                                                                                                                     |
| <i>ATTEMPT TO CREATE MORE THAN 32 QUEUES</i>                    | Error message from EXEC CREATE command, appears on issuing console. EXEC allows a maximum of 32 queues, including the three permanent batch queues. If you need the queue, close and delete an old one.                                                                                                                                                                                                          |
| <i>AWAITING ALIGNMENT</i>                                       | Status message, from EXEC STATUS @LPBx command, appears on issuing console. A CX ALIGN command was issued and the printer is waiting. Align printer if needed, then issue<br>CX ALIGN/CONTINUE @LPBx ).                                                                                                                                                                                                          |
| <i>BAD { \$\$JOB }<br/>      { \$\$PASSWORD }</i> <i>FORMAT</i> | Error message from Stacker, after CX STACK command, appears on console that issued STACK. It may appear if the input file is a card reader; the process terminates without an error message if the input file is a disk file. EXEC rejects the job. To fix it, have the user correct the \$\$JOB-\$\$PASSWORD card sequence or correct it yourself; then restack the reader and re-enter the EXEC STACK command. |
| <i>BAD USERNAME</i>                                             | Error message from EXEC's PREMOUNT command, appears on issuing console. Re-enter the PREMOUNT command the with correct username.                                                                                                                                                                                                                                                                                 |
| <i>BIAS FACTOR = n</i>                                          | Status message from EXEC STATUS (for batch streams) or SPOOLSTATUS command (queues); appears on issuing console. n is 0 if it wasn't set via the XBIAS command.                                                                                                                                                                                                                                                  |
| <i>BINARY MODE NOT ALLOWED</i>                                  | Error message from a user QPRINT/BINARY command, appears on printed file. You must enable binary mode with<br>CX BINARY @LPx cleanup-filename )<br>before anyone can QPRINT/BINARY.                                                                                                                                                                                                                              |
| <i>CANNOT DELETE UNEXPIRED<br/>FILE ON LABELED MEDIUM</i>       | System error message from write to labeled tape; appears on issuing console. The default retention period on files written to labeled tape is 90 days. Choose another tape or write a new label to the tape with the LABEL program; then retry the tape write.                                                                                                                                                   |

(continues)



**Table 8-4. Operator Messages from EXEC**

| Message                                                   | Description and Action                                                                                                                                                                                                                   |
|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>CAN'T TURN OFF -- ACTIVE BATCH REQUEST REQUIRES OP</i> | Error message from EXEC OPER OFF command; appears on issuing console. You can't turn operator off until you cope with the active batch job that was submitted with /OPERATOR switch.                                                     |
| <i>CAN'T TURN OFF -- OUTSTANDING MOUNT REQUEST</i>        | Error message from EXEC OPERATOR OFF command; appears on issuing console. You can't turn operator off until you cope with the active mount or dismount requests (use CX MOUNTSTATUS ) to check).                                         |
| <i>CLEANUP FILE DOES NOT EXIST</i>                        | Error message from CX BINARY @LPx cleanup-filename ) command; appears on issuing console. File cleanup-filename must be in directory :UTIL:FORMS. Create a cleanup file by defining the printer via the CEO.PRINTER.CLI macro.           |
| <i>COMMAND UNKNOWN</i>                                    | Error message; appears on issuing console. EXEC doesn't know your CX command. You may have miskeyed the command; use XHELP if needed.                                                                                                    |
| <i>Console already enabled</i>                            | Error message from EXEC ENABLE command; appears on issuing console. This console was enabled. If desired, you can force new log-on parameters by adding the /FORCE switch in your ENABLE command.                                        |
| <i>Console disabled</i>                                   | Status message from EXEC DISABLE command; appears on issuing console. The console has been disabled. If on, it displays a <i>Console DISABLED from logging on</i> message.                                                               |
| <i>Console enabled</i>                                    | Status message from EXEC ENABLE command; appears on issuing console. The console has been enabled. If on, it displays a <i>...Press NEW LINE to begin logging on</i> message.                                                            |
| <i>Console job terminated</i>                             | Status message from EXEC TERMINATE command; appears on issuing console. The console process specified has been terminated and the user logged off.                                                                                       |
| <i>Console not active</i>                                 | Error message from EXEC TERMINATE command; appears on issuing console. The console process you tried to terminate didn't exist.                                                                                                          |
| <i>Console unknown to exec</i>                            | Error message from EXEC DISABLE or TERMINATE command; appears on issuing console. The specified console is not enabled.                                                                                                                  |
| <i>Console will be disabled</i>                           | Status message from EXEC DISABLE command; appears on issuing console. EXEC will disable the console as soon as it can. If the console is active, EXEC will disable it when the current user logs off.                                    |
| <i>CONTROL ENTRY ALREADY EXISTS</i>                       | Error message from EXEC-creating PROCESS command; appears on system console. An entry named EXEC already exists in :PER. If an EXEC is running, everything is okay. If EXEC is <i>not</i> running, try DELETE :PER:EXEC+) and try again. |
| <i>CO-OPERATIVE INITIATED</i>                             | Status message from EXEC START or STACK command; appears on issuing console. EXEC created the cooperative process needed to run the device.                                                                                              |

(continued)

**Table 8-4. Operator Messages from EXEC**

| Message                                 | Description and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>COOPERATIVE TERMINATED</i>           | May be a status message from the Stacker after a short-lived cooperative process created by EXEC STACK terminates normally after using the QSUBMIT command on the job. It is an error if a stacker process terminated without QSUBMITTING the job, or if a long-lived cooperative like XLPT terminates without an EXEC STOP or TERMINATE command. If XLPT terminates, users won't be able to use the printer; you must recreate the process with EXEC's START command (see UP.CLI macro for syntax). This message generally appears on the system console. |
| <i>COP LEFT=</i>                        | Status message from EXEC status @LPBx command, appears on issuing console. Describes how many copies in the current job remain to be printed.                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>Could not enable console</i>         | Error message from EXEC ENABLE command, appears on issuing console. EXEC could not enable this console.                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>COULD NOT RE-OPEN QUEUE</i>          | Error message from EXEC startup after PROCESS command; appears on system console. There may be an internal EXEC or system inconsistency; or file QUEUE:Q may have been deleted. Check QUEUE:Q; if it doesn't exist, create it as shown in Chapter 5.                                                                                                                                                                                                                                                                                                       |
| <i>COULDN'T ACCESS CODE FOR MESSAGE</i> | Error message from EXEC command <i>error</i> ; appears on issuing console. EXEC could not find needed text in error file :ERMES. Perhaps ERMES has been deleted or built incorrectly. Rebuild ERMES as described in Chapter 5.                                                                                                                                                                                                                                                                                                                             |
| <i>CURPAGE =</i>                        | Status message from EXEC STATUS @LPx command, appears on issuing console. The specified page of the current request is being printed.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <i>CURRENT LOG FILE</i>                 | Status message from EXEC LOGGING command; appears on issuing console; gives the pathname of the the current log file.                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <i>CURRENTLY NOT LOGGING</i>            | Status message from EXEC LOGGING command; appears on issuing console. EXEC is not logging now; Use CX LOGGING/START <i>pathname</i> ) to start if you wish.                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>DEVICE ALREADY IN USE</i>            | System error message from EXEC ENABLE command, appears on issuing console. EXEC could not enable this console — probably because the console is "owned" by another DG process, like DATAPREP, TPMS, or DG/SNA.                                                                                                                                                                                                                                                                                                                                             |
| <i>DEVICE ALREADY MOUNTED</i>           | Error message from EXEC MOUNTED command; appears on issuing console. You have already told EXEC that a tape is mounted on this unit.                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <i>DEVICE IS NOT STARTED</i>            | Error message from EXEC STOP command, appears on issuing console. The device specified has not been started.                                                                                                                                                                                                                                                                                                                                                                                                                                               |

(continued)

**Table 8-4. Operator Messages from EXEC**

| Message                                            | Description and Action                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>DEVICE UNKNOWN</i>                              | Error message from EXEC START or DISABLE command; appears on issuing console. Perhaps a typo caused this. Or see the UP.CLI macro for correct syntax.                                                                                                                                                                                                                                     |
| <i>DISABLE CANCELLED,<br/>CONSOLE ENABLED</i>      | Status message from EXEC ENABLE after DISABLE; appears on issuing console. The DISABLE command is cancelled; the user console remains enabled.                                                                                                                                                                                                                                            |
| <i>DISABLED CONSOLE</i>                            | Status message from EXEC DISABLED; appears on issuing console. The user console was not in use and has been disabled. If on, the console has a <i>CONSOLE DISABLED</i> message.                                                                                                                                                                                                           |
| <i>DRIVE ALREADY MOUNTED --<br/>DISMOUNT FIRST</i> | Error message from EXEC MOUNTED command; appears on system console. You must dismount the tape and type <i>CX DISMOUNTED J</i> ; then retry the MOUNTED command.                                                                                                                                                                                                                          |
| <i>DRIVE IN USE - CANNOT<br/>DISMOUNT</i>          | Error message from EXEC DISMOUNTED command; appears on system console. The tape is mounted and I/O with it is occurring; so EXEC cannot obey. Perhaps you specified the wrong unit. If not, either wait or use SEND to ask the user to interrupt his/her tape I/O. If all else fails, have the user log off (or terminate the user), dismount the tape, and type <i>CX DISMOUNTED J</i> . |
| <i>DRIVE NOT MOUNTED --<br/>CANNOT DISMOUNT</i>    | Error message from EXEC DISMOUNTED command; appears on system console. A MOUNTED or PREMOUNT request is not outstanding to this tape unit. Perhaps you specified the wrong unit; check with <i>CX MOUNTSTATUS J</i> .                                                                                                                                                                     |
| <i>ENABLED CONSOLE</i>                             | Status message from EXEC ENABLE command; appears on issuing console. The user console is enabled for user log on. If on, it shows a <i>Press NEW-LINE to begin logging on</i> message.                                                                                                                                                                                                    |
| <i>Enabling all consoles</i>                       | Status message from EXEC ENABLE/ALL command; appears on issuing console.                                                                                                                                                                                                                                                                                                                  |
| <i>ERROR: message</i>                              | An error message; appears on issuing console or batch output listing. The message is another message; check the message column of this table to find it. This may be a system (not EXEC) error message with instructions; if so, follow them.                                                                                                                                             |
| <i>EXEC IS ALREADY RUNNING</i>                     | Initialization error, from system; appears on system console after EXEC-creating PROCESS command. EXEC is already running. Do nothing.                                                                                                                                                                                                                                                    |
| <i>EXEC LOGGING STARTED<br/>STOPPED</i>            | Status message from EXEC LOGGING command; appears on issuing console. It confirms EXEC logging status and file pathname.                                                                                                                                                                                                                                                                  |
| <i>EXEC NOT AVAILABLE</i>                          | Error message from system; appears on issuing console. You tried a Q-series command and EXEC isn't running. Bring EXEC UP J and try again.                                                                                                                                                                                                                                                |

(continued)

**Table 8-4. Operator Messages from EXEC**

| Message                                     | Description and Action                                                                                                                                                                                                                                                                        |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>EXEC'S PROCESS SUB-TREE ONLY</i>         | Error message from CLI MOUNT command; appears on system console. You issued a MOUNT command from the system console. Only consoles enabled by EXEC can issue MOUNT commands. Log on as OP on a user console and try again.                                                                    |
| <i>FILE ACCESS DENIED</i>                   | Error message from system; appears on issuing console. You do not have access to this directory or file. If you need access, turn Superuser on and try again.                                                                                                                                 |
| <i>FILE DOES NOT EXIST:</i>                 | Error message; appears on issuing console. This device was not identified to the VSGEN program. This can also be a system error from a CLI command.                                                                                                                                           |
| <i>FILE SPACE EXHAUSTED</i>                 | Error message from system, appears on issuing console. Generally, this means that tape file space has been exhausted. But it can occur if you issue too many ENABLE or DISABLE commands too quickly; insert more CLI PAUSE commands between the EXEC commands.                                |
| <i>FLUSHING CURRENT DECK</i>                | Error message from Stacker; appears on issuing console after an EXEC STACK command. The Stacker has found a bad \$\$JOB or \$\$PASSWORD card. See BAD \$\$JOB message for action.                                                                                                             |
| <i>FLUSHING CURRENT JOB AT USER REQUEST</i> | Status message; appears on system console. The user has issued QCANCEL for this request; EXEC is flushing it. (User QCANCEL commands, unlike EXEC's CANCEL, can cancel an active request.)                                                                                                    |
| <i>FORMS ACCESS DENIED</i>                  | Error message from CLI QPRINT/FORMS= command; appears on issuing console. The person who issued the command does not have R,E access to directory FORMS. With Superuser on, give directory FORMS and all its files +,RE access:<br><br>DIR :UTIL; ACL FORMS +,RE )<br>DIR FORMS; ACL + +,RE ) |
| <i>FORMS DO NOT EXIST</i>                   | Error message from CLI QPRINT/FORMS= command; appears on issuing console. Directory :UTIL:FORMS, or the specified file, does not exist. If directory doesn't exist, create it as described in Chapter 5. If the file doesn't exist, have the user specify an existing filename in FORMS.      |
| <i>From PID n :(EXEC) message</i>           | EXEC preamble, on system console. The message is another message; check the message column of this table to find it.                                                                                                                                                                          |
| <i>FROM SYSTEM: message</i>                 | System error message; try to find the message in this table.                                                                                                                                                                                                                                  |
| <i>GROWING TO n PAGES</i>                   | Status message on system console, displayed by EXEC as it enables consoles and gives itself more memory.                                                                                                                                                                                      |

(continued)

**Table 8-4. Operator Messages from EXEC**

| Message                                       | Description and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>HARD ERROR</i>                             | Error message from system; appears on system console. A hardware error prevents further access to the device. Don't retry; see "Hardware Errors" in Chapter 6.                                                                                                                                                                                                                                                                                                                 |
| <i>ILLEGAL CHARACTER IN LOGICAL TAPE NAME</i> | Error message from user CLI MOUNT or DISMOUNT command; appears on issuing console. The specified linkname has an illegal character. Have the user re-issue command with valid linkname.                                                                                                                                                                                                                                                                                        |
| <i>ILLEGAL COOP MESSAGE</i>                   | Error message from EXEC command; appears on issuing console. An illegal message was passed from one of EXEC's cooperative processes. Bring EXEC down and up again.                                                                                                                                                                                                                                                                                                             |
| <i>ILLEGAL DECIMAL NUMBER</i>                 | Error message from EXEC command; appears on issuing console. The number you specified was not legal; perhaps it contained a decimal point.                                                                                                                                                                                                                                                                                                                                     |
| <i>ILLEGAL DEFAULT FORMS</i>                  | Error message from EXEC DEFAULTFORMS command; appears on issuing console. The default forms format given in the file is illegal. EXEC retains the standard forms. Fix the erroneous forms file in directory FORMS.                                                                                                                                                                                                                                                             |
| <i>ILLEGAL DEVICE OR CONSOLENAME FORMAT</i>   | Error message from EXEC command; appears on issuing console. The command gave an illegal device or console filename; e.g., @CON5. It can also occur if you omit the @, which specifies :PER; e.g., CON2 would cause it.                                                                                                                                                                                                                                                        |
| <i>ILLEGAL START OPTION FOR QUEUE TYPE</i>    | Error message from EXEC START command; appears on issuing console. The specified queue doesn't allow the option given. Re-issue the command without the option.                                                                                                                                                                                                                                                                                                                |
| <i>ILLEGAL TIME FORMAT FOR STACKER</i>        | Error message from Stacker; appears on issuing console after an EXEC STACK command. The Stacker hit a \$\$JOB card with bad date or time format. For action, see <i>BAD \$\$JOB..</i> message.                                                                                                                                                                                                                                                                                 |
| <i>INCORRECT LABELED TAPE FILE ...</i>        | Error message from system; appears on issuing console, from access to a mounted labeled tape. The tape label, or volid sequence, is wrong. Perhaps you tried to start reading (LOAD) in a volume other than the first volume; if so, use the LOAD /SPECIFIC switch or start with the first volume. Or perhaps the volume doesn't belong to the fileset. If the message indicates that the label itself is bad, and you are writing to tape, relabel all volumes and try again. |
| <i>INDECIPHERABLE DUMP FORMAT</i>             | See this message in Table 8-5 (User Messages).                                                                                                                                                                                                                                                                                                                                                                                                                                 |

(continued)

**Table 8-4. Operator Messages from EXEC**

| Message                                                                                                      | Description and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>INITIAL DIRECTORY MUST BE :PER</i>                                                                        | Initialization error; appears on system console after EXEC-creating PROCESS command. EXEC was started from a directory other than :PER. EXEC terminates. Re-issue the PROCESS command, with the /DIR=@ switch.                                                                                                                                                                                                                                                                                                                                                                                |
| <i>INSUFFICIENT MEMORY FOR LOGON</i>                                                                         | Error message from EXEC startup, on system console. EXEC cannot acquire enough memory to log users on or off.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>INTERNAL CONSISTENCY ERROR IN EXEC ...</i><br><i>***HAVE EVERYONE LOGOFF AND THEN TERMINATE THIS EXEC</i> | Error message; appears on system console. Use the SEND command to warn users; DISABLE all consoles; then, when users are ready, type DOWN I or TERM OP:EXEC I. Then bring EXEC up again. When this occurs, EXEC creates a memory image file in :UTIL, with the name EXEC.mmm.dd.yy.MDM. If you want to submit a Software Trouble Report (STR) to DG about EXEC, you must include this file.<br><br>If this message includes <i>NEGATIVE TIME ENCOUNTERED</i> , this means the system clock was turned back while EXEC was running. This is illegal. To recover, bring EXEC down and up again. |
| <i>INVALID USERNAME-PASSWORD PAIR</i>                                                                        | Error message from Stacker; appears on issuing console after EXEC STACK command. The Stacker USERNAME and \$\$PASSWORD cards submitted were invalid. For action, see <i>BAD \$\$JOB</i> message. This can also occur interactively if you try to log on as a user and type an invalid username or password.                                                                                                                                                                                                                                                                                   |
| <i>JOB NOT QSUBMITTED</i>                                                                                    | Status message; appears after EXEC STACK command on issuing console. The Stacker encountered invalid \$\$JOB and/or \$\$PASSWORD cards; it has rejected the job. For action, see <i>BAD \$\$JOB</i> message.                                                                                                                                                                                                                                                                                                                                                                                  |
| <i>JOB QSUBMITTED</i>                                                                                        | Status message; appears after EXEC STACK command on issuing console. The Stacker encountered valid \$\$JOB and \$\$PASSWORD cards; it has accepted and enqueued the job.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <i>JOB RESTARTING</i>                                                                                        | Status message; appears on system console when you bring up EXEC after abnormal termination. Batch and device requests restart automatically, with this message.                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>LIMITING ENABLED</i>                                                                                      | Status message; appears after EXEC STATUS command, on issuing console. It means that the stream or device was limited via EXEC's LIMIT command.                                                                                                                                                                                                                                                                                                                                                                                                                                               |

(continued)

**Table 8-4. Operator Messages from EXEC**

| Message                                                  | Description and Action                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>@LMT ALREADY EXISTS</i>                               | Error message from EXEC initialization; appears on system console. EXEC tried to create entry :PER:LMT, but the entry already existed. Delete :PER:@LMT and bring up EXEC again.                                                                                                                                                                  |
| <i>Log on/off in progress</i>                            | Status message after EXEC CONSOLESTATUS command; appears on issuing console. It means that a user is logging on or off this console.                                                                                                                                                                                                              |
| <i>@LPBx COOPERATIVE TERMINATED</i>                      | Status message after EXEC STOP; or error message after EXEC START; appears on issuing console. The XLPT cooperative process has terminated. If you want to have it running, see if the line printer is on line; if the printer is not ON LINE, put it ON LINE and start and continue the printer. See the UP.CLI macro for syntax.                |
| <i>@LPBx PHYSICAL UNIT OFFLINE</i>                       | Error message from EXEC START command; appears on issuing console. The XLPT cooperative process terminates. Put the printer on line and start and continue it. See the UP.CLI macro for syntax.                                                                                                                                                   |
| <i>@LPBx WILL PAUSE AT END OF CURRENT JOB</i>            | Status message after EXEC PAUSE command; appears on issuing console. The device will pause after finishing its current job.                                                                                                                                                                                                                       |
| <i>MAGTAPE VOLUME ALREADY IN USE BY ANOTHER PROCESS</i>  | Error message from user MOUNT request; appears on issuing console. Another user is already using this tape volume. The user must wait until it is dismounted.                                                                                                                                                                                     |
| <i>MOUNT REQUEST CANCELLED, NO RESPONSE POSSIBLE</i>     | Status message after user MOUNT command; appears on system console. The user typed a MOUNT command, but typed DISMOUNT or logged off before you mounted the tape. Do nothing.                                                                                                                                                                     |
| <i>MUST BE A FULL PATHNAME</i>                           | Error message from a program that requested EXEC service via system call ?EXEC. The program must specify a full pathname from the root directory (:). This appears on the console that is running the program or the batch output listing.                                                                                                        |
| <i>New log-on values in effect</i>                       | Status message from EXEC ENABLE command; it confirms enactment of the new log-on values (Tries=, Stop, etc.).                                                                                                                                                                                                                                     |
| <i>NEXT VOLUME ...</i>                                   | Status message from user MOUNT; appears on system console. The user's MOUNT request needs the next tape volume; mount it on a free unit and type<br><br>CX MOUNTED @unitname )                                                                                                                                                                    |
| <i>NO MORE VOLIDS IN LIST SPECIFIED IN MOUNT COMMAND</i> | Error message from user MOUNT sequence; appears on issuing console, or batch listing if batched. All file space in the list of volids is exhausted, yet material remains to be written to tape. The labeled tape file is incomplete. The user should resubmit the MOUNT request and specify more volids, or use the MOUNT/EXTEND switch, or both. |
| <i>NO MOUNT REQUESTS</i>                                 | Status message from EXEC MOUNTSTATUS command; appears on issuing console. There are no requests in the mount queue.                                                                                                                                                                                                                               |

(continued)

**Table 8-4. Operator Messages from EXEC**

| Message                                 | Description and Action                                                                                                                                                                                                 |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>NO OUTSTANDING MOUNT REQUEST</i>     | Error message after EXEC MOUNTED, RE-FUSED, or DISMOUNTED command; appears on system console. There are no requests of the pertinent type in the mount queue. Try CX MOUNTSTATUS ).                                    |
| <i>NO SPOOLERS STARTED</i>              | Status message from EXEC SPOOLSTATUS command; appears on issuing console. No spooling device cooperatives (e.g., XLPT) have been started.                                                                              |
| <i>NO SUCH CO-OPERATIVE</i>             | Error message from EXEC command; appears on issuing console. Your specified cooperative process doesn't exist.                                                                                                         |
| <i>NO SUCH MAGTAPE UNIT</i>             | Error message from EXEC MOUNTED command; appears on issuing console. The unit doesn't exist.                                                                                                                           |
| <i>NO SUCH QUEUE</i>                    | Error message from EXEC command; appears on issuing console. There is no such queue. Check the queues with QDISPLAY ).                                                                                                 |
| <i>NO SUCH QUEUE TYPE</i>               | Error message from EXEC CREATE command; appears on issuing console. The queue types are PRINT, PLOT, PUNCH, HAMQ, FTA, and SNA.                                                                                        |
| <i>NON-UNIQUE \$\$ CARD</i>             | Error message from Stacker, from EXEC STACK command; appears on issuing console. The Stacker hit a \$\$JOB card with non-unique switch specification. For action, see BAD \$\$JOB message.                             |
| <i>NOT A CONSOLE DEVICE TYPE</i>        | Error message from EXEC ENABLE command; appears on issuing console. The command specified a nonconsole device; correct it.                                                                                             |
| <i>NOT ENOUGH ARGUMENTS FOR COMMAND</i> | Error message from EXEC command; appears on issuing console. Retry the command with the correct number of arguments.                                                                                                   |
| <i>NOT FOUND</i>                        | Error message from CX command; appears on issuing console. EXEC could not find the item or file specified. Check; try a corrected command.                                                                             |
| <i>NOT PAUSED AND IDLE</i>              | Error message from EXEC BINARY, CPL, FORMS, LPP or similar command; appears on issuing console. You must pause the device and wait until it becomes idle (or in worst case stop and flush it), then retry the command. |
| <i>NOT WAITING TO BE ALIGNED</i>        | Error message from EXEC ALIGN/CONTINUE command; appears on issuing console. The printer was not paused via EXEC'S ALIGN command.                                                                                       |

(continued)



**Table 8-4. Operator Messages from EXEC**

| Message                                         | Description and Action                                                                                                                                                                                                                          |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>NOT YOUR UNIT</i>                            | Error message from a user DISMOUNT command; appears on issuing console. The user typed DISMOUNT and specified a linkname that someone else is using.                                                                                            |
| <i>\$\$PASSWORD CARD MISSING</i>                | Error message from Stacker after EXEC STACK command; appears on issuing console. For action, see BAD \$\$JOB message above.                                                                                                                     |
| <i>\$\$PASSWORD NOT PRECEDED BY<br/>\$\$JOB</i> | Error message from Stacker after EXEC STACK command; appears on issuing console. For action, see BAD \$\$JOB message above.                                                                                                                     |
| <i>PHYSICAL UNIT OFFLINE</i>                    | Error message from EXEC MOUNTED command; appears on issuing console. The unit that you specified is not on line. Put it on line and type the EXEC MOUNTED command again.                                                                        |
| <i>PREVIOUS VOLUME ...</i>                      | Status message from EXEC, appears on system console as part of tape status message.                                                                                                                                                             |
| <i>PROFILE NOT FOUND</i>                        | Error message, from Q-series command, appears on issuing console. You have no user profile. There must be a profile for username OP if the operator is to issue Q-series commands from the system console. Create such a profile with PREDITOR. |
| <i>QUEUE ALREADY EXISTS</i>                     | Error message from EXEC CREATE command; appears on issuing console. The queue you tried to create already exists. You can open, start, and continue its device. To recreate it, you must first delete it.                                       |
| <i>QUEUE IS ALREADY OPEN</i>                    | Error message from EXEC OPEN command; appears on issuing console. The queue you tried to open is already open. You can start it on a device and continue it if you want.                                                                        |
| <i>QUEUE IS FULL</i>                            | See <i>THE QUEUE IS FULL</i> message.                                                                                                                                                                                                           |
| <i>QUEUE IS NOT EMPTY</i>                       | Error message from EXEC DELETE command; appears on issuing console. The queue you tried to delete has requests in it. If you must delete it, stop it; then purge and delete it.                                                                 |
| <i>QUEUE IS NOT OPEN</i>                        | Error message from EXEC CLOSE command; appears on issuing console. The queue you tried to close is not open (but may still have requests in it; use QDISPLAY to check).                                                                         |

(continued)

**Table 8-4. Operator Messages from EXEC**

| Message                                                                  | Description and Action                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>QUEUE IS OPEN</i>                                                     | Error message from EXEC DELETE or PURGE command; appears on issuing console. The queue you tried to delete or purge is open. Before retrying, stop it and purge it; pause the associated device if needed; then close and delete it.                                                                                                        |
| <i>QUEUE IS STARTED</i>                                                  | Error message from EXEC START command; appears on issuing console. The queue is already started.                                                                                                                                                                                                                                            |
| <i>QUEUE MAY NOT BE DELETED</i>                                          | Error message from EXEC DELETE command; appears on issuing console. You cannot delete a permanent queue, BATCH_INPUT, BATCH_LIST, or BATCH_OUTPUT.                                                                                                                                                                                          |
| <i>REQUEST ENTRY ALREADY EXISTS</i>                                      | Error message; appears on system console. It may indicate that another EXEC is running. Check with the ? macro; if two EXECs are running, get users off, terminate them both, and restart one. If only one EXEC is running, delete :PER:EXEC+.                                                                                              |
| <i>REQUEST IS ...</i>                                                    | User MOUNT message, appears on system console; and specifies <i>EXPLICIT</i> or <i>IMPLICIT LABELED MOUNT</i> , and/or <i>WRITE RING OUT</i> , or other information. Either find the (labeled or unlabeled) tape, mount it, issue the EXEC MOUNTED command; or refuse the request — perhaps using SEND to tell the user why you refused it. |
| <i>REQUIRES A MAGTAPE UNIT NAME</i>                                      | Error message from EXEC MOUNTED command; appears on issuing console. Include the unitname, form @MTxn, in the MOUNTED command.                                                                                                                                                                                                              |
| <i>RESPOND: CONTROL @EXEC DISMOUNTED</i>                                 | Status message; appears on system console after a user types a DISMOUNT command or logs off with an outstanding MOUNT request. Type CX DISMOUNTED I.                                                                                                                                                                                        |
| <i>RESPOND: CONTROL @EXEC MOUNTED @UNITNAME OR CONTROL @EXEC REFUSED</i> | Mount message; appears on system console after a user issues a MOUNT command. It is preceded by other information. Either find the tape, mount it, and type CX MOUNTED @MTxn I; or type CX REFUSED I, perhaps sending the user an explanation.                                                                                              |
| <i>Ring 6 growing to n pages</i>                                         | Status message on system console; displayed by EXEC as it gives the ring 6 portion of itself more memory.                                                                                                                                                                                                                                   |
| <i>SEARCHING FOR \$\$JOB</i>                                             | Status message after EXEC STACK command; appears on issuing console. EXEC is looking for the user \$\$JOB card entry. If \$\$JOB and \$\$PASS-WORD are okay, the Stacker will accept the job and display <i>JOB QSUBMITTED</i> .                                                                                                            |

(continued)

**Table 8-4. Operator Messages from EXEC**

| Message                                                           | Description and Action                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>SOFT ERROR</i>                                                 | System error message; appears on system console. A correctable media error occurred. If it recurs, see "Hardware Errors" in Chapter 6.                                                                                                                                                          |
| <i>SPECIFIED FORMS FILE DOES NOT HAVE VFU SPECIFICATIONS</i>      | Error message from XLPT co-operative process; appears on printer. The forms file given by user with QPRINT/FORMS= does not have Vertical Format information. Have the user fix the file in :UTIL:FORMS with the FCU utility (or fix the file yourself); then have the QPRINT command re-issued. |
| <i>STACKER REACHED END OF FILE</i>                                | Status message from Stacker; appears on console that issued STACK command, after Stacker has completed the job(s) in the reader or on disk. It terminates. To stack another job, put it in the reader and issue the STACK command again.                                                        |
| <i>SWITCH IS NOT UNIQUE</i>                                       | Error message from EXEC command; appears on issuing console. The characters you gave for the switch were not unique. Retry command with more switch characters.                                                                                                                                 |
| <i>SWITCH REQUIRES A VALUE</i>                                    | Error message from EXEC LOGGING command with /MAX= switch; appears on issuing console. Specify a maximum number of blocks or omit the switch.                                                                                                                                                   |
| <i>SWITCH UNKNOWN</i>                                             | Error message from EXEC command; appears on issuing console. The switch is unknown to EXEC. Try XHELP.                                                                                                                                                                                          |
| <i>TAPE ALREADY MOUNTED</i>                                       | Error message from EXEC MOUNTED command; appears on issuing console. The tape is already mounted.                                                                                                                                                                                               |
| <i>TAPE SET IN USE - CANNOT DISMOUNT</i>                          | Error message from EXEC DISMOUNT command, appears on issuing console. You cannot dismount this tape(s) now; they are in use. Check with CX MOUNTSTATUS ).                                                                                                                                       |
| <i>THE QUEUE IS FULL</i>                                          | Error message from Q-series command; appears on system console, user console, or batch output file. The queue needed by your command is full; check with QDISPLAY. The maximum number of queue entries is 256. Have the user try again when there are fewer entries.                            |
| <i>TOO { FEW ARGUMENTS<br/>MANY ARGUMENTS<br/>MANY SWITCHES }</i> | Error message from EXEC command; appears on issuing console. You gave an illegal number of arguments or switches for the command. Retry command, using XHELP if needed.                                                                                                                         |

(continued)

**Table 8-4. Operator Messages from EXEC**

| Message                                                   | Description and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>UNABLE TO INITIALIZE THE QUEUE</i>                     | Error message during EXEC startup; appears on system console. EXEC couldn't open the queue (file :QUEUE:Q). This probably means that QCMP or some other program has QUEUE:Q open. Check and terminate the other program.                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>UNIT DISMOUNT ...</i>                                  | Mount message; appears on system console after a user has typed DISMOUNT or logged off with an outstanding mount request. EXEC will display <i>NO RESPONSE POSSIBLE</i> or tell you what to do. In any case, you need to remove the tape from the unit.                                                                                                                                                                                                                                                                                                                                                                                                      |
| <i>UNIT MOUNT ..</i>                                      | MOUNT message; appears on system console, followed by user and MOUNT ID= information and perhaps REQUEST IS... information; followed by RESPOND... instructions. Follow EXEC's advice and/or see REQUEST IS ... message above.                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <i>UNKNOWN \$\$ CARD</i>                                  | Error message from Stacker; appears on console that issued EXEC STACK command. For action, see BAD \$\$JOB message above.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>UNKNOWN STREAM NUMBER</i>                              | Error message from EXEC command; appears on issuing console. Valid batch stream numbers are 1, 2, 3, or 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>USER SPECIFIED FORM DOES NOT MATCH FORM IN PRINTER</i> | Error message from XLPT cooperative process, appears on printer listing. A user tried to print a file that has form specs in the file's own UDA (not in a different forms file, specified via QPRINT/FORMS=). But a spec in the file's UDA (LPP, CPL, etc.) is greater than the current default form spec.<br><br>For the file to be printed, the conflict must be resolved. The file's UDA spec value can be reduced via FCU (preferably by the user) to match the default form value; or the printer forms file can be changed with EXEC's FORMS or DEFAULTFORMS command (if you know the name of a forms file that can handle the user file's UDA specs). |
| <i>VALID ONLY FROM OPERATOR</i>                           | Error message from EXEC command; appears on issuing console. You tried to issue a command to EXEC, but your username is not OP. EXEC accepts commands only from a process with the username of OP. If you are the operator, log on as the operator (or go to the system console) and retry the command.                                                                                                                                                                                                                                                                                                                                                      |

(continued)

**Table 8-4. Operator Messages from EXEC**

| Message                                    | Description and Action                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>WAITING TO BE ALIGNED</i>               | Status message from EXEC STATUS command, appears on issuing console. An EXEC ALIGN command is in effect; align the printer(s) if needed and type an ALIGN/CONTINUE command to it.                                                                                                                                                      |
| <i>WARNING: message</i>                    | An error message; appears on issuing console or batch output listing. The message is another message; check the message column of this table to find it. The message may be a system (not EXEC) error message with instructions; if so, follow them.                                                                                   |
| <i>WRONG QUEUE TYPE FOR ... command...</i> | Error message from EXEC OPEN, START, or other queue-oriented command; appears on issuing console. The queue type, as set with the EXEC CREATE command, is wrong for the command just issued. For example, <code>CX START LPT @PLA J</code> could cause this. If the queue type is the problem, delete the queue, then create it again. |
| <i>WRONG VOLUME</i>                        | Error message from EXEC MOUNTED command; appears on system console. The tape volume you just mounted is not the next one specified by the user's valid list. Remove it from the unit, find the correct one, mount it, and type<br><br><code>CX MOUNTED @unitname J</code>                                                              |

(concluded)

## User Messages from EXEC

The messages that EXEC gives *users* differ somewhat from the messages it gives to the operator process. But user messages are important because

- You, as the operator, are treated as a user whenever you issue a Q-series command: QBATCH, QPRINT, and so on. You *are* a user when you log on to a user console — even if your username is OP. So you will probably receive some of these messages.
- Other users will receive these messages and ask you — in your role as operator — what they mean.

Table 8-5 shows and explains the most common EXEC user messages, in alphabetical order. The word “you” applies to the person who received the message — either on a console or, for batch, on the batch output file. The table includes a few pertinent *system* (not EXEC) error messages.

Messages may appear either on a user's console, a batch output listing, or a printed file.

You may want to make copies of this table for users.

**Table 8-5. EXEC User Messages**

| Message                                     | Meaning/Action                                                                                                                                                                                                                                                                     |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>ABORT</i> : message                      | An abort error message; appears on issuing console or batch output listing. The message is another message; check the message column of this table to find it. This may be a system-generated (not EXEC generated) message.                                                        |
| <i>ALREADY BEING PROCESSED</i>              | Error message; appears on issuing console. You tried to hold this job via a CLI QHOLD command, but the entry was already being processed. Use QCANCEL.                                                                                                                             |
| <i>sysid BATCH OUTPUT FILE</i>              | Identification message; appears at the beginning of the batch output file, along with log-on information, for each batch job.                                                                                                                                                      |
| <i>BINARY MODE NOT ALLOWED</i>              | Error message from QPRINT/BINARY command; appears on printed file. The operator must enable binary mode with an EXEC BINARY command before anyone can QPRINT/BINARY.                                                                                                               |
| <i>BINARY MODE NOT ENABLED</i>              | Error message; appears in printed file. You included the /BINARY switch on your QPRINT command, but the system operator has not enabled binary mode on the pertinent printer. Have him/her do this with EXEC's BINARY command.                                                     |
| <i>CANCELLED BY OPERATOR</i>                | Status message; appears on batch/printed output file. The system operator cancelled your request. If you want to know why, ask with the SEND command.                                                                                                                              |
| <i>CANCELLED BY USER</i>                    | Status message; appears on batch output/printed file. You cancelled your request via the CLI QCANCEL command.                                                                                                                                                                      |
| <i>CANNOT DELETE UNEXPIRED FILE ON LMT</i>  | System error message from write to labeled tape; appears on issuing console or batch output file if batched. The default retention period on files written to labeled tape is 90 days. Specify another tape volume or have a new label written to the tape with the LABEL program. |
| <i>CANNOT RESTART, /NORESTART SPECIFIED</i> | Status message; appears in batch output or printed file. The system (as always) tried to restart your batch request; or the operator attempted to restart your printing request, but you specified /NORESTART when you queued the job, so it will not be restarted.                |
| <i>Console DISABLED from logging on</i>     | Appears on a console screen/printer. The system operator has disabled this console for EXEC-supervised user logon. You cannot log on to it.                                                                                                                                        |
| <i>CONTACT YOUR SYSTEM MANAGER</i>          | Error message, usually means EXEC or the system found an error in your user profile. The profile may need to be recreated; see the system operator or manager.                                                                                                                     |

(continues)

**Table 8-5. EXEC User Messages**

| Message                                                          | Meaning/Action                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>DATA GENERAL AOS/VS text</i>                                  | This is the beginning of the default system banner — appearing on batch output listings and consoles that are ready for user log on. To log on, press J (NEW LINE); then enter your username and password. The banner (DATA GENERAL AOS/VS) can be changed by someone in authority via the CLI command SYSID. |
| <i>DELETE ACCESS DENIED</i>                                      | Error message from a Q-series command with /DELETE switch, appears on console or batch listing. You do not have delete (Write) privileges to the request source file. The command will be executed without the /DELETE.                                                                                       |
| <i>DIRECTORY ACCESS DENIED</i>                                   | Error message from system; appears on console or batch or printer output file. You do not have the read/execute access privilege to this file. If you really need to read the file, ask the system operator to include your username,RE (or +,RE) in the file's ACL.                                          |
| <i>Enter your new password:</i>                                  | Appears on console after you enter your password but press the ERASE PAGE key instead of NEW LINE. Type in your new password, 3 to 15 alphanumeric characters, For a valid password, the system will then display <i>new password in effect</i> .                                                             |
| <i>ERROR: message</i>                                            | An error message; appears on issuing console or batch output listing. The message is another message; check the message column of this table to find it. This may be a system-generated (not EXEC generated) message.                                                                                         |
| <i>ERROR PROCESSING PROFILE</i>                                  | EXEC couldn't process your user profile; see the system operator or manager. The profile may need to be recreated.                                                                                                                                                                                            |
| <i>FILE ACCESS DENIED</i>                                        | Error message from system; see <i>DIRECTORY ACCESS DENIED</i> .                                                                                                                                                                                                                                               |
| <i>FLUSHED BY OPERATOR</i>                                       | Status message, appears on batch output or printer listing. The system operator has specifically flushed your request.                                                                                                                                                                                        |
| <i>FORMS ACCESS DENIED</i>                                       | Error message from QPRINT/FORMS= command, appears on printed file. You do not have at least E access to directory :UTIL:FORMS and R access to the file. The system operator can correct this with the ACL command.                                                                                            |
| <i>FORMS DO NOT EXIST</i>                                        | Error message from QPRINT/FORMS= command, appears on printed file. Directory :UTIL:FORMS does not exist, or the file does not exist. The system operator should check for the existence of :UTIL:FORMS and create it if necessary; if it exists, check the filename specified.                                |
| <i>Illegal character in password<br/>-- password not changed</i> | Error message from system; appears on console. You entered an illegal character in your new password. Log off, then on again, and type a legal password: 6 to 15 characters.                                                                                                                                  |

(continues)

**Table 8-5. EXEC User Messages**

| Message                                          | Meaning/Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>ILLEGAL VFU CHANNEL AFTER VFU NEXT</i>        | Error message from QPRINT/FORMS= command, appears on printed file. A channel number was not between 1 and 12. The cause is probably an error in the text source file; if not, check the forms file or user data area with the FCU utility.                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <i>ILLEGAL VFU LINE SLEW AFTER VFU NEXT CHAR</i> | Error message from QPRINT/FORMS= command, appears on printed file. Probable cause is a syntax error in the text source file or the FCU-created forms file. Check the source; then check the forms file or user data area via the FCU utility.                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>INCORRECT LABELED TAPE FILE ...</i>           | Error message from system, from access to a labeled tape volume; appears on console or batch output listing if batched. The tape label, or volid sequence, is wrong. Perhaps you tried to start reading (LOAD) in a volume other than the first volume; if so, start with the first volume. Or, the volume may not belong to this fileset. If the message indicates that the label itself is bad, have the operator use LABEL to relabel the volume(s) (or do it yourself) and try again.                                                                                                                                                                                                       |
| <i>INDECIPHERABLE DUMP FORMAT</i>                | Error message from system; appears on console after CLI LOAD command. The cause may be: <ul style="list-style-type: none"> <li>1) This is an unlabeled tape and you tried to treat it as labeled; e.g., LOAD/V TAPE:FILE ;;</li> <li>2) The file was not dumped to the tape (it may have been written with the COPY command or by a user program);</li> <li>3) the file was dumped with a nonstandard buffersize (e.g., /BUFFER=8192) and you did not specify the nonstandard buffer size in your LOAD command;</li> <li>4) The tape is the second or subsequent volume (not the first volume) in a multivolume fileset. Find and mount the first tape volume in the fileset; retry.</li> </ul> |
| <i>Invalid Remote Username-Password Pair</i>     | Error message from system; your MOVE, COPY, QPRINT, etc., command cannot be executed on the remote system because your password and/or username on the remote system differ from those on the local system. Try and find some way to make the username and password the same on both systems.                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>Invalid username-password pair</i>            | Error message from system; appears on console. EXEC cannot find a user profile with this username and password. Try again.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <i>LAST MESSAGE CHANGE date time</i>             | This message may also mean that you are not allowed to use a console.<br>Status message; appears on console after logon. This describes the time at which file :UTIL:LOG-ON.MESSAGE (whose contents are displayed for each user at logon), was last updated. Usually, the system operator or manager updates this file; but in some systems users can do so.                                                                                                                                                                                                                                                                                                                                    |
| <i>LAST PREVIOUS LOGON date time</i>             | Status message; appears on console or batch output file. Specifies the last time you logged on to this system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

(continued)



**Table 8-5. EXEC User Messages**

| Message                                                                            | Meaning/Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>LIST FILE EMPTY, WILL NOT BE PRINTED</i>                                        | Status message; appears on batch output file. You have not specified output to the batch list file with the /L or /QLIST switches.                                                                                                                                                                                                                                                                                                                                                               |
| <i>MAY NOT RUN BATCH JOBS</i>                                                      | Error message from system; appears on console. Your user profile does not allow you to submit batch requests. If you need batch, see the system operator/manager.                                                                                                                                                                                                                                                                                                                                |
| <i>New password in effect</i>                                                      | Status message; appears on console. Your new password is now effective, and the old one ineffective.                                                                                                                                                                                                                                                                                                                                                                                             |
| <i>NO MORE VOLIDS IN LIST SPECIFIED IN MOUNT COMMAND</i>                           | Error message from MOUNT sequence; appears on console or on batch output if batched. File space in your list of volids is exhausted, yet material remains to be written to tape. The labeled tape file is incomplete. You may want to write it again, specifying more volumes with the MOUNT/VOLID= switch, or telling EXEC to extend the list as needed with the MOUNT/EXTEND switch, or use both switches. One 2400-foot tape, dumped at 1600 bpi with /BUFFER=8192, holds about 39 megabytes. |
| <i>NO SUCH QUEUE</i>                                                               | Error message from system; appears on console or batch/printed output file. The specified queue doesn't exist. Type QDISPLAY J to see the names of existing queues.                                                                                                                                                                                                                                                                                                                              |
| <i>NON VFU CTRL CHARACTER AFTER VFU NEXT</i>                                       | Error message from QPRINT/FORMS= command; appears on printed file. There is an invalid character after J R. Check the text source file; if it's okay, then check the forms file or user data area with the FCU utility.                                                                                                                                                                                                                                                                          |
| <i>OPERATOR NOT AVAILABLE</i>                                                      | Error message from MOUNT command; appears on console or batch output file if MOUNT command was batched. The EXEC command OPERATOR ON has not been issued by the operator process. MOUNT requests cannot be honored until someone types the EXEC command OPERATOR ON on the system console.                                                                                                                                                                                                       |
| <i>PAGE LIMIT EXCEEDED</i>                                                         | Error message from QPRINT command; appears on printed file. The system operator enabled page limiting, and the number of pages EXEC estimated for your request exceeds the limit. Append the /PAGES= switch to your QPRINT command (estimating the number of pages); or try another queue.                                                                                                                                                                                                       |
| <i>Password:</i>                                                                   | System query message during logon. Type your password followed by J (NEW LINE).                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <i>? Password must have 6 to 15 characters</i><br><i>--Password not changed --</i> | Error message from system; appears on console while you are changing password. Log off and try again, giving a password of 6 to 15 printable characters.                                                                                                                                                                                                                                                                                                                                         |
| <i>PHYSICAL UNIT FAILURE</i>                                                       | Error message from system; appears on console during I/O. The unit (disk or tape) on which the file resided has returned a HARD ERROR. Do not type anything else; tell the system operator immediately.                                                                                                                                                                                                                                                                                          |

(continued)

**Table 8-5. EXEC User Messages**

| Message                                                                        | Meaning/Action                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>PRIORITY TOO HIGH FOR YOU</i>                                               | Error message from Q-series command; appears on console or batch/printed output file. Your highest priority (in your user profile) is too low for the queue; or, the priority you gave with the /QPRIORITY switch is higher (closer to 0) than the profile allows. Consult the system operator.   |
| <i>PROCESS nn TERMINATED [by]<br/>ELAPSED TIME:<br/>USER 'user' LOGGED OFF</i> | Status message from system; appears on console or batch output file. The user process that connected your console or batch job has terminated normally, or by operator command, or by the system, or by a CTRL-C CTRL-B sequence.                                                                 |
| <i>PROFILE NOT FOUND</i>                                                       | Error message after Q-series command; appears on batch output file. You issued a Q-series command (perhaps with an /AFTER switch); but EXEC could not find a profile with your username when it tried to run the request. Your profile may have been changed or deleted; see the system operator. |
| <i>REQUEST REFUSED BY SYSTEM<br/>OPERATOR</i>                                  | Error message from MOUNT command; appears on console or in batch output file. The operator specifically refused your request. There may also be an explanation of why the operator did this.                                                                                                      |
| <i>RESTARTED BY OPERATOR</i>                                                   | Status message; appears on printed file. The operator specifically restarted this request.                                                                                                                                                                                                        |
| <i>SKIP TO VFU CHANNEL N GIVEN<br/>CHANNEL N NOT PUNCHED</i>                   | Error message from QPRINT/FORMS= command; appears on printed file. Syntax error in text source file or forms file. Check the source file; if it's okay, check the forms file or user data area with the FCU utility.                                                                              |
| <i>TAB SENT BEYOND LAST TAB STOP</i>                                           | Error message from QPRINT/FORMS= command; appears on printed file. See previous message for action.                                                                                                                                                                                               |
| <i>THE QUEUE IS FULL</i>                                                       | Error message from Q-series command; appears on console or batch output file. The queue needed by your command was full; check with QDISPLAY; try again when there are fewer entries. The maximum number of entries in a queue is 256.                                                            |
| <i>Too many attempts, console locking for n<br/>seconds</i>                    | Error message during log-on attempt; appears on console. Wait <i>n</i> seconds and try again.                                                                                                                                                                                                     |
| <i>Too many attempts,<br/>disconnecting</i>                                    | Error message during log-on attempt via remote console; appears on console. Hang up, redial, and try again.                                                                                                                                                                                       |
| <i>Too slow - disconnecting</i>                                                | Error message during log-on attempt via remote console; appears on remote console. Hang up, redial, and try again.                                                                                                                                                                                |
| <i>Too slow - input timed out</i>                                              | Error message during log-on attempt; appears on console. If you still want to log on, start over.                                                                                                                                                                                                 |

(continued)

**Table 8-5. EXEC User Messages**

| Message                                                   | Meaning/Action                                                                                                                                                                                                              |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>UNABLE TO CREATE YOUR PROCESS</i>                      | Error message during log on; appears on console or batch output file. EXEC couldn't create a user process for you. Your profile may need to be recreated. See the system operator or manager.                               |
| <i>Username:</i>                                          | Query message from system; appears during logon. Type your username and ↵ (NEW LINE).                                                                                                                                       |
| <i>USER NOT PRIVILEGED TO CHANGE PASSWORD</i>             | Error message; appears on console when you try to change your password. Your user profile does not allow you to change your password.                                                                                       |
| <i>USER SPECIFIED FORM DOES NOT MATCH FORM IN PRINTER</i> | From XLPT process. See this message in Table 8-4, preceding.                                                                                                                                                                |
| <i>USER SPECIFIED @OUTPUT ERROR</i>                       | Error from Q-series command; appears on batch output file. With the /QOUTPUT= switch, you specified an illegal @OUTPUT file. Try again with another @OUTPUT filename.                                                       |
| <i>VALID ONLY FROM OPERATOR</i>                           | Error message from CONTROL @EXEC (CX) command; appears on console. Your username is not OP and you issued a CONTROL command. Only processes with username OP can tell EXEC what to do.                                      |
| <i>WARNING: message</i>                                   | An error message; appears on issuing console or batch/printed output file. The message is another message; check the message column of this table to find it. This may be a system-generated (not EXEC generated) message.  |
| <i>WAS NOT MOUNTED</i>                                    | Error message from DISMOUNT command; appears on console or batch output file if batched. The tape linkname you specified was not mounted. Perhaps you specified the wrong linkname or this is your second DISMOUNT command. |
| <i>YOU MAY NOT LOG ON FROM A CONSOLE</i>                  | Error message during log-on attempt; appears on console. Your user profile does not allow you to use a console. You are restricted to batch.                                                                                |

(concluded)

## What Next?

This chapter described EXEC — but really much more, because EXEC includes interactive user logon/logoff, batch and spooling, queues, and labeled tapes and user mount requests. Other products, like XODIAC, entered the picture because they use EXEC queues. A lot of device-oriented information is also involved: consoles, line printers, and magnetic tape units. So if you understand even a part of EXEC, and know where to look for more, you've done a lot. Parts of EXEC appear complex because there are two parties involved: users (people logged on to user consoles) and the system operator. You can integrate and clarify what you're read by logging on as user, submitting a batch request or two, then a mount request or two, and watching what happens on the system console.

EXEC is *the* primary multiuser tool. But there are many others: the CLI, display programs, system log, and backup procedures. The next two chapters describe these.

## End of Chapter



# Chapter 9

## Other Runtime Tools, CLI, Lock, Display, and Logging

Read this chapter when you want to use one or more AOS/VS tools to help operate the system.

There are many tools to help you run your system. They include the SCP-OS, ESD, FIXUP, PREDITOR, and EXEC — all explained in previous chapters. The tools described in *this* chapter don't run themselves — like EXEC — nor are they recovery programs like FIXUP.

Instead, these tools are for active use during the course of a normal working day. This chapter describes them in the following major sections:

- Using the OP CLI
- LOCK\_CLI
- File Access Control with ACL
- Process Environment Display (PED)
- DISPLAY and File Comparison Utilities
- Event Logging with SYSLOG, the Error Log, and REPORT
- Confidence Testing with CONTEST
- DISCO Disk Monitor Program
- SPRED Selective Preamble Editor Utility

Backup tools are described in Chapter 10.

Other operator-oriented programs, that you may want to use occasionally, are the Disk Formatter, Installer, and FRU diagnostic tests, described in later chapters.

### Using the OP CLI

The CLI — AOS/VS' command language — is a very powerful tool, with over 100 commands and a flexible macro facility that allows you to create your own commands.

By default, when AOS/VS comes up, it runs a CLI process on the system console. This CLI has process ID (PID) 2, the username OP (operator), and it is the father of all lower processes. It has a number of special privileges, including Superuser and Superprocess. This CLI is called the *root* or *master* CLI.

The UP macro issues a number of commands to the master CLI, including: an ACL command that gives users access to tape units, a PROCESS command that starts EXEC, and finally an EXECUTE command that starts a son CLI under the master process. This son CLI is usually the one that runs on the system console.

The son CLI can be a standard CLI or LOCK\_CLI (a lockable CLI to safeguard the system console). You choose the CLI you want in the UP macro.

A standard CLI under the master has nearly all the privileges of its father. It has the username OP, which allows it to issue commands to EXEC. And it has the privileges that the system operator may need to run the system.

A locked LOCK\_CLI, though, has no privileges and practically no power. It can issue commands to EXEC. But otherwise, it can do almost nothing — which makes it an ideal guardian of the system console. (When unlocked, LOCK\_CLI has the same powers as a standard CLI.)

To get back to the master CLI, a person needs to terminate the son CLI on the system console. Terminating a standard CLI is easy (type BYE ). Terminating a locked LOCK\_CLI requires a password.

Table 9-1 summarizes some process-oriented CLI commands and macros that can be issued by the master CLI, a standard son, or any user CLI that has the appropriate privileges. It describes the commands briefly, in the context of system operation. For full syntax and all switches, of any CLI command, use HELP ) or see the CLI manual. For a *session* with the CLI, try *Learning to Use Your AOS/VS System*.

You can abbreviate any CLI command to the shortest string of characters that identifies the command.

**Table 9-1. Operator-oriented CLI Commands and Macros**

| Command or Macro                                | Description                                                                                                                                                                                                                                                    | Example                                                                                             |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| ?CLI                                            | A macro that describes all processes on the system. Creating it is shown in Chapter 5.                                                                                                                                                                         | ) ? )                                                                                               |
| ACL template                                    | Displays or sets a file access control list. ACL is the primary access control tool, explained later in this chapter.                                                                                                                                          | ) ACL / V :UTIL:FORMS )<br>) ACL / V + OP,OWARE )                                                   |
| BROADCAST.CLI                                   | A macro that sends a message to all user consoles. Creating it is shown in Chapter 5.                                                                                                                                                                          | ) BROADCAST Log off! )                                                                              |
| BYE                                             | Terminates the current CLI or SED text editor process. The process' father (process from which it was executed) gets control. If there is no father, as with the master CLI, BYE starts a system shutdown. Typed to a user CLI process, BYE logs the user off. | ) BYE )                                                                                             |
| CHARACTERISTICS [char]<br>/RESET<br>/DEF [char] | Displays, sets, or resets the hardware characteristics of a console, overriding the VSGEN setting if desired. Use it when you want to change the system console's (or any user console's) behavior.                                                            | ) CHAR / PM )<br>...<br>) CHAR / RESET )<br><br>) CHAR / DEF / 605X )<br>) CHAR / DEF / 8BT @CON5 ) |
| CONTROL @process command                        | Sends an IPC message of command to process in :PER. Use it to control EXEC and other DG products. Also see the CX.CLI macro in this table.                                                                                                                     | ) CONTROL @EXEC ALIGN )                                                                             |

(continues)

**Table 9-1. Operator-oriented CLI Commands and Macros**

| Command or Macro                                                            | Description                                                                                                                                                                                                                                                                                                              | Example                                                               |
|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| COPY dest-file source-file                                                  | Copies a source-file to a destination file (dest-file). COPY is useful when you want to copy a file literally, without the header information that DUMP writes.                                                                                                                                                          | ) COPY @MTB0 TBOOT )<br>) COPY @NULL @MTB0 )                          |
| CREATE <i>//MAX=n/</i> path<br><i>//DIR/</i> path<br><i>/LINK</i> link dest | Creates the file named in <i>path</i> (pathname). Use <i>/MAX=n</i> to create a control point directory of <i>n</i> blocks, or <i>/DIR</i> to create a standard directory. Use <i>/LINK</i> to create a link entry to a destination file. You may use CREATE pretty often. To insert text in the new file, use CREATE/I. | ) CREATE/MAX=8000 F77 )<br>) CRE/I FOO )<br>) TYPE Hi )<br>) ) )<br>) |
| CX.CLI                                                                      | A macro that makes it easy to issue EXEC commands. Creating it is described in Chapter 5.                                                                                                                                                                                                                                | ) CX ALIGN @LPB )                                                     |
| DELETE template                                                             | Deletes the file(s) given in template. You will often delete files in the course of system house-keeping.                                                                                                                                                                                                                | ) DELETE/V +.BRK )<br>) DEL/V DIR:XX+ )                               |
| DIRECTORY <i>[dir]</i>                                                      | Displays the working directory name or sets it to <i>dir</i> . The easiest way to work within a directory is to DIR into it.                                                                                                                                                                                             | ) DIR )<br>) DIR :UTIL )                                              |
| DOWN.CLI                                                                    | This is a DG-supplied macro that brings down EXEC. Tailoring it is described in Chapter 5.                                                                                                                                                                                                                               | ) DOWN )                                                              |
| DUMP file <i>[template]</i><br>DUMP_II file <i>[template]</i>               | Copies files to tape or disk. DUMP is most useful for file backup (archiving), described in Chapter 10. The DUMP_II program is a faster version of the DUMP command.                                                                                                                                                     | ) DUMP/V TAPE:FOO + )<br>)XEQ DUMP_II/V @MTB0 )                       |
| FILESTATUS <i>[template]</i>                                                | Describes files in any directory. It is one of the most useful commands.                                                                                                                                                                                                                                                 | ) FILES/AS )<br>) F/AS/S :+ )                                         |
| HELP <i>[command]</i>                                                       | Gives help on CLI topics or any command.                                                                                                                                                                                                                                                                                 | ) HELP )<br>) HE/V ACL )                                              |

(continued)

**Table 9-1. Operator-oriented CLI Commands and Macros**

| Command or Macro                                                                                       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Example                                                                                                           |
|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <p>INITIALIZE</p> <p>{<br/> unitname ...<br/> unitname!unitname ...<br/> }/NOMIRROR unitname ... }</p> | <p>Grafts a logical disk unit (LDU), composed of one or more physical units, onto the working directory. For a mirrored LDU, separate the units with a !. Use /NOMIRROR to initialize one image of a mirrored LDU.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>*) INIT @DPJ0 ↓</p> <p>*) INIT @DPJ1 @DPJ2 ↓</p> <p>*) INIT @DPJ1!@DPJ2 ↓</p> <p>*) INIT /NOMIRROR @DPJ1 ↓</p> |
| <p>JPINITIALIZE</p> <p>[/EXISTING / n<br/> [/MCODEFILE=pathname]</p>                                   | <p>Initializes a job processor, n, other than the default job processor (the default processor is usually 0). This gives AOS/VS control of the new job processor. You need System Manager privilege to use this command, which works only on systems that have more than one job processor.</p> <p>If you omit switches, the system loads microcode from the default microcode file (described in Chapter 6) into the job processor. It loads microcode <i>whether or not</i> microcode is already loaded.</p> <p>If microcode has already been loaded into the job processor, use the /EXISTING switch. /EXISTING tells AOS/VS to use existing microcode, saving time on warm starts. AOS/VS will report an error if microcode hasn't been loaded.</p> <p>To load a nondefault microcode file (instead of loading the default or using the existing microcode), use the /MCODEFILE=pathname switch.</p> <p>Normally, you will want to insert the JPINITIALIZE command in your UP.CLI macro, before any PROCESS or XEQ commands.</p> | <p>) JPINITIALIZE 1 ↓</p>                                                                                         |

(continued)



## Operator-oriented CLI Commands and Macros

| Command or Macro                                                   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Example                                                                                                                  |
|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| JPRELEASE <i>//LAST/</i> n                                         | Releases an initialized job processor other than the default processor on a system with more than one job processor. You might use this command if you wanted to remove a job processor from the system without shutting down.<br><br>If you've defined a logical processor (via the optional CLASP utility or user program), and the job processor you want to release is the last one connected to your logical processor, include the <i>/LAST</i> switch. (If you don't include it, you will get an error.) | ) JPRELEASE 1 )<br>)                                                                                                     |
| LOAD file <i>/template/</i>                                        | Loads dumped files; precise counterpart of DUMP and DUMP_II.                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ) LOAD /V TAPE:UDDFILE + )<br>) LOAD /V @MTB0 )                                                                          |
| MIRROR<br>{ /SYNC /WAIT<br>/FORCESYNC /WAIT }<br>LDU name unitname | Initializes a second image of a mirrored LDU and begins synchronization. Use /SYNC when the image that is initialized (via INITIALIZE /NOMIRROR) is the preferred image. Use /FORCESYNC when the image you are bringing in is more recent than the initialized image. Using /WAIT with either /SYNC or /FORCESYNC pends the CLI until the synchronization has completed, which can take several hours. So use /WAIT only if you need to ensure that the mirror is synchronized before the system comes up.      | *) MIRROR /SYNC UDD1<br>@DPJ1 )<br><br>*) MIRROR /FORCESYNC UDD1<br>@DPJ2 )<br><br>*) MIRROR /SYNC /WAIT UDD1<br>@DPJ1 ) |

**Table 9-1. Operator-oriented CLI Commands and Macros**

| Command or Macro           | Description                                                                                                                                              | Example                                                    |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| MOVE dir <i>[template]</i> | Copies file(s) named in template to another directory. You'll use MOVE often for housekeeping and maintenance.                                           | ) MOVE/V/R : ERMES )                                       |
| ON.CLI<br>OFF.CLI          | Macros that turn Superuser and Superprocess on and off; shown in Chapter 5. Typing ON or OFF is easier than typing Superuser or Superprocess.            | ) ON )<br>*) OFF )<br>) ON/P )<br>+)                       |
| POP                        | Restores the previous CLI environment. After PUSH, it can save a lot of effort. It's explained below.                                                    | ) PUSH )<br>) DIR XX:YY )<br>) CHAR/PM )<br>...<br>) POP ) |
| PROCESS program            | Creates a new process — as XEQ does — but is more versatile. You may want to write PROCESS commands for your applications into the UP macro.             | ) PROCESS/IOC=@CON2& )<br>&) /BLOCK/DEF :CLI )             |
| PUSH                       | Descends to a new CLI environment. To ascend, use POP.                                                                                                   | See the POP example.                                       |
| QBATCH command             | Posts a batch job; you may use batch fairly often for prolonged operations that can run by themselves. Also, see the BATCH and CHEK macros in Chapter 5. | ) QBATCH/AFT=17 DDUMP )                                    |
| QDISPLAY                   | Describes all queues and their status; this is handy in a multi-user environment.                                                                        | ) QD/V )                                                   |
| QPRINT template            | Posts a printing job; you'll use this when you want line-printer hard copy.                                                                              | ) QPRINT MYFILE )<br>) QPR/C=10 C:ZFILE )                  |
| RENAME old new             | Renames a file. Use this to preserve a backup file when you know that the program you're about to run will delete the original.                          | * ) REN ERMES ERMES.OLD )<br>* ) LINK_ERMES )              |

(continued)

**Table 9-1. Operator-oriented CLI Commands and Macros**

| Command or Macro                         | Description                                                                                                                                                                                                                      | Example                                                   |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| RUNTIME [ <i>pid</i> ]                   | Describes process statistics; use it when you think a process may be malfunctioning. If it's using all the CPU time, you <i>know</i> it's malfunctioning.                                                                        | ) RUN )<br>) RUN 1 )                                      |
| SEARCH [ <i>dir</i> ] [...]              | Displays or sets your search list. This is a list of directories the CLI scans when it can't find a file in the working directory. The UP macro sets your search list, but you may want to change it for some system operations. | ) SEARCH )<br>) SEA [!SEA],:ZDIR )                        |
| SED.CLI                                  | A macro that executes the SED text editor; described in Chapter 5. It's easier than typing X SED filename.                                                                                                                       | ) SED MYFILE )                                            |
| SEND <i>pid</i> message                  | Sends a message to a process ID ( <i>pid</i> ). You'll use this often to communicate with users.                                                                                                                                 | ) SEND 20 What?? )                                        |
| SPACE [ <i>cpd</i> ]<br>[ <i>cpd n</i> ] | Tells you how much disk space is used, and how much remains free, in a control point directory ( <i>cpd</i> ). It's often useful to know this. With <i>cpd n</i> , set a different maximum size of <i>n</i> disk blocks.         | ) SPACE : )<br>) SPA :UDD:OP )<br>*) SPA :UDD:SAL 20000 ) |
| SUPERPROCESS [ON]<br>[OFF]               | Turns Superprocess, the power to control any process, on or off. You need this to terminate a brother or father process; it's detailed below.                                                                                    | ) SUPERPROCESS ON )<br>+)                                 |
| SUPERUSER [ON]<br>[OFF]                  | Turns Superuser, the ability to access and write any file on the system, on or off. You may need this to create, examine, and delete files outside your OP directory.                                                            | ) SUPERUSER ON )<br>*)                                    |

(continued)

**Table 9-1. Operator-oriented CLI Commands and Macros**

| Command or Macro      | Description                                                                                                                                                                                    | Example                                                          |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| SYSTAPE.CLI           | A DG-supplied CLI macro that creates a tailored system tape. Use it for tailored system back-up.                                                                                               | *) SYSTAPE @MTB0 SYS.PR ↓                                        |
| TERMINATE process pid | Terminates a subordinate process. This is used in the DOWN macro; you will use it yourself when you need to terminate a process. With Superprocess on, this command can terminate any process. | ) TERMINATE 34 ↓<br>+) TERM 4 ↓<br>+) TERM OP:EXEC ↓             |
| TYPE template         | Types an ASCII file on the console. Use it whenever you want to read a file or tape label.                                                                                                     | ) TYPE MYFILE ↓<br>) TY :UTIL:ERMES.SR ↓<br>) TY @MTB0 ↓         |
| UP.CLI                | A DG-supplied macro that brings up EXEC and the multi-user environment.                                                                                                                        | ) UP ↓                                                           |
| WHO [pid]             | Displays the username associated with PID <i>pid</i> . Use it when you want to know who is in the PID.                                                                                         | ) WHO ↓<br>) WH 30 ↓                                             |
| WRITE arguments       | Displays arguments on the console or listing file. WRITE is most useful in CLI macros.                                                                                                         | ) WRITE Hi ↓<br>) WRITE [!OCT 518] ↓<br>) WRITE/L=FILE [!DATE] ↓ |
| XEQ program           | Executes a program — similar to PROCESS, but easier and less versatile.                                                                                                                        | ) X DISPLAY ZZ.PR ↓<br>) X PED ↓<br>) X VSGEN ↓                  |

(concluded)

## Filename Templates

A filename template includes a special character that specifies a set of filenames. The most common template characters are as follows.

| Character | What it Means                                                                                                                                                    |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| *         | Match any single character except a period.                                                                                                                      |
| -         | Match any series of characters not containing a period.                                                                                                          |
| +         | Match any series of characters.                                                                                                                                  |
| \         | <i>Omit</i> a series of characters.                                                                                                                              |
| #         | Search the specified directory <i>and all subordinate directories</i> . Without this template, the search is restricted to the working (or specified) directory. |

For example

| This command         | Searches for filenames of                                                            |
|----------------------|--------------------------------------------------------------------------------------|
| ) FILES/AS ***** )   | six characters without a period.                                                     |
| ) FILES/AS **.CLI )  | two characters without a period, ending in .CLI                                      |
| ) FILES/AS - )       | any characters without a period.                                                     |
| ) FILES/AS -.CLI )   | any characters without a period, ending in .CLI                                      |
| ) FILES/AS + )       | any characters.                                                                      |
| ) FILES/AS +.CLI )   | any characters ending in .CLI                                                        |
| ) FILES/AS :#:+ )    | any characters <i>in all directories in the system, starting at the root</i> .       |
| ) FILES/AS :#:+.SR ) | any characters ending in .SR in all directories on the system, starting at the root. |

Templates work with most CLI commands and are extremely useful. For file searches — especially prolonged ones with # — you may want to apply the /L=@LPT switch, so the listing will show you the pathnames of the filenames found.

## Filename Suffixes and Their Meanings

Certain filename suffixes indicate the kind of material in the file. These suffixes are useful because they tell you at a glance what's in a file. You may want to delete files with certain suffixes periodically to conserve disk space. The most common filename suffixes are as follows.

| Suffix | Meaning                                                                                                                                                                                                                                                    | Example Filename    |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| .BRK   | This is a break file created by a program on abnormal termination. These are occasionally useful in problem diagnosis, but generally you can delete them.                                                                                                  | ?00013.16_34_22.BRK |
| .CLI   | This is a CLI macro. It's in ASCII and you can type it.                                                                                                                                                                                                    | UP.CLI              |
| .CSF   | This is a VSGEN customer specification file, which contains the specs for an operating system. You can type such files (usually in :SYSGEN) to see what hardware and software a system supports. A companion file, which VSGEN reads, has the .SSF suffix. | COLDSPOT.CSF        |

| <b>Suffix</b> | <b>Meaning</b>                                                                                                                                                                                                             | <b>Example Filename</b> |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| .DL<br>.DS    | These are dialog files created by Link for DG's SWAT debugger. The files are needed by SWAT; but after a program has been debugged, the .DL and .DS files should be deleted.                                               | MYPROG.DL               |
| .ED           | This is a SED edit file, created by SED for its own use during an edit session. Such files can be deleted if you need disk space.                                                                                          | UP.CLI.ED               |
| .FXP          | This is a FIXUP script file, created when someone ran FIXUP using the /BUILDSRIPT switch. Such files must be in the root directory to be usable with stand-alone FIXUP. Omit the .FXP suffix when you use the script file. | FIX_DPJ0.FXP            |
| .JOB          | This is a batch input file, which the system deletes after the job completes. Such files remain in users' working directories only if jobs don't finish normally. You can type them.                                       | ?00028.CLI.001.JOB      |
| .LB           | This is a library file: a group of .OB files from which Link takes material it needs to build .PR files.                                                                                                                   | URT32.LB                |
| .LPT          | This is a temporary print queue file, which the system should delete, as with .JOB files. These files are created in directory :QUEUE.                                                                                     | JACK_0001.LPT           |
| .MCF          | This is a microcode file, which the system bootstrap program can load into the main processor CPU if microcode is not already loaded.                                                                                      | MV10000.MCF             |
| .MDM          | This is a memory dump file, created by an ?MDUMP system call in a program. Such a file can help DG solve problems; you should include a copy of it if you submit a software trouble report. Memory dump files are rare.    | EXEC_12 ... _22.MDM     |
| .OB           | This is an object file, produced by compilation or assembly of a source file. Link uses .OBs to build .PR files.                                                                                                           | SEDERMES.OB             |
| .OL           | This is an overlay file, used by the the .PR file of some utility programs.                                                                                                                                                | EXEC.OL                 |
| .PR           | This is a program file, executable under AOS/VS.                                                                                                                                                                           | CLI.PR                  |
| .SR           | This is an assembly language source file, in ASCII. It can be a basis for an executable program, or assign parameters. You can type such files.                                                                            | PARU.32.SR              |

| Suffix | Meaning                                                                                                                                                                                                                                                         | Example Filename   |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| .SSF   | This is a VSGEN system specification file, used by VSGEN to generate a tailored system. Delete the file only if the VS system based on it is obsolete.                                                                                                          | COLDSPOT.SSF       |
| .ST    | This is a symbol table file, which gives symbols numeric addresses. Link creates it automatically. The patch program and autopatch macros need these files. For a user program, unless the program may need debugging or patching, you can delete the .ST file. | AGENT.ST           |
| .TM    | This is a temporary file, created by a utility program for its own use. The utility usually deletes such files after normal termination. Aside from the VSGEN .TMP files, you should delete these.                                                              | ?00006.MYFILE.TM   |
| .TMP   |                                                                                                                                                                                                                                                                 | ?00018.SPEED.A.TMP |

Other suffixes are used for other DG products. For example, .F77 denotes a FORTRAN 77 source file, .PL1 a PL/I source file, and so on.

## Screen Editing

The CLI — like the SED text editor — offers screen editing via console control characters. This can be a big timesaver on CRT consoles. It is detailed in *Learning to Use Your AOS/VS System*.

## Pushing and Popping

There are many levels of CLI available, each with its own environment. Normally, the CLI runs on level 0, the highest level.

But you can PUSH a level, set up a new CLI environment with new characteristics, directory, search list, and others (described in the CLI manual). Then, when you're done with the new environment, simply POP to the higher one. The LEVEL command tells you the current level. PUSH and POP can help eliminate confusion and save time. For example:

```

) DIR ↓
:UTIL                               (The working directory is :UTIL.)
) PUSH ↓                            (Push a level.)
) DIR :OBS:ZZZ ↓                    (Change directory and other things.)
) SUPERU ON; SEARCH ZZ:XX ↓        (The semicolon allows you to stack CLI
                                   commands.)

*) MOV/V :UDD:OP FILEX ↓
FILEX
*) POP ↓                            (Pop to restore everything.)
) DIR ↓
:UTIL

```

## Superuser and Superprocess

Superuser, if on, allows a user to read, write, modify, delete, or change the ACL of any file on the system. Superusers can bypass all file access controls at will. This privilege can imperil all files. The CLI prompt is \*) when Superuser is on.

Superprocess, if on, allows a process to block any other process, become resident, or terminate any other process, including the master CLI — which would shut down AOS/VS. The CLI prompt is +) when Superprocess is on. It is #) when both are on.

The Superuser and Superprocess privileges are options for each user profile. If you want a secure system, users should not have these privileges — nor should they have *Change username* privilege, which gives easy access to privileged usernames. In some systems, even the operator doesn't have these privileges — described in LOCK\_CLI, next.

## File Access Control with ACL

In a multiuser system, users need access to, and privacy for, their own files. System and user files need protection from accidental (or malicious) deletion. AOS/VS file access control lists (ACLs) help ensure this.

Each directory, including the root (:), and each nondirectory file, has an ACL. An ACL is a list of matched username-access pairs, with the form

`username, access [username, access] ...`

A username can be a real username, or it can include filename template characters to specify a group of usernames. Access types are O, W, A, R, E, and null. They have the following meanings (repeated, with more detail, in Chapter 16).

| Access Type | Allows                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| O (Owner)   | <p>Owner access to a directory allows a user to change directory ACL, rename, or delete the directory, regardless of the ACLs of files in it. The user can also change the ACL of any file — directory or nondirectory — within the directory. E access is also needed if the user wants to enter the directory or use its name in a pathname.</p> <p>Owner access to a logical disk unit (LDU, set by the Disk Formatter) allows a user to initialize the LDU.</p> <p>Owner access to a nondirectory file allows a user to change ACL, rename or delete the file, check filestatus, check or change permanence, or create a user data area (UDA) for the file.</p>                                                                                                         |
| W (Write)   | <p>Write access to a directory allows a user to delete or rename the directory, regardless of ACLs of files in it. The user can also create files in the directory, change their ACLs, rename them, or delete them. Write access allows a user to initialize and release an LDU in the directory. E access is also needed if the user wants to enter the directory or use its name in a pathname.</p> <p>Write access to a nondirectory file allows a user to delete the file, change file contents (for example, by adding text from another file), check filestatus, check or change permanence, and create a user data area (UDA). Write access has little value if the user lacks read access — since, without read access, the user can't tell what's in the file.</p> |
| A (Append)  | <p>Append access to a directory allows a user to add files (directory or nondirectory) to it. E access is also required, for access to the directory.</p> <p>Append access to a nondirectory file allows a user to check the filestatus and check or change permanence for the file.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| R (Read)    | <p>Read access to a directory allows a user to read filenames in it (for example, in a FILESTATUS command, with or without templates). E access is also required for access to the directory.</p> <p>Read access to a nondirectory file allows a user to read it — for example, with the TYPE command or a text editor. The user can also check the filestatus and check or change permanence. The user also needs at least E access to the parent directory and all higher directories.</p>                                                                                                                                                                                                                                                                                |



E (Execute)      Execute access to a directory allows a user to enter the directory and use its name in a pathname. To list files or check file ACLs in the directory, a user must have both E and R access. (Users *can* list a specific filename, if they know it, with E access only.)

Execute access to a nondirectory file allows the user to execute the file as a program (XEQ or PROCESS command), to read filestatus, and to check or change permanence. It does not allow the user to debug the program.

., (null)      Null access excludes a user from access. For a directory, null access prevents the user from accessing files within the directory. The user can list the directory name.

For a nondirectory file, null access prevents the user from accessing the file.

By default, users who are not given access have null access anyway — which implies that you don't need to specify null access. But if you use a template to give a group of users access, null lets you *exclude* users in the group. You can assign null access specifically with ., (two commas) after the username or template. If you end an ACL command line with null, use one comma instead of two (e.g., ACL FILEA A+,WARE \$+, ,).

For example, assume you want to retain ownership of a file and give most users RE access to the file. You want to exclude users ANDY\_B and any user whose username begins with \$. You could type

```
) ACL pathname [!USER],OWARE ANDY_B, $+, , +,RE )
```

To deny everyone (including its creator) access to a file, use the ACL /K switch, as follows:

```
) ACL /K pathname )
```

PREDITOR creates each user directory (in :UDD) with an ACL of username,OWARE. Each file the user creates within this directory gets the same ACL (username,OWARE) by default. The user profile files, in :UPD, have null ACLs, which means that only Superusers, like EXEC, can read them.

Every user has Owner access, thus can change his/her file ACLs with the ACL command, or change the default ACLs with the DEFACL command.

A user can give another user (or all users) read access to any file by giving E access to his directories — up to :UDD:username — and by giving R access to the file. For example, assume Sam wants to give Al read access to file :UDD:SAM:MARK\_IV:MARKET\_PLAN. Sam can type

```
) ACL :UDD:SAM SAM,OWARE AL, E )
) ACL :UDD:SAM:MARK_IV SAM,OWARE AL, E )
) ACL :UDD:SAM:MARK_IV:MARKET_PLAN SAM,OWARE AL, R )
```

(The SAM,OWARE is needed to retain Sam's access rights to his own file.)

If a user will often need a specific, nondefault ACL, you or the user can specify this ACL in the user's logon macro with the DEFACL command. For example, assume that Sam will periodically want to give Al read access to selected files. Sam can put the command

```
DEFACL SAM,OWARE AL,E
```

in his logon macro. This will allow Al to access all Sam's directories (but not go shopping for files in them). Sam can then let Al read a file by typing only *one* ACL command, regardless of the directory that holds the file; for example

```
) ACL :UDD:SAM:MARK_XV:STRATEGY SAM,OWARE AL,E )
```

In a more relaxed situation, you might want to specify E access for *everyone*. For this, the easiest method is to put the DEFACL command in the *central* logon macro (that executes user logon macros). The command would be

```
DEFACL [!USERNAME],OWARE +,E
```

The DEFACL command can be inserted in a logon macro with a text editor.

### Order of Usernames

When you (or anyone) gives access privileges to different users, be sure to assign specific username group(s) before general username groups (templates). For example, the ACL

```
+,RE SALLY,OWARE
```

gives all users (which includes Sally) read and execute access — and *only* read and execute access. The O, W, and A access for Sally are ignored. With this ACL, no one but a superuser can write to the file or change the ACL. But transposing the user groups:

```
SALLY,OWARE +,RE
```

gives Sally all access, and gives all users read and execute access — which is what people want from ACLs. When you use templates in an ACL, place specific username(s) first and the most general usernames (templates) last.

The specific-to-general rule also applies when you *exclude* users via null access. For an example, here's the example given above: You want to retain owner access, and give all users RE access — except ANDY\_B and any user whose username begins with \$. You can type

```
) ACL pathname [!USERNAME],OWARE ANDY_B ,, $+ ,, +,RE )
```

By specifying null for the usernames you want to exclude, you tell the system to exclude them before it acts on the +,RE template.

The number of user-access pairs you can specify is limited only by the number of characters involved. The maximum number of characters allowed is 255. You can assign a multiple-line ACL easily by writing it into a macro file with a text editor, ending each line with the & continuation character, then using the macro to assign the ACL to the desired file(s). For example, assume you create the macro ACL\_MARK\_II.CLI with the following ACL specification:

```
ACL/V %1% al_r,RE allan,WRE barnes,RE carnaby_a,RE erm,RE fort-,RE&  
jamison,RE s.a.a.,RE prodigy,AE &
```

You could then change one or more ACLs quite easily; for example

```
) ACL_MARK_II PROG+ )
```

This assigns the long ACL to all files whose names begin with PROG in the working directory. To add OWARE access for the user who runs the macro, you'd insert [!USERNAME],OWARE before the first username-access pair.

If you (or a user) want to change the ACL of all files in a directory and its subordinates, get into the directory and type an ACL command of the form

```
ACL/V # username-access [username-access ...]
```

For example,

```
| *) ACL/V # [!SAL,OWARE] OP,WARE )
```

With Superuser on, you can bypass all ACLs. But so can any user who has Superuser privilege. The ideal arrangement allows people to work productively without Superuser.

## Device and LDU ACLs

Devices — like disk and tape units, and consoles — are accessed through filenames in directory PER. The default ACL of PER is +,RE — which allows users to read and use devices. The default ACL of tape, disk, and diskette units is OP,WARE. The default ACL of consoles is PMGR,OWARE.

The default tape unit ACL (OP,OWARE) allows users other than OP no access. To allow user access, many sites use the UP macro to change tape unit ACLs to +,WARE. Unfortunately, an ACL of +,WARE allows any user to read or write any tape that happens to be mounted on the unit — an obvious security risk.

One way to keep tape units secure is to make users employ the MOUNT command, which asks the operator to mount a tape. After the operator mounts the tape and informs EXEC, EXEC changes the unit ACL to give the user exclusive access (username, WARE). The user retains exclusive access during the tape mount; then EXEC restores the old unit ACL.

You can restrict users who don't have Superuser to the MOUNT command by leaving tape unit ACLs as OP,WARE or making them null. Users won't be able to access the units directly, thus must rely on EXEC to allow them access. Thus, they must use the MOUNT command.

Default disk and diskette unit names — like tape unit names — are OP, WARE. For diskette units — like tape units — many sites use the UP macro to change the unit ACL to +,WARE.

The ACL of a disk or diskette unit remains in force only while there is no initialized LDU in the unit. After a disk has been initialized into the file system, the ACL assigned to the LDU with the Disk Formatter takes effect. The LDU is then treated like any directory; its ACL can be changed by an owner of the parent directory. To initialize, owner access to the LDU (set by the Formatter) is needed; so is write access to the parent directory and read access to the unit name(s) in directory :PER. (Setting ACLs with the Disk Formatter is described in Chapter 12.)

Before an LDU is initialized, it's vulnerable. Anyone at the system console or logged on with username OP can read from or write to it as a physical device (for example, DUMP/V@DPJ10 MYFILE !.) To prevent this, have all on-line disks initialized as soon as possible after starting AOS/VS, or leave disk power off, or change disk unit name ACLs in :PER to null.

ACLs of files shipped with AOS/VS are described in Chapter 16.

Generally, any standard CLI process with username OP can overcome any ACL. If you're concerned with file security, avoid leaving such a process running unattended. On the system console, run LOCK\_CLI (next).

After you've established the ACL standards that you want, the ACL mechanism works pretty well by itself. You don't need to change ACLs very often. But you do need to understand them.

## LOCK\_CLI

LOCK\_CLI is a lockable CLI that requires a password to unlock or terminate. It's designed to safeguard the system console from unauthorized people. It has two special commands, LOCK and UNLOCK. LOCK\_CLI comes up in the locked state. While locked, it executes only innocuous CLI commands, and ignores the following commands:

|         |              |         |              |
|---------|--------------|---------|--------------|
| BLOCK   | ENQUEUE      | MOVE    | RENAME       |
| BYE     | EXECUTE      | PROCESS | SUPERPROCESS |
| CHAIN   | INITIALIZE   | PROMPT  | SUPERUSER    |
| CONNECT | JPINITIALIZE | QBATCH  | TERMINATE    |
| COPY    | JPRELEASE    | QFTA    | XEQ          |
| DEBUG   | LOAD         | QPLOT   |              |
| DELETE  | LOCALITY     | QSUBMIT |              |
| DUMP    | MIRROR       | RELEASE |              |

This means that you cannot execute programs (including the LABEL program which labels tapes) from a locked LOCK\_CLI. LOCK\_CLI also ignores the process termination sequences CTRL-C CTRL-B, CTRL-C CTRL-E, and CTRL-D CTRL-D.

While locked, LOCK\_CLI allows printing (via QPRINT) of files on the root directory only. And, it ignores the /L= switch.

You can unlock LOCK\_CLI by typing UNLOCK *l* and password *l*; and you can lock it again via LOCK *l*.

For example, assume the password XYZZY:

```
) WHO l                                     (Check the process.)
PID 20 : OP OP :LOCK_CLI.PR                (It's LOCK_CLI.)

) SUPERUSER ON l                           (Try for Superuser.)
)   (No error, but no Superuser prompt.)
) F/AS :UPD:+ l                             (Try to check files in :UPD.)
WARNING: FILE ACCESS DENIED                (Not allowed.)

) BYE l                                     (Try to terminate LOCK_CLI.)
) WHO l                                     (Check again...)
PID: 20 OP OP :LOCK_CLI.PR                 (Still LOCK_CLI.)

) UNLOCK l                                 (Start to unlock.)
XYZZY l                                    (Type password, which doesn't echo.)

) SUPERUSER ON l                           (See if it's unlocked.)
*)  (Yes — it now has full CLI powers.)
LOCK l                                     (Lock it again.)
)   (LOCK l also turns off Superuser and
   Superprocess.)
```

You can type the password in either upper- or lowercase. LOCK\_CLI is shipped with a password, but this should be changed according to your application. Changing LOCK\_CLI's password is described in Chapter 16. Users should not know the password to LOCK\_CLI.

To execute LOCK\_CLI, simply type X :LOCK\_CLI *l*. To run it as a matter of course, edit the UP\_CLI macro. In this macro, change the line that says EXECUTE CLI to EXECUTE LOCK\_CLI. Then insert SUPERUSER ON before the EXECUTE line and insert SUPERUSER OFF after. The three lines should look like this:

```
SUPERUSER ON
EXECUTE LOCK_CLI
SUPERUSER OFF
```

Now LOCK\_CLI will run on the system console whenever you come UP.

LOCK\_CLI retains the username OP, so it can issue commands to EXEC while locked.

## Process Environment Display (PED)

PED, the Process Environment Display program, displays information about the active processes running on your system. It is designed for DASHER CRT display consoles, but will also run on hardcopy consoles.

There are many different ways to invoke PED. The easiest way is simply to type

`z ) PED ↓`

which invokes the supplied macro PED.CLI, and gives you a display that looks like Figure 9-1.

| PID | USERNAME | PROCESS | PROGRAM  | ELAPS | CPU BS  | SH7 | US7 | I/O  | FTA  | WSS |
|-----|----------|---------|----------|-------|---------|-----|-----|------|------|-----|
| 1   | PMGR     | PMGR    | PMGR     | 22/51 | 9:55    | 0   | 1   | 204  | 267  | 273 |
| 2   | OP       | OP      | CLI      | 22/51 | 34.14 B | 17  | 12  | 2795 | 1641 | 127 |
| 3   | OP       | EXEC    | EXEC     | 18/06 | 26.05 B | 1   | 28  | 3339 | 2213 | 284 |
| 4   | OP       | LPB     | XLPT     | 18/06 | 28.07 B | 4   | 4   | 5331 | 93   | 61  |
| 6   | OP       | 00011   | PED      | 2.00  | 0.09    | 20  | 86  | 0    | 76   | 83  |
| 9   | OP       | CON0    | LOCK_CLI | 13/10 | 0.65 B  | 17  | 3   | 114  | 252  | 112 |
| 12  | SALLY    | 00012   | SED      | 0:24  | 0.34    | 42  | 19  | 20   | 42   | 48  |
| 14  | JACK     | 00014   | F77      | 20.00 | 0.37    | 14  | 364 | 9    | 122  | 118 |
| 45  | BEN      | STREAM3 | CLI      | 12.01 | 0.81 B  | 18  | 2   | 38   | 85   | 55  |

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*Figure 9-1. Sample PED Display*

By default, PED displays only active processes. In the example, the master CLI process (PID 2) is running EXEC, EXEC's cooperative XLPT process, PED, and LOCK\_CLI. User Sally is running the SED text editor, Jack is compiling a FORTRAN 77 program, and Ben is using batch.

PED column heads have the following meanings.

|          |                                                                                                                                                                          |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PID      | is the process ID;                                                                                                                                                       |
| USERNAME | is the username, first eight characters only;                                                                                                                            |
| PROCESS  | is the system name for the program process; you can assign this by including /NAME= in the PROCESS command. Only the first eight characters are displayed.               |
| PROGRAM  | is the program filename (first 10 characters);                                                                                                                           |
| ELAPS    | is the amount of time the process has existed. Abbreviations are defined next.                                                                                           |
| CPU      | is the amount of CPU time used.                                                                                                                                          |
| BS       | means blocked, swapped to disk, neither (2 spaces), or both;                                                                                                             |
| SH7      | is the number of shared pages in ring 7 (the default ring for user processes);                                                                                           |
| US7      | is the number of unshared pages in ring 7;                                                                                                                               |
| I/O      | is the number of 512-byte disk blocks transferred via the data channel;                                                                                                  |
| FTA      | is the number of pages that had to be read from disk because they weren't in virtual memory (page faults). Page faults are an important indicator of program efficiency; |
| WSS      | is the number of pages in the process' <i>working set</i> of pages in main memory.                                                                                       |

By default, PED displays only those processes that have changed since the last screen update. The default screen cycle period is 10 seconds, but you can change this with runtime commands or the /CYCLE= switch; the minimum is 1 second. Or, you can update the display by striking any key other than a PED command key. The /ALL switch tells PED to display all processes, but in many systems all the PIDs won't fit on a screen.

The default PED display is useful in many situations. You can get a different display by using switches when you execute PED. While in a PED session, you can dynamically change the PED screen's display by pressing M (menu) and selecting different statistics for display. You can also issue runtime commands to PED.

PED is a HELP topic; any user can get help by typing `HELP *PED`.

## PED Switches

There are two types of PED switches: those that select process statistics for display, and those that set PED parameters. If you select statistics (e.g., /FTP), PED will display only those you select. The parameter group includes /ALL, /CYCLE=, /LISTFILE= and /MINPID=. If you use parameter switch(es), and no statistics switches, PED will display all statistics shown above.

You can abbreviate all switches to the shortest unique form. PED ignores ambiguous abbreviations and nonexistent switches.

The switch order is unimportant: PED always displays columns in a specific order, regardless of your switch sequence.

### Switch

### What it Displays or Does

|            |                                                                                                                                                           |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| /ALL       | All PIDs; the default is active PIDs. On a CRT, active PIDs are bright, others are dim.                                                                   |
| /BS        | Blocked and swapped status.                                                                                                                               |
| /CLASSID   | Class ID for each process. The column header is CID.                                                                                                      |
| /CLASSNAME | Classname for each process. Classnames are created via the optional Class Assignment and Scheduling Package (CLASP).                                      |
| /CPU       | CPU time used (total).                                                                                                                                    |
| /CPUS      | Milliseconds of CPU used per second. Each unit is 0.1% of the total CPU time. For example, 500 means 50% of the total CPU time. The column header is CPS. |
| /CYCLE=n   | Sets a cycle time of n seconds between updates.                                                                                                           |
| /ELAPSED   | Process' elapsed time.                                                                                                                                    |
| /FATHER    | Father process ID, under head FP.                                                                                                                         |
| /FLAGn     | Flag word n, where n is 1 through 5 (the flag words contain process parameters, described under ?PSTAT in the <i>AOS/VS Programmer's Manual</i> ).        |
| /FTA       | Page faults, sum of logical and physical.                                                                                                                 |
| /FTAS      | Page faults, sum of logical and physical, per second.                                                                                                     |
| /FTL       | Page faults, logical.                                                                                                                                     |
| /FTLS      | Page faults, logical, per second.                                                                                                                         |
| /FTP       | Page faults, physical.                                                                                                                                    |
| /FTPS      | Page faults, physical, per second;                                                                                                                        |
| /IO        | I/O blocks (number of 512-byte blocks transferred to disk or tape).                                                                                       |
| /IOS       | I/O blocks per second.                                                                                                                                    |
| /IREC      | Number of process' tasks that are waiting for an IPC message (are waiting on an ?IREC system call). The column header is IR.                              |

|                           |                                                                                                                                                                                                                                                                                                                            |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| /LISTFILE[= <i>path</i> ] | This sends PED output to file named in <i>path</i> ; or, if you omit = <i>path</i> , to current generic @LIST file. PED uses /ALL for the first write to the file, then it writes the specified or default display at each cycle period. PED ignores runtime commands when you use this switch. Use CTRL-C CTRL-B to exit. |
| /MINPID= <i>n</i>         | This displays only those PIDs equal to or greater than <i>n</i> . Runtime commands can change this.                                                                                                                                                                                                                        |
| /MPROCESS                 | Mother process status only. The column header is MP. Y means yes.                                                                                                                                                                                                                                                          |
| /PAGESECONDS              | Page-seconds: the integral of (pages-used * CPU-secs-used). The column head is PGSEC.                                                                                                                                                                                                                                      |
| /PID                      | Process' ID.                                                                                                                                                                                                                                                                                                               |
| /PIDSIZE                  | Process' PID-size type: A, B, or C. The column header is PSZ.                                                                                                                                                                                                                                                              |
| /PLOCALITY                | Process' program locality. The column header is PL.                                                                                                                                                                                                                                                                        |
| /PNQ                      | Process' priority queue factor (indicates its priority relative to other processes of the same type).                                                                                                                                                                                                                      |
| /PRIORITY                 | Process' priority, under column head P.                                                                                                                                                                                                                                                                                    |
| /PRIVBITS                 | Process' privilege word (?PPRV, in <i>AOS/VS Programmer's Manual</i> ), under head PRIVS.                                                                                                                                                                                                                                  |
| /PROCESS                  | Process' name.                                                                                                                                                                                                                                                                                                             |
| /PROGRAM                  | Program name.                                                                                                                                                                                                                                                                                                              |
| /PSW                      | Process' status word (?PSTAT, in <i>AOS/VS Programmer's Manual</i> ), under head PSW.                                                                                                                                                                                                                                      |
| /SH                       | Shared pages in rings 3-7 (cumulative).                                                                                                                                                                                                                                                                                    |
| /SH <i>n</i>              | Shared pages in ring <i>n</i> . <i>n</i> can be an integer 3 through 7. The default displays ring 7 only.                                                                                                                                                                                                                  |
| /SUBSLICES                | Number of subslices in time slice (see glossary); under column head SL.                                                                                                                                                                                                                                                    |
| /SUPERMODE                | Superprocess and Superuser <i>status</i> in CLI prompt format (+ means Superprocess, * means Superuser, # means both). The column header is M.                                                                                                                                                                             |
| /SUPERPRIVILEGES          | Superprocess and Superuser <i>privileges</i> in CLI prompt format; column header is P.                                                                                                                                                                                                                                     |
| /SYSMGR                   | System Manager privilege. The column header is S. Y means yes.                                                                                                                                                                                                                                                             |
| /TSE                      | Time slice exponent, header is E, see /SUBSLICES.                                                                                                                                                                                                                                                                          |
| /ULOCALITY                | Process' current user locality. The column header is UL.                                                                                                                                                                                                                                                                   |
| /US                       | Unshared pages in rings 3-7 (cumulative).                                                                                                                                                                                                                                                                                  |
| /US <i>n</i>              | Unshared pages in ring <i>n</i> , range 3 through 7. The default displays ring 7 only.                                                                                                                                                                                                                                     |
| /USERNAME                 | Username.                                                                                                                                                                                                                                                                                                                  |
| /WSS                      | Working set size, current.                                                                                                                                                                                                                                                                                                 |
| /WSSMAX                   | Working set size, maximum, as given (or defaulted) in user profile.                                                                                                                                                                                                                                                        |
| /WSSMIN                   | Working set size, minimum, as given (or defaulted) in user profile.                                                                                                                                                                                                                                                        |

Invoking PED with no arguments is equivalent to

```
) PED /CYCLE=10 /PID /USER /PROCESS /PROGRAM /ELAPSED& )
&) /CPU /BS /SH7 /US7 /IO /FTA /WSS )
```

## PED Menu

The PED Menu allows you to select different statistics for display. Pressing M during a PED session displays the PED Menu. Figure 9-2 shows the PED Menu.

```

Cursor positioning chars:      U - up      D - down  L - left  R - right
Switch selection  chars:      Y - yes     N - no     S - default switches
Misc:      space - refresh screen      BREAK/ESC - exit this menu

```

---

|    |          |   |    |          |    |          |          |        |          |
|----|----------|---|----|----------|----|----------|----------|--------|----------|
| 1  | BS       | Y | 15 | FTL      | 29 | PRIORITY | 43       | SYSMGR |          |
| 2  | CLASS ID |   | 16 | FTLS     | 30 | PRIVBITS | 44       | TSE    |          |
| 3  | CLASSNAM |   | 17 | FTP      | 31 | PROCESS  | Y        | 45     | ULOCAL   |
| 4  | CPU      | Y | 18 | FTPS     | 32 | PROGRAM  | Y        | 46     | US       |
| 5  | CPUS     |   | 19 | IO       | Y  | 33       | PSW      | 47     | US3      |
| 6  | ELAPSED  | Y | 20 | IOS      |    | 34       | SH       | 48     | US4      |
| 7  | FATHER   |   | 21 | IREC     |    | 35       | SH3      | 49     | US5      |
| 8  | FLAG1    |   | 22 | MAXBLOCK |    | 36       | SH4      | 50     | US6      |
| 9  | FLAG2    |   | 23 | MPROCESS |    | 37       | SH5      | 51     | US7      |
| 10 | FLAG3    |   | 24 | PAGESEC  |    | 38       | SH6      | 52     | USERNAME |
| 11 | FLAG4    |   | 25 | PID      | Y  | 39       | SH7      | Y      | 53       |
| 12 | FLAG5    |   | 26 | PID SIZE |    | 40       | SUBSLICE |        | 54       |
| 13 | FTA      | Y | 27 | PLOCAL   |    | 41       | SUPRMODE |        | 55       |
| 14 | FTAS     |   | 28 | PNQ      |    | 42       | SUPPRIVG |        | WSS      |
|    |          |   |    |          |    |          |          |        | WSSMAX   |
|    |          |   |    |          |    |          |          |        | WSSMIN   |

Width is 78

Figure 9-2. The PED Menu

When you first see the PED Menu, the default PED switches, or those you selected when you executed PED, have a Y displayed. At the bottom of the menu the total width of the PED columns, 78, appears. The first line of the menu shows the keys to press to move the cursor around the menu. Move the cursor to the item you want to change or select. Then, press N if you don't want to display an item already displayed, or Y to select an item.

At all times, the menu keeps a running tally of the total width. Since PED cannot display more than 80 characters, the PED Menu won't let you leave the menu if the total width is more than 80 characters. Delete items until the total falls to 80 or less, and press BREAK/ESC to exit from the menu and return to the PED screen, which will show the items you just selected.

After you have experimented with the PED Menu, you may want to write a macro selecting the switches corresponding to the column headings you're interested in. This will save time in the future.



## PED Commands

You can type any of the following commands to PED while it is running.

| Command     | What it Does                                                                                      |
|-------------|---------------------------------------------------------------------------------------------------|
| A           | Changes /ALL to active PIDs, then active to /ALL, and so on.                                      |
| B           | BYE; returns to the CLI.                                                                          |
| E           | Exit; returns to the CLI.                                                                         |
| H           | Gives help.                                                                                       |
| M           | Displays PED Menu.                                                                                |
| Q           | Quits; return to the CLI.                                                                         |
| R           | Refreshes the screen; useful after the screen has been changed by a message sent by another user. |
| CTRL-S      | Freezes display; works as with any program.                                                       |
| CTRL-Q      | Unfreezes display; works as with any program.                                                     |
| ^ (SHIFT-6) | Increases Minpid minimum PID number by 5.                                                         |
| V (V key)   | Decreases Minpid by 5.                                                                            |
| <           | Decreases PED cycle time by 1 second.                                                             |
| =           | Resets PED cycle time to 10 seconds.                                                              |
| >           | Increases PED screen cycle time by 1 second.                                                      |

The B, E, or Q command leaves PED. Unless you use the /LISTFILE switch, avoid exiting with CTRL-C CTRL-B (or else you will need to type CHAR/RESET ↵ to restore your console's screen characteristics).

## PED Abbreviations

For compact display, PED uses the following abbreviations:

|       |                                                                            |
|-------|----------------------------------------------------------------------------|
| dd-hh | for days-hours. For example, 4-03 means 4 days and 3 hours.                |
| hh/mm | for hours-minutes. For example, 3/27 means 3 hours, 27 minutes.            |
| mm:ss | for minutes:seconds. For example, 27:03 means 27 minutes, 3 seconds.       |
| ss.nn | for seconds.fractional seconds. For example, 3.50 means 3 and 1/2 seconds. |

If a PID has run for more than 99 days and 23 hours (99-23), PED displays its time as \*\*\*\*\*.

If a number will not fit in its field, PED divides it by thousand (integer division) and appends K to it. If it won't fit when divided by a thousand, PED divides it by a million and appends M to it.

For example, in a five-character field,

|       |                                          |
|-------|------------------------------------------|
| 65899 | means 65,899.                            |
| 199K  | means between 199,000 and 200,000.       |
| 2100K | means between 2,100,000 and 2,100,999.   |
| 12M   | means between 12,000,000 and 13,000,000. |

Many of PED's features are designed to help programmers streamline and speed up their programs. But in its general form, PED can give anyone either an overview or very specific information. PED is a great program — you'll find it increasingly useful as the number and complexity of the processes on your system grows.

For *general* system operations, you may tend to use the ?.CLI macro and RUNTIME command more than PED. But for system and program analysis, PED is an invaluable tool.

## PED Examples

```
) PED ↓
... (display) ...

B

) PED / CYCLE=60 / L=PED_LISTING_FILE ↓
CTRL-C  CTRL-B
*ABORT*
*CONSOLE INTERRUPT*
) TYPE  PED_LISTING_FILE ↓
...

) PED / ALL / MINPID=5 ↓
... (Display) ...

V
...
V
...
V
...

B

) PED / PID / USER / WSS / CPU / CPUS ↓
... (Display) ...
...
A
...
A
...
B

)
```

## DISPLAY and File Comparison Utilities

The DISPLAY program can read any binary, ASCII or EBCDIC file — on tape or disk — and display it or write it to a listing file. DISPLAY is useful when you want to read a tape file without loading it; or when you want to see what an EBCDIC file looks like in ASCII; or when you want to see everything (including nonprinting characters) that a program wrote to a disk file. For example:

```
) XEQ DISPLAY @MTB0:0 )
) X DISPLAY MYPROG.PR )
*) X DISPLAY :SYSLOG )
) X DISPLAY /L=REAL_OUTPUT_FILE OUTPUT_FILE )
```

DISPLAY is a help topic. Anyone can get help on it by typing `HELP *DISPLAY`.

FILCOM and SCOM are file-comparison utilities. FILCOM compares binary files; SCOM compares ASCII text files. These programs can be helpful when you want to see if two files differ, or how they differ. For example, if you have two revisions of a program and want to see if they differ, you'd use SCOM for the source file or FILCOM for the program file. For example

```
) DIR NEW_PROGS )
) XEQ FILCOM MPROG_1.PR MPROG_2.PR )
... (Listing to console) ...
) XEQ SCOM /L=@LPT MPROG_1.SR MPROG_2.SR )
... (Listing to line printer) ...
)
```

The CLI manual gives a little more information on FILCOM and SCOM.

## Event Logging with SYSLOG, the Error Log, and REPORT

SYSLOG, the system log function, records user information in file SYSLOG. It also records hardware errors in the system *error* log, ERROR\_LOG. The REPORT program can produce reports from either log — even while the log file is open and logging is occurring.

While on, the system log records

- user account-related information, as gathered by AOS/VS and EXEC;
- XODIAC network information, as gathered by networking software and AOS/VS.

If you select full-detail logging, the log also records file access information, as gathered by AOS/VS and EXEC, to help you monitor the level of system security.

People and programs can write additional information to the system log file several ways:

- with the CLI command LOGEVENT. Any superuser can write messages into the log file with the LOGEVENT command;
- with the assembly language system call ?LOGEV (Superuser mode required, described in the *System Call Dictionary (AOS/VS and AOS/DVS)*).

Device error information, like entries for hard disk errors or ERCC memory errors, is *not* recorded in the system log file. Device errors are recorded in the error log file (pathname :ERROR\_LOG). Error logging is always on (you cannot turn it off) to make sure error records will be available if needed. The error log includes information on hardware errors and AOS/VS errors like hangs or panics. You can rename the error file (which starts a fresh error log file), using a SYSLOG switch.

## Other Log Functions

There are a number of other logging functions in MV/Family software. They include

- The SCP log. On computers that have an SCP CPU, the SCP-OS always logs certain kinds of hardware errors (all MV/Family computers except the 4000-series have an SCP CPU). The SCP log file is on diskette for MV/8000 systems; it is retained in SCP memory for other systems. Some — but not all — material from the SCP log is written into file ERROR\_LOG. Generally, the AOS/VS error log will tell you what you need to know; you don't need the SCP log unless you're having problems. Reading the SCP log is described in Chapter 11.
- EXEC's log. EXEC has its own logging feature, described in Chapter 8. EXEC always writes user-relevant information to SYSLOG; so, in terms of user logging, you don't need EXEC's log if you use SYSLOG.
- The Common Logger. This is relevant if your system runs DG's INFOS II file management system. The Common Logger records database-backup information on tape. It has no relation to SYSLOG.
- XODIAC network logging. This is relevant if your system runs DG's XODIAC network system. Via CONTROL commands, you can direct networking processes like X.25 and LMGR (Link manager) to log network events. Each XODIAC log file is separate from SYSLOG; it is usually in directory :NET. SYSLOG records some — but not all — of the network events recorded in the XODIAC log file(s).
- Communications product logging. This is relevant if your system runs an IBM emulator like DG/SNA. These products have logging features similar to those of XODIAC; and SYSLOG records *some* of their events.

The system log is useful because it records user and user account information. The error log can be *very* useful to DG diagnostic personnel, since it continuously records hardware errors.

## Starting and Stopping Logging

The current system log file is always called SYSLOG and is located in the root directory. You start, stop, and rename this log file with the CLI command SYSLOG.

The current error log file is named ERROR\_LOG, also in the root directory. Error logging occurs automatically — and you can use the SYSLOG command to rename the old error log file and start a new error log.

SYSLOG is the CLI command to control logging. If you type SYSLOG alone, without arguments or switches, it tells you the status of system logging: *OFF* if system logging is off and *ON* if system logging is on. (Error logging is always on.)

SYSLOG is a privileged command; only the master CLI, PID 2, can issue it. The SYSLOG command has the following variations.

$$\text{SYSLOG} \left\{ \begin{array}{l} \left[ \begin{array}{l} \text{/START} \quad \left[ \begin{array}{l} \text{/DETAIL=MINIMAL} \\ \text{/DETAIL=FULL} \end{array} \right] \end{array} \right] \quad [\text{filename-for-old-syslog}] \\ \text{/STOP} \\ \text{filename-for-old-syslog} \\ \text{/RENAMEERROR filename-for-old-errorlog} \\ \text{/NOSOFTTAPEERRORS} \\ \text{/SOFTTAPEERRORS} \end{array} \right\}$$

where

/START

starts recording in the system log (:SYSLOG). If file :SYSLOG doesn't exist, the system creates it. If it does exist, and you omit the *filename-for-old-syslog*, the system appends to it. If you include the *filename-for-old-syslog*, the system renames the old system log file to the new name, then starts logging in a fresh file named :SYSLOG.

/DETAIL=MINIMAL  
/DETAIL=FULL

tells the system how much detail to write to the log file. The default, MINIMAL, includes most user account information except for file access. Minimal logging includes console connect time, CPU time, I/O blocks, pages printed, and other things. With detail set to minimal, if the LDU that holds the log file fills up, logging will stop.

A detail setting of FULL includes all account information above, plus user access (audit trail) information. This setting records events that may relate to system security, as follows:

- all file access attempts (successful or unsuccessful);
- all file ACL changes;
- all file renames or deletes;
- all process creations (with process privileges), process terminations, and ring loads (?RINGLD system calls);
- all attempts to turn Superuser and Superprocess on or off.
- an error code, if an error occurred on the event. If no error occurred, the user's call succeeded.

Be aware that all this information will make file SYSLOG grow quite rapidly. And, with detail set to FULL, the system tries to continue logging at all costs: if the LDU that holds the log file fills up, the system won't disable logging; it will panic. See "Disk Space Cautions" later in this chapter.

To change detail from full to minimal, use SYSLOG with the /DETAIL=MINIMAL switch.

|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>/STOP</code>                     | stops recording in the system log file. (Error logging continues.) Shutting down AOS/VS automatically stops recording in the system log file, so you don't need to use this switch before shutting down.                                                                                                                                                                                                                                                                                                                                                                                   |
| <code>filename-for-old-syslog</code>   | is the new name you want for the existing system log file. The system renames file <code>:SYSLOG</code> to this name.                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <code>/RENAMEERROR</code>              | renames the error log file, <code>ERROR_LOG</code> , to <code>filename-for-old-errorlog</code> . The system starts recording hardware errors in a new, fresh <code>ERROR_LOG</code> . This is useful when you want to dump and/or delete an error log file.                                                                                                                                                                                                                                                                                                                                |
| <code>filename-for-old-errorlog</code> | tells the system to rename the old error log file to this name, and start recording errors in a new, fresh <code>ERROR_LOG</code> file. Renaming the error log is useful when you want to dump and/or delete old error information.                                                                                                                                                                                                                                                                                                                                                        |
| <code>/NOSOFTTAPEERRORS</code>         | tells the system <i>not</i> to record soft tape errors in the error log file. A soft tape error is an I/O inconsistency that disappeared in fewer than 13 retries. (If it persisted for more than 13 retries, it would be a hard error.) By default, soft tape errors are logged in the error log file. However, certain brands of mag tapes can produce many soft error messages — growing the log file rapidly and slowing response.<br><br>To disable soft tape error logging in the error log file, include this switch. You can use this switch, or the next one, at will from PID 2. |
| <code>/SOFTTAPEERRORS</code>           | tells the system <i>to</i> record soft tape errors in the error log file. This switch is useful if you want to record soft errors and the current VSGEN system was generated with soft tape error reporting suppressed. (See <code>/NOSOFTTAPEERRORS</code> above for more information.)                                                                                                                                                                                                                                                                                                   |

## Log File Pointers and Suggestions

Generally, logging is useful for the following reasons.

- It can track the amount of system resources used by each user. This is useful for billing — or other user monitoring situations — in a timesharing system.
- It can record file accesses and use of special privileges and processes — events that may affect system security. This can be critically important on a system used to maintain sensitive or classified databases and programs.
- It records hardware errors. This happens automatically.
- With detailed logging, you may lose information if you stop or start logging while the system is active.

If you are concerned with security, do not stop or start the system log while the multiuser environment is active. Avoid using the `SYSLOG` command with the `/DETAIL=switch`, which implicitly stops, then starts logging. If you do start logging while the multiuser environment is up, `SYSLOG` cannot *get* information you need. For example, any processes that are running when logging starts will have only PID number (not username) data available for reports. Also, any files that are open when logging starts will have only PID and channel number (not pathname) data available.

For detailed logging, we suggest that you start the system log immediately after the master CLI comes up, before EXEC or any other process. (The UP macro is a good place from which to start logging.)

If you do need to stop logging or rename the log file via `SYSLOG/START` pathname (perhaps because disk space is low), we recommend shutting down every process except the master CLI (PID 2) before doing so. This will limit the processes recorded without a username to PID 1 and 2 (PMGR and master CLI), and these processes' usernames (PMGR and OP) are easy to identify in reports.

If you must stop logging while the multiuser environment is active, use PED (`PED/ALL/L=path`; then wait 10 seconds and press CTRL-C CTRL-B) to record the PIDs and usernames on the system. The list PED produces will help you match usernames to PIDs on reports you may generate later on from the new log file.

To be most useful, logging should be consistent. And, log records for at least the last 12 months should be available. Because system logs — especially those with detail set to full — grow so rapidly, you need a procedure for naming, archiving, and deleting them.

The current log pathnames are always `SYSLOG` and `ERROR_LOG`. One way to identify old logs is to rename the current one to a name that indicates the date it was started. You might do this every week or oftener for the `SYSLOG` file, which grows rapidly, and every month or so for the error log file, which grows slowly. This way, the filename will show the end of the logging period covered by the file. For the date, you could use the form

`ddmmmyy`

where `ddmmmyy` is the date on which the preceding logfile was started; for example, `30MAY86`. This identifies each log clearly and uniquely. For more clarity, you can add the suffix `.LOG` or `LOG.ERROR` to the filename.

You can rename an old log file (starting a new log file) at any time. Commands to rename have the form

`SYSLOG/START [other-switches] name-for-old-logfile`

`SYSLOG/RENAMEERROR name-for-old-errorfile`

For example, a sequence might go

*AOS/VS CLI REV date time*

) DATE ↓

30-NOV-...

) SYSLOG/START 29NOV.LOG ↓

) SYSLOG/RENAMEERROR 29NOV.LOG.ERROR ↓

) SUPERUSER ON ↓

\*) LOGEVENT Running new rev ↓

\*) UP ↓

... (System runs through the day) ...

\*) DOWN ↓

\*) BYE ↓

*SYSTEM SHUTDOWN*

*SCP-CLI> BOOT 24 ↓*

...

*AOS/VS CLI REV ....*

) DATE ↓

02-DEC-...

) SYSLOG/START 02DEC.LOG ↓

) SYSLOG/RENAMEERROR 02DEC.LOG.ERROR ↓

) UP ↓

...

(Bring up AOS/VS system.)

(Check date.)

(It's 30 November.)

(Rename old system log file to previous date and start new system log file (SYSLOG).)

(Rename old error log file to previous date and start new error log file (ERROR\_LOG).)

(Turn on Superuser.)

(Log an event in system log.)

(Bring up multiuser environment.)

(Bring it down.)

(Bring it up.)

(Check date.)

(Rename system log and start new one.)

(Rename error log and start new one.)

(Once more with feeling...!)

There are several different approaches to this. An easy way is to start fresh logs each time a system is brought up — by commands like those shown above. But you can't *always* start fresh logs at startup, since bringing up the system twice on the same day would mean renaming logs to existing names. Ideally, you'd rename the logs only if they weren't started today. A macro to do this is shown in Figure 9-3. This macro starts the system log, and renames both logs to filenames that show the date they were started *if* logs weren't renamed today. If disk space is an issue — and with full-detail logging it usually is — you might also use the CHECK\_SPACE macro, which is designed to warn you when disk space is low. See "Disk Space Cautions," later in this chapter.



## Text of SYSLOG\_UP.CLI Macro

```
[!equal,%0%,/H]
    write This macro starts the system log with a SYSLOG command that
    write renames the old system and error log files to the date they
    write were started. Then it moves the old system log and error
    write files into directory :LOGS. If the old :SYSLOG was started
    write today the macro starts :SYSLOG and doesn't rename the error
    write log -- appending new information to the existing :SYSLOG and
    write :ERRORLOG instead of renaming and moving them. You could
    write name this macro SYSLOG_UP.CLI and call it from the UP macro.
    write Before the macro will work, someone must:
    write ,, 1. Create it in the root directory.
    write ,, 2. Create macro MAKE_DATE.CLI in the root directory.
    write ,, 3. Create directory :LOGS -- e.g., via CREATE/DIR :LOGS
    write After these steps have been done, the macro will do log
    write housekeeping simply via the command ,, SYSLOG_UP. It takes
    write no arguments but the /H switch produces this help message.
[!else]
    push
    superuser on
    dir :
    string [MAKE_DATE [!explode [!date]]].LOG
    [!nequal,([!filenames LAST_LOG_DATE]).()]
    comment For security, use /DETAIL=FULL. Add this switch to the
    comment two syslog command lines.
    push
    string [LAST_LOG_DATE]
    comment If today's date differs from the date stored in file
    comment LAST_LOG_DATE, rename the log files and move them.
    [!nequal,[!string/p],[!string]]
        syslog/start/1=warning/2=warning [!string]
        syslog/renameerror [!string].ERROR
        acl [!string] OP,OWARE +,RE
        write Moving log files [!string] and [!string].ERROR to :LOGS
        move LOGS [!string] [!string].ERROR
        delete [!string] [!string].ERROR
    [!else]
        comment SYSLOG was started today -- just start logging.
        syslog/start
    [!end]
    pop
[!else]
    write File ,, LAST_LOG_DATE ,, doesn't exist. I will create it.
    write Please rerun this macro by typing %0% after it stops.
[!end]

comment Update -- or create -- the LAST_LOG_DATE file.
delete/2=ignore LAST_LOG_DATE
string/1=LAST_LOG_DATE
acl LAST_LOG_DATE +,R
pop
[!end]

Text of MAKE_DATE.CLI

%1%%2%%4%%5%%6%%8%%9%&
```

Figure 9-3. Example SYSLOG\_UP and Companion Macros

Assume you run the SYSLOG\_UP macro shown in Figure 9-3 on 27 November 1986 (after following setup instructions in the macro). The log pathnames will remain

:SYSLOG (For system log)  
:ERROR\_LOG (For error log)

Then, on 28 November, you run the macro again. Since the dates differ, the macro renames the logs and moves them to directory :LOGS. The current log filenames remain (as always) SYSLOG and ERROR\_LOG. The logs with records from yesterday to today have the pathnames

:LOGS:28NOV86.LOG (system log)  
:LOGS:28NOV86.LOG.ERROR (error log)

Later on, at reasonable intervals, you can dump and delete log files in directory :LOGS. If desired, before deleting them, you can create reports (using the REPORT program), then print and delete the report files. The REPORT step depends on whether standard reports (which can be done as a matter of routine) will satisfy your needs.

In any case, if you need a report on a given period, you can always reload the dump file that holds the desired logs, and then run REPORT on these files.

## Disk Space Cautions

As mentioned earlier, log files can grow to consume a large amount of disk space. This is most critical with full-detail logging. If you start logging with detail set to full, AOS/VS will panic if the log file grows to the point where it runs out of disk space.

The next two sections suggest a way to avoid running out of disk space. The first section shows how to put the system log file in its own directory, ideally on its own LDU. The second section shows how to use the CHECK\_SPACE macro, which monitors disk space, and warns you when space becomes crucial.

Whatever the degree of logging (minimal or full), and even if you devote a whole LDU to the log file, you need to monitor disk space carefully. Periods of intense activity (like heavy interactive use and backup) make the log file grow rapidly.

The space-warning threshold should leave space for report generation. Then, if disk space reaches the warning point, space will remain for a report. After the warning, the operator can rename the log (starting a new one), generate a report from the old log, then print the report, and dump and delete the log. (The SYSLOG\_UP macro shows a way to rename the old log and start a new one automatically. The CHECK\_SPACE macro can warn of low disk space.)

### Using a Specific Log Directory

With system logging — especially with detailed logging — you should put the log file in its own directory, ideally a separate LDU. This will minimize file creations and deletions in the root directory — minimizing file fragmentation and I/O to the system disk.

Logging occurs to file :SYSLOG on the master LDU — but :SYSLOG can be a link file to a log file in another directory, in the master LDU or another LDU. For example, suppose you have an LDU called LOGS (formatted with that name by the Disk Formatter). In the root of the master LDU, you create a link to SYSLOG on the log LDU:

\*) CREATE /LINK :SYSLOG :LOGS:SYSLOG )

Your UP macro can initialize the LDU. After initializing, the UP macro must conditionally create a file of type LOG on the LDU; then it should assign a null ACL to file SYSLOG. (If the SYSLOG file is not type LOG, the system will conclude it's not a real log file; it will then delete the link and create a SYSLOG file in the root. Creating a file of type LOG is easy via the CREATE command and /TYPE= switch.)

A sample command sequence for the UP macro (using the LDU name LOGS) is

```
...
INITIALIZE disk-unit
[!EQUAL,[!PATHNAME LOGS:SYSLOG],]
CREATE/TYPE=LOG LOGS:SYSLOG
ACL/K LOGS:SYSLOG
[!END]
SYSLOG_UP ...
...
```

Then, logging will occur to file SYSLOG in the LOGS directory. Giving the log file a null ACL prevents access to it by unauthorized users.

The log directory should have ample disk space: at least four times the space you expect the log file ever to consume. This space is a safety factor for log file growth and allows you to generate reports in the log directory. Also, you may want to load old log files here and create reports from them — to check user or file access history.

(By the way, it's not possible or necessary to put the error log in its own directory. It's not possible because the error file, ERROR\_LOG, is started before the master CLI starts, which makes it impossible to initialize an LDU for it. And it's not necessary to put the error log in its own directory because error logs don't take up much disk space. If you want to, you *can* create a link named :ERROR\_LOG to another directory on the master LDU.)

If you decide on a nondefault logging directory, and want to use the SYSLOG\_UP macro shown in Figure 9-3, you'll have to edit the macro to fit your own arrangement. For example, edit the macro if you want to specify full-detail logging or if your logging directory has a name other than LOGS.

Another macro you might want to include in your UP macro — after starting SYSLOG but before executing LOCK\_CLI — is the space-checking macro shown in the next section.

### Checking Disk Space

The macro shown in Figure 9-4 is designed to warn you when disk space is low. The macro runs, checks space, pauses for 30 minutes, runs again, and continues this cycle until you terminate it. If the amount of disk space remaining in the log directory *or* its parent directory shrinks to less than 5,000 blocks (about 2,500,000 bytes), the macro sends warning messages to the system console, PID 2.

The name of this macro is CHECK\_SPACE\_CLI. You may want to run it as a matter of course if you use detailed logging. The CLI that runs it needs Superuser privilege (to find SYSLOG's pathname). You must change a specified character as described in the macro (type CHECK\_SPACE :) before it will work.

The best way to use the macro is to create a subordinate CLI from PID 2, and have this CLI run the macro. You could do this in the UP macro, before UP executes LOCK\_CLI. Use a command line like this:

```
PROCESS/NAME=CHECK_SPACE/INPUT=@NULL/OUTPUT=@NULL/DEF &
:CLI CHECK_SPACE_CLI
```

The new, space-checking CLI will run the macro every 30 minutes (or a different period if you want to change the PAUSE line near the macro's end). You can check or terminate the subordinate CLI by PID number or by the process name CHECK\_SPACE from the master CLI or any superprocess; for example

```
) RUNTIME CHECK_SPACE )
ELAPSED: 22:10 ...
) SUPERPROCESS ON )
+) TERMINATE CHECK_SPACE )
+)
```

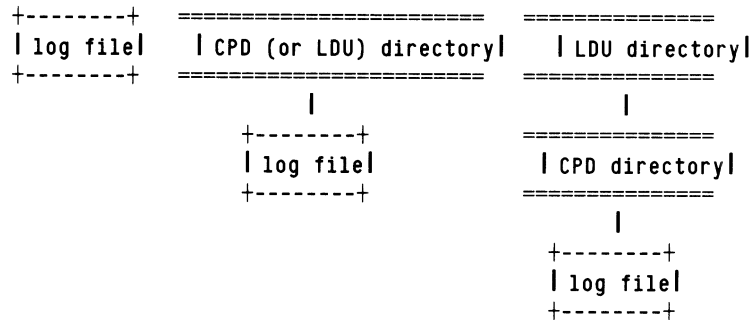
If you decide to have a CLI run CHECK\_SPACE from your UP macro, you might also chose to terminate this CLI from your DOWN macro.

The macro expects one of the following directory structures:

- : SYSLOG-logfile
- : control-point-directory : SYSLOG-logfile
- : ldu-directory : control-point-directory : SYSLOG-logfile

It will run with some other arrangements, but we suggest one of those above.

```
[!EQUAL,1,2]
[!equal,comment,] This macro checks the amount of space left for log file
SYSLOG. It requires the log file to be in a control point directory, on
the master LDU or other LDU, in one of the following directory arrangements.
```



To run this macro, a CLI process needs Superuser privilege. It also needs E access to the log directory and its parent directory (if any).

On startup, if this is the first check, set up needed files to be used while the macro runs. Use VAR9 as an indicator: a VAR9 value of 99999 means the CHECK\_SPACE files are ready. [!end]

```
[!nequal [!var9],99999]
  permanence/2=ignore :UDD:[!username]:??CHECK_DIR off
  delete/2=ignore :UDD:[!username]:??CHECK_DIR
  create/max=100 :UDD:[!username]:??CHECK_DIR
  permanence :UDD:[!username]:??CHECK_DIR on
  write/1=:UDD:[!user]:??CHECK_DIR:ARG2.CLI [!ascii 045]2[!ascii 045][!ascii 046]
  write/1=:UDD:[!user]:??CHECK_DIR:ARG6.CLI [!ascii 045]6[!ascii 045][!ascii 046]
  [!equal,comment,] Set VAR0 to danger threshold of disk space. Original
                    figure is 5,000 blocks for a check each 30 minutes.[!end]
  var0 5000
  [!equal,comment,] Turn Superuser on to check the pathname and type of
                    the log file. Then turn it off. [!end]
  superuser on
  pathname/2=abort/1=:udd:[!username]:??CHECK_DIR:??CHECK_SPACE_PATH.TMP :SYSLOG
  files/nh/type/1=:UDD:[!username]:??CHECK_DIR:??CHECK_SPACE.TMP :SYSLOG
  superuser off
  string [:UDD:[!username]:??CHECK_DIR:??CHECK_SPACE.TMP]
  string [:UDD:[!username]:??CHECK_DIR:ARG2 [!string]]
  [!equal,comment,] The string has the SYSLOG file type, LNK or LOG. Use
                    VAR8 value of 88888 to signify LNK. [!end]
  [!equal [!string],LNK]
    VAR8 88888
  [!end]

  [!equal,comment,] Set variable VAR9 to show that setup is done. [!end]
  var9 99999
[!end]
```

Figure 9-4. CHECK\_SPACE Macro to Check Disk Space Periodically (continues)

```

[!equal,comment,] Ready to go. See if SYSLOG is a link -- VAR8 is 88888.[!end]
[!nequal [!var8],88888]
  [!equal,comment,] SYSLOG is a not a link -- log file's in the root. [!end]
  delete/2=ignore :UDD:[!username]:??CHECK_DIR:??CHECK_SPACE.TMP
  space/1=:UDD:[!username]:??CHECK_DIR:??CHECK_SPACE.TMP
  string [:UDD:[!username]:??CHECK_DIR:??CHECK_SPACE.TMP]

  var1 [:UDD:[!username]:??CHECK_DIR:ARG6 [!string]]
  [!equal,comment,] Set VAR2 high enough to keep it out of the way This
  lets us use the same check routine regardless of log file directory.[!end]
  var2 4000000000
[!else]
  [!equal,comment,] SYSLOG is a link. Get the name of the real log
  file directory and parent directory.

  First, get name of log file directory -- from pathname file. [!end]

  string [:UDD:[!username]:??CHECK_DIR:??CHECK_SPACE_PATH.TMP]
  string [!edirectory [!string]]
  delete/2=ignore :UDD:[!username]:??CHECK_DIR:??CHECK_SPACE.TMP
  space/2=abort/1=:UDD:[!username]:??CHECK_DIR:??CHECK_SPACE.TMP [!string]
  string [:UDD:[!username]:??CHECK_DIR:??CHECK_SPACE.TMP]

  [!equal,comment,] Extract space remaining from SPACE string. [!end]
  var1 [:UDD:[!username]:??CHECK_DIR:ARG6 [!string]]

  [!equal,comment,]
  Second, get name of log file parent directory -- from pathname file. [!end]

  string [:UDD:[!username]:??CHECK_DIR:??CHECK_SPACE_PATH.TMP]
  string [!edirectory [!edirectory [!string]]]
  delete/2=ignore :UDD:[!username]:??CHECK_DIR:??CHECK_SPACE.TMP
  space/2=abort/1=:UDD:[!username]:??CHECK_DIR:??CHECK_SPACE.TMP [!string]
  string [:UDD:[!username]:??CHECK_DIR:??CHECK_SPACE.TMP]

  [!equal,comment,] Again, extract space remaining from SPACE string.[!end]
  var2 [:UDD:[!username]:??CHECK_DIR:ARG6 [!string]]

[!end]
[!equal,comment,] Disk space figures are in VAR1 and VAR2. Compare them to
the threshold. Notify -- twice -- if lower figure is below threshold. [!end]
[!ult [!var1] [!var0]]
  send 2 [!ascii 214]
  send 2 [!ascii 212] [!ascii 207]
  send 2 [!ascii 216] *** Warning -- Low Disk Space *** [!ascii 217]
  send 2 , , , On [!date] at [!time]
  send 2 [!ascii 212]
  send 2 Space left in log directory is [!var1]. Threshold is [!var0].
  pause 5
  send 2 [!ascii 207] [!ascii 212]
  send 2 [!ascii 216] *** Warning -- Low Disk Space *** [!ascii 217]

```

Figure 9-4. CHECK\_SPACE Macro to Check Disk Space Periodically (continued)

```

[!else]
  [!ult [!var2] [!var0]]
    send 2 [!ascii 212] [!ascii 207]
    send 2 [!ascii 214]
    send 2 [!ascii 216] *** Warning -- Low Disk Space *** [!ascii 217]
    send 2 [!ascii 212]
    send 2 Space left in log directory PARENT directory is [!var1].
    send 2 The threshold is [!var0].
    pause 5
    send 2 [!ascii 212]
    send 2 [!ascii 216] *** Warning -- Low Disk Space *** [!ascii 217]
  [!end]
[!end]
[!equal,comment,] Pause 30 minutes -- 1800 seconds, and call this macro again.
[!end]
pause 1800
%0%
[!ELSE]
write This macro is nonexecutable. To make it executable you must use a
write text editor to change the 2 in line 1 to 1 -- both numbers must be 1.
[!END]

```

Figure 9-4. CHECK\_SPACE Macro to Check Disk Space Periodically (concluded)

### Detail-Log Panics

If a growing log file does force an AOS/VS panic, follow these steps.

1. Run ESD and restart AOS/VS (but don't type UP ↓ yet). Before resuming normal processing, you must dump and delete the log file.
2. Check the log file size with the FILES/AS command. If the log file will fit on one tape, you can dump it and delete it without bringing EXEC up. (A 2,400-foot tape, at 1600 bpi, can hold a 39,000,000-byte file.) Dump the log to unlabeled tape (MTxn:0), delete it, and bring everything up.
3. If the log file won't fit on one tape, you must start EXEC and use labeled tape. Use a manual PROCESS command, instead of the UP macro, to start EXEC (the syntax is shown in your UP.CLI macro). Then, via a labeled tape mount request, labeling tapes as necessary, dump the log file to labeled tape, and delete it. Bring everything up.

After this kind of panic, you might want to review your log file procedures — and perhaps generate reports, and dump and delete log files, more often.

### User Writes and Reads with the System Log File

Any Superuser can post messages into the active SYSLOG file, under the general-purpose code, with the CLI command LOGEVENT. Or, a user program with Superuser turned on can do the same thing with the ?LOGEV system call, if it uses event code 1065 (2051 octal). Either of these writes an event record into the log file (but neither returns an error if logging is not on).

SYSLOG files are not directly readable. But user programs can read these files if they use the proper record formats. Also, users can read log files (including the active one) via the DISPLAY program. Most important, they can get reports on log files using the REPORT program. Qualified users can run REPORT on file SYSLOG even while logging is on.

As with all files, a user cannot read or write a log file without read or write access to it — unless he or she has Superuser on. The access control list for file SYSLOG is null (only superusers can read it). The access control list for ERROR\_LOG is OP,R.

## The REPORT Program

The REPORT program interprets, sorts, and displays the records in system and error log files. REPORT is in :UTIL, filename REPORT.PR. It is available to any user process. It is a CLI Help topic, so anyone can get help on it by typing **HELP \*REPORT** .

REPORT can write the logged information to any device or file you name. It can report specific types of information and can report on multiple log files.

If you run REPORT on a system log file, the report includes user information. If you run it on an error log file, the report includes device error information. The default report from a system log file is a summary of user information. The default report from an error log file includes hardware errors. You can specify both system and error log filenames to REPORT; if so, the report includes both user and device information. From any file, you can select specific information via switches.

If you omit switches, REPORT creates a default report. A default user report includes the following information for each user.

- username (\* means that this user has a Super or access devices privilege);
- user tape or disk mount requests (if any);
- console connect time. This appears as 0:00 if the system log file was started or stopped while this user was logged on;
- number of pages printed;
- CPU time in hours, minutes, seconds and milliseconds;
- I/O blocks: the number 512-byte disk blocks read or written;
- page-seconds. This relates memory usage and CPU time; it is memory pages used multiplied by the number of CPU seconds; and
- number of processes created for this user during his or her connect time.

For example, take the commands

```
*) SEARCHLIST [!SEARCH],:LOGS )
```

```
*) X REPORT/L=@LPT 15SEP86.LOG 15SEP86.LOG.ERROR )
```

The REPORT program might produce reports that look like Figure 9-5 and 9-6.



USER SUMMARY FROM FILE(S): :15SEP86.LOG

| USERNAME | CONNECT<br>CONSOLE | TIME<br>UNIT | PAGES<br>PRINTED | CPU TIME    | I/O<br>BLOCKS | PAGE NUMBR<br>SECS PROCS |
|----------|--------------------|--------------|------------------|-------------|---------------|--------------------------|
| BILL     | 1:14               | 0:00         | 5                | 0:00:05.847 | 517           | 437 10                   |
| BRIDGET  | 4:30               | 0:00         | 119              | 0:10:04.370 | 34409         | 79391 170                |
| *GAMMA   | 3:00               | 0:00         | 0                | 0:04:27.916 | 29761         | 31903 61                 |
| JEFF     | 1:34               | 0:00         | 0                | 0:00:38.435 | 714           | 2662 19                  |
| JOE      | 2:47               | 0:00         | 6                | 0:02:22.956 | 11084         | 15046 80                 |
| LUCY     | 4:27               | 0:00         | 0                | 0:04:28.486 | 30421         | 18306 45                 |
| MARC     | 2:22               | 0:00         | 7                | 0:03:53.311 | 13029         | 26748 44                 |
| MASM     | 2:29               | 0:00         | 0                | 0:02:29.910 | 6819          | 8080 43                  |
| NETOP    | 0:00               | 0:00         | 0                | 0:00:02.451 | 103           | 150 2                    |
| *OP      | 2:46               | 0:34         | 20               | 0:15:28.560 | 82321         | 66996 59                 |
| PAUL     | 0:01               | 0:00         | 0                | 0:00:00.418 | 61            | 23 2                     |
| PETE     | 1:03               | 0:00         | 14               | 0:12:33.800 | 148183        | 53282 50                 |
| STEVE    | 0:02               | 0:00         | 0                | 0:00:01.045 | 46            | 64 2                     |
| SWAT     | 4:03               | 0:00         | 50               | 0:24:09.367 | 56109         | 172285 409               |

NO DEVICE ERRORS REPORTED  
NO DEVICE SUMMARY WILL BE PRINTED

Figure 9-5. Default Report from System Log (User Summary)

NO USER ERRORS RECORDED  
NO USER SUMMARY WILL BE PRINTED

DEVICE SUMMARY FROM FILE(S): :15SEP86.LOG.ERROR,

| DEVICE<br>CODE | UNIT | HARD | SOFT | ERRORS<br>TIMEOUT |
|----------------|------|------|------|-------------------|
| 22             | 0    | 0    | 31   | 1                 |

Figure 9-6. A Default Report from an Error Log File

## Running REPORT

To run REPORT, use the command form

```
[QBATCH] XEQ REPORT [switches] [logfile-pathname] [...]
```

where

**QBATCH** runs REPORT in batch. Depending on the size of the log file(s), REPORT may take some time (say 15 minutes for a 2-megabyte log file) to create the report on line. Thus, you might want to run REPORT in batch to keep your console free.

**switches** select options as described next. If you omit switches, the report goes to the generic output file @OUTPUT. By default, @OUTPUT is your console.

**logfile-pathname** specifies the system or error log file from which you want the report. If you omit a *logfile-pathname*, REPORT will use all the log files in the working directory. (Log files are a special type of file, LOG. REPORT reports on all files of this type.)

For a report on the current log file (system or error), you will need to turn Superuser on, since the ACL for this log file is null. (If the ACL of SYSLOG isn't null, make it null when you start logging, since the log file often contains sensitive information.)

When it generates a report from multiple log files, REPORT processes the files in chronological order of creation time — regardless of the order in which you specify them.

## REPORT Switches

REPORT *always* produces the default report on users or errors. You can request additional reports via one or more REPORT switches, described below.

REPORT can report only on events whose codes are recorded in a system or error file. These codes are recorded only when AOS/VS (or ESD) is running with logging on. There are some events that AOS/VS can't record, for the following reasons.

- The event forces AOS/VS to panic. Some events indicate an error condition so serious that the safest course is for AOS/VS to panic. If AOS/VS panics, ESD will write the panic information to the error log, but it will be written under the panic event code, not the specific error event code.
- The event occurs so often that logging overhead would degrade performance. If an event would occur very frequently, in the course of normal operations, AOS/VS will not log it. This applies only to error conditions like a persistent memory parity error or disk error, not to security-related events. (But AOS/VS logs everything if you specified a detail setting of FULL when you started logging.)
- AOS/VS is not running when the event occurs. For example, a BOOT command to the SCP cannot be logged, since AOS/VS isn't running when it occurs.
- If detailed logging was started *after* the multiuser environment was brought up, important information (like usernames) may not be available for reports. For example, REPORT can provide only the PID (not the username) of processes started before logging was started. Also, REPORT can give only the channel number and user PID (not the pathname) of files opened before logging was started.

If you care enough about security to use detailed logging, you should start logging immediately after AOS/VS startup (in the UP macro); don't stop until shutdown.

- The SCP is responsible for telling AOS/VS about the event, but doesn't do so (perhaps because the SCP, or its interface to AOS/VS, is having problems). Certain events can be detected only by the SCP. On one of these SCP-detected events, the SCP notifies AOS/VS on device code 45; then, if AOS/VS is logging, AOS/VS notes the event code in the error log file. If AOS/VS isn't notified, it cannot log the event.
- Implementation is planned for the future. One revision of AOS/VS may not log an event, but future revisions *will* log the event.

Under any of these circumstances, the pertinent event code will not be written to SYSLOG. And REPORT will not be able to report the event.

Several REPORT switches include the functionality of other switches. For example, the /C switch includes reports on all 30-odd CPU-related switches. So — if you use the /C switch — you will see a report (usually with *NO EVENTS RECORDED*) for each CPU-related switch.

All REPORT switches and descriptions follow. The log event code, in form decimal (followed by octal in parentheses), is part of the description. For events detected by the SCP, you may be able to find more information in Chapter 11, Table 11-1 (using the octal error code).

**NOTE:** REPORT requires that you type the *entire name* of each switch. If you abbreviate a switch name, REPORT will ignore the switch specification (displaying no error message!). Be sure to type the full name of each switch.

## Switch

/AFTER=dd-mmm-yy  
[:hh:mm:ss]

/AIR

/ATU

/BB

/BEFORE=dd-mmm-yy  
[:hh:mm:ss]

/BNC

/BT

/C

/CT

## What It Does

Reports only the events that occurred on or after the specified date or time. This is relevant for both system and error log files. You can combine the /AFTER= and /BEFORE= switches to display any time period. For example, to view only those events occurring on December 4, 1986:

```
*) X REPORT /AFTER=4-DEC-86 /BEFORE=4-DEC-86 & )  
*&) pathname )
```

To see the action between 8 p.m. and 2 a.m. on this night:

```
*) X REPORT /AFT=4-DEC-86:20:00:0& )  
*&) /BEF=5-DEC-86:2:00:0 pathname )
```

Reports air flow faults, as detected by the SCP (on MV/8000s with SCP diskette only). Relevant for error log files only. Event code is 102 (146).

Reports events in which the CPU Address Translation Unit (ATU) accelerator was disabled or enabled by an operator command (detected by the SCP). Normally, the ATU accelerator is enabled. An ATU disable/enable cannot occur on an MV/4000. Relevant for error log files only. Event codes are 122 (172) and 123 (173).

Reports successful transfers to battery backup, as they were detected by SCP. Relevant for error log files only. Event code is 104 (150).

Reports entries that occurred on or before the specified date and time. Relevant for system and error log files.

Reports the first word of buffer-not-clear events (the SCP did not clear the host-SCP buffer as expected). Relevant for error logs only. Event code is 80 (120).

Reports SCP time-outs (no response from SCP detected by AOS/VS within 20 seconds). Relevant for error logs only. Event code is 77 (115).

Reports all CPU-related information. It includes all information gathered by the following switches: /AIR, /ATU, /BB, /BNC, /BT, /DT, /FATAL, /HANG, /HI, /HP, /HRCC, /IC, /IOC, /IPF, /IPR, /LD, /NF, /NRCC, /OS, /PAR, /PH, /PW, /PWR, /RB, /RC, /REC, /RES, /RQ, /SB, /SC, /SCP, /TE, /UN, /UPSC, and /XCM switches. Most of these reports will be "NO xx EVENTS RECORDED." This switch is relevant for error logs only.

Reports Connect Time (CT). For each console user, this report gives username, connect time, and console name (console name information is not in the default report). An example is shown in Figure 9-7. Relevant for system logs only. Event code is 1024 (2000).

## Switch

/DEVICES=dd.u  
[+dd.u][...]

/DT

/EV

/FA

/FAILED\_LOGONS

/FATAL

/FE

## What It Does

Reports specific devices. The *dd* is the device code and *u* is the unit; e.g., 27.0 for DPF0. The default error log report always includes this information. Relevant for error logs only. Event code is 4 (4).

Reports error and normal returns from DTOS, as detected by the SCP (on machines with SCP diskette only). Do not try to run DTOS while AOS/VS is running. AOS/VS does not record this event. Event codes are 126 (176) and 132 (204).

Reports all human-defined events (EV). Superusers can write messages to the log file with the CLI command LOGEVENT. Or, they can use the ?LOGEV system call, with general-purpose event code 1065 (2051). REPORT will include human-defined messages only if you include the /EV switch.

If there are EV entries, the Event report will look like the one in Figure 9-7, below. As with all of the reports, it will start on its own page. REPORT prints only about 40 characters of the user message. It converts lowercase letters to uppercase and converts each nonprinting character into a space. This switch is relevant for system logs only.

Reports a XODIAC functional level summary. By username, this includes the number of FTA connections, RMA requests, FTA I/O blocks, total packets transmitted and received, and total bytes transmitted and received. Also see the /X switch. Relevant for system logs only. Event code is 1067 (2053).

Reports on all failed logons — situations where someone started to log on, but did not complete the procedure. A surge in the number of failed logons may mean that someone is trying to break into your system. Relevant for system log files only. Event code is 1215 (2277).

Reports fatal AOS/VS errors (panics). ESD records these when you run it if logging is on. Relevant for error logs only. Event code is 41 (51).

Reports XODIAC functional level errors. By username, the report includes the host, virtual circuit number, and error code for each network function that hit an error. Also see the /X switch below. Relevant for system logs only. Event code is 1068 (2054).

## Switch

/FILE=full-pathname

## What It Does

Reports on all accesses — successful and unsuccessful — to the file named in full-pathname. The report includes username, date, and time. You must specify a full pathname from the root directory — for example,

**\*) X REPORT/FILE=:UPD:OP ... :SYSLOG I**

The /FILE switch can help you check on accesses to critical files. As with any switch, you can also specify other switches; for example

**\*) X REPORT/FILE=:UPD:OP/TRACE=BILL :SYSLOG I**

This switch is relevant for system log files only. Event codes are 910 (1616), 912 (1624), 917 (1625), 920 through 947 (1630 through 1663), and 1214 (2276).

The events represented by the codes are

- File ACL change (codes 939 and 943)
- File close (922)
- File create (929)
- File delete (924 and 931)
- File open (920)
- File print (1214)
- File rename (938 and 942)
- File UDA create, delete, and write (927 and 934, 925 and 932, 926 and 933)
- LDU (logical disk unit) initialize and release (937 and 928)
- Permit access to protected file (used to modify shared file) (947)
- Process create (910)
- Process terminated by superior process (912)
- Process chain to another process (917)
- Shared file open (first and subsequent, 945 and 946)

All of these events indicate *attempts* at the specified action. For example, “File open” means that a user tried to open a specified file. If the attempt failed, the record will include an error code which REPORT will interpret and display. If the attempt succeeded, there will be no error code.

## Switch

## What It Does

/HANG

Reports on all AOS/VS system hangs (deadlocks). ESD records this when you run it if logging is on. Relevant for error logs only. Event code is 42 (52).

/HI

Reports hard interrupts from an unknown source (e.g., a faulty CPU board or bad connection). As of AOS/VS Revision 2.00 and later, the SCP records this in its own log (if any), but does not send it over device code 45. Relevant for error logs only. Event code is 133 (205).

/HP

Reports host request parameter errors (in which AOS/VS requested SCP action, but the SCP could not comply). Relevant for error logs only. Event code is 81 (121).

/HRCC

Reports MV/8000 or MV/6000 soft (single-bit) ERCC errors (replaces /ERCC switch on these machines). AOS/VS Revision 7.00 does not try to recover from, or log a record of, multibit ERCC errors. Relevant for error logs only. Event code is 106 (152).

/I

Tells REPORT to ignore user-defined system log entries. Use this switch to suppress *UNKNOWN CODE* messages.

User programs with Superuser on can write their own codes and messages to SYSLOG, via system call ?LOGEV. (The CLI LOGEVENT command writes only to code 1065 and isn't relevant here.) If the user-defined code is not one of the standard codes REPORT will not accept it. You should include this switch if programmers at your site have used ?LOGEV to write their own codes and messages into a log file on which you want a report.

/IC

Reports events in which the CPU instruction cache was disabled or enabled by an operator command (detected by SCP). Normally, this cache is enabled. An instruction cache disable/enable cannot occur on an MV/4000. Relevant for error logs only. Event codes are 117 (165) and 118 (166).

/IOC

Reports all IOC (input output controller) parity errors, as detected by the SCP. This has no meaning on MV/4000 logs. If the error occurs on behalf of a user, AOS/VS logs a hard error. If the error occurs on behalf of AOS/VS, AOS/VS panics and can't log the error. Relevant for error logs only.

/IPF

Reports infinite page faults, as detected by the SCP. AOS/VS will probably not stay up to record this, if it happens. Relevant for error logs only. Event code is 116 (164).

/IPR

Reports infinite protection faults detected by SCP. See comment under /IPF. Relevant for error logs only. Event code is 115 (163).

/L[=*pathname*]

Sends the report to the generic @LIST file, set by your CLI LISTFILE command. Or, if you include =*pathname*, sends the report to the file named *pathname*; e.g., /L=@LPT. Relevant for both system and error logs. If you omit it, the report goes to @OUTPUT — which, for interactive use, is your console screen.

/LD

Reports events in which the diskette log became inoperative (MV/8000s with SCP diskette). Relevant for error logs only. Event code is 114 (162).

| Switch | What It Does                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| /MT    | Reports on user unit mount requests. For each mount request, this report gives the user name and identifies the tape(s) or disk(s). Relevant for system logs only. Event code is 1025 (2001).                                                                                                                                                                                                                                                                                  |
| /NA    | Reports XODIAC connection level summary. For each network user, this shows the number of connections, connect time, packets transmitted and received, and number of bytes transmitted and received. (For reports on <i>all</i> XODIAC events, use the /X switch.) Relevant for system logs only. Event code is 1067 (2053).                                                                                                                                                    |
| /NE    | Reports XODIAC connection level errors. For each link, this includes each error code, associated diagnostic number, channel, virtual circuit number and transmit or receive status. A -1 for any entry means "not applicable". See also the /X switch. Relevant for system logs only. Event code is 1068 (2054).                                                                                                                                                               |
| /NF    | SCP interface degrade (no response received from SCP). Relevant for error logs only. Event code is 78 (116).                                                                                                                                                                                                                                                                                                                                                                   |
| /NRCC  | Reports soft (single-bit) ERCC errors on MV/10000s and MV/4000s (replaces /ERCC switch on MV/10000s and MV/4000s). AOS/VS Revision 7.00 does not try to recover from, or log a record of, multibit or Sniff ERCC errors. Relevant for error logs only. Event codes are 43(53) for single-bit, 44 (54) for multibit, and 45 (55) for Sniff errors.                                                                                                                              |
| /OS    | Reports operating system errors. Unused in AOS/VS Revision 2.00 and later. Relevant for error logs only. Event code is 113 (161).                                                                                                                                                                                                                                                                                                                                              |
| /PAR   | <p>Reports parity errors on the following boards and busses (detected by SCP or other hardware):</p> <ul style="list-style-type: none"> <li>• System Cache, event code is 108 (154);</li> <li>• Cache to Bank Controller, event code is 109 (155);</li> <li>• IOC (I/O controller), event code is 110 (156);</li> <li>• Microsequencer, event code is 107 (153);</li> <li>• S-bus, event code is 112 (160).</li> </ul> <p>The /PAR switch is relevant for error logs only.</p> |
| /PH    | Reports main processor halts, as detected by SCP. Relevant for error logs only. Event code is 98 (142).                                                                                                                                                                                                                                                                                                                                                                        |
| /PP    | Reports pages printed. For each user, this report gives the number of pages printed per file; this information is not part of the default report. Relevant for system logs only. Event code is 1027 (2003).                                                                                                                                                                                                                                                                    |
| /PR    | Reports all privileged users. This gives the names of all users who are logged on and who have Superuser, Superprocess, or access devices privileges. A user need not activate the privilege to be listed. Relevant for system logs only. Event code is 1026 (2002).                                                                                                                                                                                                           |
| /PT    | Reports all process terminations. For every process that was active during the log period, this describes the date and time of termination, full process name, and other information, shown in Figure 9-7.                                                                                                                                                                                                                                                                     |



## Switch

## What It Does

|            |                                                                                                                                                                                                                                                                                                                                              |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| /PT (cont) | The /PT switch can produce a very sizable report, since a process terminates after every text editing session, compilation, batch job, and so on. Relevant for system logs only. Event code is 3 (3).                                                                                                                                        |
| /PW        | Reports CPU power failure and power restore. These are logged as one event, at the time of power restore. Relevant for error logs only. Event codes are 7 (7) and 40 (50).                                                                                                                                                                   |
| /PWR       | Reports CPU power failure and power restore. These are logged as one event, at the time of power restore. Relevant for error logs only. Event codes are 100 (144) and 101 (145).                                                                                                                                                             |
| /RA        | Reports a XODIAC RMA agent summary. By username, this gives total connect time and RMA requests. Also see the /X switch. Relevant for system logs only. Event code is 1030 (2006).                                                                                                                                                           |
| /RB        | Reports host-SCP buffer full faults (indicates data overflow between processors). Relevant for error logs only. Event code is 76 (114).                                                                                                                                                                                                      |
| /RC        | The Bank controller normally detects, reports, and tries to correct ERCC errors. This report includes events in which the Bank detected so many ERCC errors that it disabled error reporting. (It continued to try to check/correct ERCC errors.) This event is reported via the SCP. Relevant for error logs only. Event code is 131 (203). |
| /REC       | Reports SCP function request acknowledgements. This may occur so often that logging it would degrade performance; AOS/VS Revision 7.00 does not log it. REPORT looks for code 74 (112).                                                                                                                                                      |
| /RES       | Reports SCP resets. AOS/VS Revision 7.00 does not log this code in SYSLOG. REPORT looks for event code 73 (111).                                                                                                                                                                                                                             |
| /RQ        | Reports Host-SCP request errors. AOS/VS Revision 7.00 does not log this code. REPORT looks for event code 75 (113).                                                                                                                                                                                                                          |
| /SA        | Reports a DG/SNA accounting summary. By username, it gives connect time, number of logical units, number of request units received and sent, and number of bytes received and sent. Relevant for system logs only. Event code is 1066 (2052).                                                                                                |
| /SB        | Reports S-bus time-outs (detected by SCP). The SCP cannot use the CPU S-bus. Relevant for error logs only. Event code is 111 (157).                                                                                                                                                                                                          |
| /SC        | Reports events in which the CPU's system cache was disabled or enabled by operator command (detected by the SCP). This event cannot occur. Event codes are 119 (167) and 120 (170).                                                                                                                                                          |
| /SCP       | Reports status of SCP logging, as detected by the SCP. By default, SCP logging is on. Events are recorded only if someone has turned it off or on with an SCP command. This has no meaning for MV/4000 logs. Relevant for error logs only. Event codes are 96 (140) and 97 (141).                                                            |
| /TA        | Reports a XODIAC File Transfer Agent (FTA) summary. By username, it gives the connect time, number of FTA connections, number of FTA blocks, packets transmitted and received, and bytes transmitted and received. Relevant for system logs only. Event code is 1064 (2050).                                                                 |

## Switch

/TE

/TRACE=username

## What It Does

Reports overtemperature state, as detected by the SCP (on MV/8000s only). AOS/VS Revision 7.00 panics, thus does not log this code. Event code is 103 (147).

Reports on all security-related events (logons, file accesses, process creations, pages printed), that involved *username*, as well as multi-processor and class events. This can produce a sizable report. The report is useful when you want to monitor a user's behavior, or check an application program (run by the user, like OP) for Trojan horses, or see class or multiprocessor events. For example

\*) X REPORT /TRACE=JKN ... :SYSLOG I

This switch is relevant for system logs only. Event codes include 910 through 947 (1616 through 1663), 966 and 967 (1076 and 1707), and 1211 through 1226 (2273 through 2312) for security-related events; 948 through 960 (1664 through 1700) and 964 (1704) for class and multiprocessor events; and 961 through 963 (1701 through 1703) for mirroring events.

The security-related events represented by the codes are

- Access devices privilege turned on (call ?IDEF) or off (call ?IRMV) (code 915)
- Class or logical processor event, or user locality change (951 through 960)
- Console assigned to a program or deassigned from a program (for example, assigned to EXEC when user logs on) (918 and 919)
- File ACL change (939 and 943)
- File close (922)
- File create (929)
- File delete (924 and 931)
- File open (920)
- File print (1214)
- File rename (938 and 942)
- File UDA create, read, or write (927 and 934, 925 and 932, 926 and 933)
- Invalid log-on attempt (1215)
- Job processor initialized or released, or status checked (948 through 950)
- Labeled medium (tape) mount or dismount (1211 and 1212)
- LDU (logical disk unit) initialize (937) or release (928)
- Permit access to protected file (used to modify shared file) (947)
- Process create (910)
- Process chain to another process (917)

## Switch

/TRACE=username  
(cont)

## What It Does

- Process ringload (?RINGLD) of a program (916)
- Process terminated by superior process (912)
- Shared file open (first and subsequent, 945 and 946)
- Superprocess privilege turn on/off (914)
- Superuser privilege turn on/off (913)
- System Manager privilege turn on/off (964)
- User password change (subset of 1225)
- User logon (1213)
- User profile created, deleted, or renamed (1220, 1221, 1222)
- User profile opened, read, or closed (e.g., by EXEC when a user logs on) (codes 1223, 1224, 1226)
- User profile written to (follows profile open) (1225). When anyone logs on, the time is written in the profile. Password changes are reported here and as specific events elsewhere.
- Window create (966) and window delete.

All of these events indicate *attempts* at the specified action. For example, "File open" means that a user tried to open a specified file. If the attempt failed, the record will include an error code which REPORT will interpret and display. If the attempt succeeded, there will be no error code.

/UN

Reports unknown DIB code from SCP events (the SCP requested AOS/VS to act, but AOS/VS could not understand or execute the request). Relevant for system logs only. Event code is 79 (117).

/USERS=name  
[+name][...]

Reports accounting information (like CPU and I/O usage) on only the user(s) specified with name(s). For example, for a report on users F77 and SWAT:

**\*) X REPORT/USERS=F77+SWAT pathname ↓**

The /USERS switch is relevant for system logs only.

/UPSC

Reports UPSC (CPU power supply) faults detected by AOS/VS, on the following machines: MV/20000-series, MV/10000-series, MV/8000 II, MV/8000 C, and MV/4000. AOS/VS can record these only if it stays up through the error. Relevant for error logs only.

/X

Reports a XODIAC summary. This includes the reports from the /FA, /FE, /NA, /NE, /RA and /TA switches described above. Relevant for system logs only.

/XCM

Reports occurrences of the following SCP commands, as detected by the SCP (machines with SCP diskette only). Relevant for error logs only.

- BOOT (AOS/VS cannot record this, since it is not running.)  
Event code is 99 (143);
- HALT, event code is 127 (177);
- CONTINUE, event code is 128 (200);

## Switch

## What It Does

/XCM (cont)

- INIT, event code is 130 (202);
- START, event code is 129 (201);
- XEQ DTOS, event code is 125 (175).

## SYSLOG and REPORT Examples

```
) SYSLOG/START )  
... (System runs) ...  
) XEQ REPORT/USERS=F77+SACKVILLE :SYSLOG )  
... (Report on console) ...
```

```
) X REPORT/AFTER=[!DATE]/L=@LPT :SYSLOG )
```

The preceding command reports on all entries that occurred today.

```
) X REPORT/L=COBOL_BILL/BEF=17-DEC-86/AFT=12-DEC-86 )  
) X REPORT/USER=COBOL :LOGS:17DEC86.LOG )
```

The preceding command reports on user COBOL, between 12 December, 1986 and 17 December 1986, and sends the report to file COBOL\_BILL.

```
) SYSLOG/START/DETAIL=FULL )  
... (System runs) ...  
) X REPORT/TRACE=JOAN_S/L=LOGS:JOAN_S.REPORT :SYSLOG )  
... (Report on console) ...
```

This command sequence starts the log file — then, later, generates a report on all system use by user JOAN\_S. The report is written to the file JOAN\_S.REPORT in directory :LOGS. Superuser is needed to access the current log file.

```
) X REPORT/FAILED_LOGONS/EV :LOGS:28SEP86.LOG )
```

This command produces a report on failed logons and events (written into the log file with the LOGEVENT command). The log file is 28SEP86.LOG in directory LOGS. Since no listing file was specified with /L, the report is displayed on the console.

```
) X REPORT/EV/PT :LOGS:28MAY86.LOG )
```

This command would produce process termination reports (like those shown in Figure 9-7).

| EVENT LOG DUMP           |                          |              |             |            |           |   |
|--------------------------|--------------------------|--------------|-------------|------------|-----------|---|
| 28-MAY-86 07:50:23       | *** SYSLOG STARTED ***   |              |             |            |           |   |
| 28-MAY-86 07:50:30       | RUNNING REV 7.00         |              |             |            |           |   |
| 28-MAY-86 17:32:06       | RUNNING 4 BATCH STREAMS  |              |             |            |           |   |
| 28-MAY-86 20:03:38       | REV 7.00 LOOKS FANTASTIC |              |             |            |           |   |
| 30-MAY-86 07:53:49       | *** SYSLOG STOPPED ***   |              |             |            |           |   |
| -----                    |                          |              |             |            |           |   |
| PROCESS TERMINATION DUMP |                          |              |             |            |           |   |
|                          | PROCESS NAME             | ELAPSED TIME | CPU TIME    | I/O BLOCKS | PAGE SECS |   |
| 28-MAY-86 07:50:23       | *** SYSLOG STARTED ***   |              |             |            |           |   |
| 28-MAY-86 07:51:25       | OP:00003                 | 0:00:07      | 0:00:00.077 | 107        | 2         |   |
| 28-MAY-86 08:52:45       | GAMMA:00011              | 0:00:08      | 0:00:00.156 | 9          | 6         |   |
| 28-MAY-86 08:53:01       | GAMMA:00011              | 0:00:10      | 0:00:00.312 | 9          | 12        |   |
| 28-MAY-86 08:53:10       | GAMMA:00012              | 0:00:03      | 0:00:00.047 | 13         | 2         |   |
| 28-MAY-86 08:53:16       | GAMMA:00012              | 0:00:03      | 0:00:00.095 | 13         | 4         |   |
| 28-MAY-86 08:53:17       | GAMMA:STREAM_1           | 0:00:56      | 0:00:01.345 | 163        | 83        |   |
| 28-MAY-86 08:53:23       | OP:CON0                  | 0:00:56      | 0:00:00.041 | 0          | 2         |   |
| 28-MAY-86 08:53:28       | GAY:CON45                | 0:00:59      | 0:00:01.345 | 12         | 73        |   |
| 28-MAY-86 08:53:35       | ALEXIS:CON44             | 0:03:35      | 0:00:01.410 | 184        | 86        |   |
| .                        | .                        | .            | .           | .          | .         | . |
| .                        | .                        | .            | .           | .          | .         | . |
| .                        | .                        | .            | .           | .          | .         | . |

Figure 9-7. Process Event and Termination Reports from System Log

## Confidence Testing with CONTEST

Periodically — often after generating a new AOS/VS system or getting new hardware — you may want to test your hardware and software.

The CONTEST confidence test package supplied with AOS/VS is designed to do this. It puts extreme demands on both hardware and software. If your system passes the CONTEST tests, you can be fairly confident of its ability to handle day-to-day processing. Contest can test

- magnetic tape unit 0;
- the master LDU from which CONTEST runs;
- the CPU, including floating-point unit and commercial instructions;
- main memory.

You can run CONTEST on any console. The user process that runs CONTEST needs the following privileges in its profile.

```
CREATE WITHOUT BLOCK
USE IPC
USE CONSOLE
UNLIMITED SONS
CHANGE TYPE
CHANGE ADDRESS SPACE TYPE
CHANGE WORKING SET LIMIT
DISK QUOTA of 30000
```

You can create a special profile for CONTEST — giving these privileges and defaulting the others — or you can edit the OP profile to contain these privileges. CONTEST also needs a PAGE and SWAP directory size of at least 50,000 blocks each.

## Running the CONTEST Package

Generally, CONTEST should not be run while timesharing users are on the system. Run it while users are off. To run it:

- If you want to test mag tape unit 0, mount a scratch tape, 400 feet or more, with ring in, on the unit. Put the unit on line.
- Check the SWAP and PAGE directories with SPACE :SWAP ) and SPACE :PAGE ) commands. If each is 50000 or more, proceed. Otherwise, shut down AOS/VS, bring it up again, override default specs, and specify 50000 ) for both SWAP and PAGE definitions.
- Go to a user console (preferably a CRT) and log on with the username under which you will run CONTEST. The profile needs the privileges described above. Your search list must include :UTIL.
- Type  
 ) CONTEST )  
 )

*Contest Rev n*

*Memory size = x.xx Mbytes*

*Do you wish to test tape unit MTx0 [N] ?*

- To test your primary tape unit, type Y ) otherwise press ).

*The following tests will be run :*

... (Names and descriptions of tests) ...

*Enter # of minutes to run Contest :*

- Answer with the number of minutes you want CONTEST to run; e.g., 60 ). An answer of 0 ) tells CONTEST to run indefinitely; you will then need to terminate it yourself. Sixty minutes is a good general-purpose minimum time.

- The CLI prompt returns and CONTEST runs. You can let it run silently or have it summarize errors on the console. Messages will be recorded in disk files anyway, as described below. The summary display is useful. To get it, type

) CONTEST.ERRORS )

*DO NOT TOUCH THIS SYSTEM - AOS/VS TESTING*

*PATH n - xxxx TEST      PASSES=n      ERRORS=n*  
*PATH n - xxxx TEST      PASSES=n      ERRORS=n*

If there are errors, CONTEST will note them in the ERRORS column and with error messages.

To see what's happening, you can run PED on this console or another console, by typing

) PED/ALL/CYCLE=5 )

- CONTEST should terminate on its home console when your specified period has passed. Then it will display

*Contest Run Finished*  
 )

If the summary shows no errors, and CONTEST terminated normally, then CONTEST found no errors. Type CONTEST.CLEAN ) to delete temporary files (some of these are quite large). Type X REPORT :ERROR\_LOG ) to see if any errors occurred during the CONTEST run. If the report shows no errors, your system passed the tests; you're done.

If you see error messages, or an *ABNORMAL PATH TERMINATION* message, then CONTEST detected an error. Proceed to the next section.

- If you want to terminate CONTEST before it's done, type CTRL-C CTRL-A to interrupt the CONTEST.ERRORS macro; wait for the CLI prompt and type BYE ) to the CLI. CONTEST will ask for verification; and you will type Y ) to terminate it. Several moments may pass before CONTEST actually terminates and the CLI prompt returns. If too much time passes, you can terminate CONTEST's father CLI from the system console.

## CONTEST Error Interpretation

Generally, system hangs (deadlocks) indicate software problems. System panics (*FATAL AOS/VS ERROR*) or CONTEST test failures mean hardware problems. If either a hang or panic occurred, the system failed the test. The display, and/or messages on the system console may tell why it failed. On a deadlock, get back to the SCP, do a memory dump, and run ESD (described in Chapter 6). On a panic, note the panic values, do a memory dump, and run ESD. Next, check the SCP log as described in Chapter 11. Then restart AOS/VS and check the error log by typing X REPORT :ERROR\_LOG ). The SCP log and error log may pinpoint the problem.

File PATH\_ERRORS.TS shows a duplicate of the last summary display. It will show no errors if CONTEST found none. If there are errors, you might print (QPRINT) this file for the record.

File MONITOR.LOG.TS shows the sequences, priorities, paths and PIDs that CONTEST ran. It shows no errors but can help trace problems. Related files — that have meaning only if an error occurred, have the form

ERRORnnhhmmss.TS

where nn is the path number, and hhhmmss is the time (in hours, minutes, and seconds) of the error. Each of these files represents one error on the console display. These files might be

useful if you ran CONTEST overnight, errors occurred, and you wanted to know *when* the error occurred and other specifics.

File CONTEST.CLEAN.CLI is a macro that cleans up by deleting all CONTEST-created files *except* for CONTEST\_ERRORS.TS and the ERROR+ files. Run it after checking the CONTEST and PATH files for errors. After the contents of the ERROR+ files have been noted, delete them so that the working directory is not cluttered with old information.

CONTEST is really very easy to run; and its error messages are quite specific about problems.

After any CONTEST run, you should check for errors that CONTEST didn't detect. Soft and hard errors are displayed on the system console. They are also recorded in the error log. So you should always check the error log (X REPORT :ERROR\_LOG ) for device errors produced during a CONTEST session.

## Specific Tests and Script Files

CONTEST allows you to run specific tests and/or create your own test scripts.

To run only selected tests (for example, to test *only* your tape hardware or floating point, use the /Q switch:

CONTEST /Q )

CONTEST then asks you which tests you want to run. To choose a test, press ) (or type Y ). To skip the test, type N ). After you select or reject all tests, CONTEST starts the one(s) chosen. For an error display, you can type CONTEST.ERRORS ) as shown above.

To create your own script file without running tests, use the /N switch. CONTEST then asks about the mag tape. After receiving an answer, it builds a script file including all tests (except for the mag tape test, if you said N ) to mag tape); then CONTEST terminates. The script filename is CONTEST.SCR. If a file named CONTEST.SCR already exists in the working directory, CONTEST deletes and recreates it.

You can create a custom script file by combining the /Q and /N switches. If you combine them, CONTEST asks questions about each test. Then it builds a script file that specifies *only* the tests you chose. The script filename is CONTEST.SCR. If you create different script files, you can rename each after it is created so that CONTEST doesn't delete it when you create another script file.

To *use* a script file, give the command sequence

CONTEST script-filename (e.g., CONTEST CONTEST.SCR )



## CONTEST Example

This example assumes the process running CONTEST has the needed privileges.

Log on to an EXEC-owned console.

Put a write-enabled tape on unit 0; put unit on line.

) CONTEST ↓

*Contest Rev n*

*Memory Size = 2.00 Mbytes*

*Do you wish to test tape MTx0 [N] ? Y ↓*

*The following tests will be run:*

*PATH 70 - MV/ECLIPSE MEMORY TEST*

*PATH 71 - SPAGE MEMORY EXERCISER*

*...*

*Enter # of minutes to run Contest : 60 ↓*

*AOS/VS CLI REV 7.00.00.00 ....*

) CONTEST.ERRORS ↓

*DO NOT TOUCH THIS SYSTEM - AOS/VS TESTING*

*AOS/VS REV n*

*CPUID = n*

*PATH ERROR INFORMATION*

*ELAPSED TEST TIME n HOURS n MINUTES*

*PATH 70 - MV/ECLIPSE MEMORY TEST*

*PASSES= n ERRORS=n*

*PATH 71 - SPAGE MEMORY EXERCISER*

*PASSES= n ERRORS=n*

*PATH 72 - SYSTEM DISK TEST (BLK I/O)*

*PASSES= n ERRORS=n*

*PATH 73 - TAPE EXERCISER*

*PASSES= n ERRORS=n*

*PATH 74 - FLOATING POINT TEST*

*PASSES= n ERRORS=n*

*PATH 76 - COMMERCIAL TEST*

*PASSES= n ERRORS=n*

*... (Display above cycles every 45 seconds) ...*

*... (60 minutes pass) ...*

*Contest run finished*

) TYPE CONTEST\_ERRORS.TS ↓

*WARNING: FILE DOES NOT EXIST...*

) TYPE PATH\_ERRORS.TS ↓

*... (Duplicate of last display) ...*

If there were no errors, then type CONTEST.CLEAN ↓

*DELETED ...*

*DELETED ...*

) X REPORT :ERROR\_LOG ↓

*... (Check for new device errors) ...*

## DISCO Disk Monitor Program

The DISCO disk monitor program displays statistics on disk I/O. These statistics include requests made to the unit, percentage of busy time, queue length, average seek distance, and blocks read and written, among others. For systems with multiple disks, this information can help you decide when to redistribute the file system for better load balancing or to purchase an additional controller. For any system, you can use the average seek figure to detect when file fragmentation has occurred.

Read the following sections to learn how to execute DISCO, look at its screens, issue commands while DISCO runs, and use DISCO productively.

### How to Execute DISCO

To run DISCO, put :UTIL in your search list and type

```
) XEQ DISCO )
```

Exit from DISCO by pressing function key 11.

You can append any of the following switches to DISCO. Switch abbreviations don't work. If you do abbreviate a switch name, DISCO will ignore your switch specification without sending you an error message.

- |                         |                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>/CYCLE=n</b>         | Defines the DISCO update cycle in seconds. The default cycle is 10 seconds. For n, you can specify any value from 1 to 65535. This switch is useful for longer than normal cycles, which can give you a better picture of DISCO rates. For example,<br><br><b>) X DISCO /CYCLE=30 )</b>                                                                          |
| <b>/LISTFILE[=path]</b> | Sends DISCO output to file named in <i>path</i> ; or, if you omit <i>path</i> , to the default list file DISCO.LIST. The file will be deleted and then recreated if it already exists. If you use this switch, DISCO displays the word "Listing" in the upper lefthand corner of the screen. You can also enable/disable listing during a session by pressing T. |
| <b>/RATE</b>            | DISCO can display two screens, the main screen, with numbers accumulated since system startup, and a rate-oriented screen, with data from the last cycle. To start DISCO with the rate screen (instead of the main screen), use this switch.                                                                                                                     |
| <b>/RESET</b>           | By default, DISCO uses counts that have accumulated since each disk was initialized. This switch tells DISCO to start with 0 for each count, and is useful for tracking information from a specific time.                                                                                                                                                        |

### The DISCO Screens

There are two DISCO screens, which are quite similar. Figure 9-8 shows the first DISCO screen, which displays total figures since system startup. Figure 9-9 shows the second DISCO screen, which displays figures from the last cycle only.

|                                     |   |                             |       |      |      |         |      |        |            |         |            |      |      |
|-------------------------------------|---|-----------------------------|-------|------|------|---------|------|--------|------------|---------|------------|------|------|
| Aug 7, 1985                         |   | AOS/VS DISC MOnitor Program |       |      |      |         |      |        |            | 9:47:41 |            |      |      |
| Function key #11 to Exit            |   |                             |       |      |      |         |      |        |            |         |            |      |      |
| D i s c U n i t S t a t i s t i c s |   |                             |       |      |      |         |      |        |            |         |            |      |      |
| Actual time                         |   | 8.9 seconds                 |       |      |      |         |      |        | Cycle time |         | 10 seconds |      |      |
| U                                   |   |                             |       |      |      |         |      |        |            |         |            |      |      |
| D                                   | n |                             |       |      |      |         |      |        |            |         |            |      |      |
| e                                   | i | # of                        | % of  | % of | % of | Avg/Max | Avg  | Blocks | Blocks     | Avg     | Avg        |      |      |
| v                                   | t | Reqs                        | Total | Busy | Intf | Queue   | Seek | Read   | Written    | % of    | Serv       | Resp |      |
|                                     |   |                             |       |      |      |         |      |        |            | Util    | Time       | Time |      |
| 25                                  | 0 | 138714                      | 8.5   | 6.4  | .0   | .1      | 15   | 10.1   | 178034     | 186866  | 2          | .014 | .015 |
| 27                                  | 0 | 393430                      | 24.0  | 39.7 | .0   | .8      | 15   | 164.8  | 548830     | 147536  | 14         | .033 | .059 |
| 27                                  | 1 | 178914                      | 10.9  | 4.2  | .2   | .0      | 5    | 51.3   | 650803     | 6919    | 3          | .020 | .059 |
| 67                                  | 0 | 35899                       | 2.2   | 17.4 | .0   | .2      | 5    | 35.3   | 50198      | 85357   | 0          | .021 | .026 |
| 67                                  | 1 | 137364                      | 8.4   | 27.0 | .0   | .3      | 24   | 68.7   | 214768     | 154887  | 3          | .025 | .034 |
| ===== second IOC =====              |   |                             |       |      |      |         |      |        |            |         |            |      |      |
| 124                                 | 0 | 148829                      | 9.1   | 25.9 | .0   | .3      | 40   | 80.2   | 147495     | 123762  | 4          | .029 | .039 |
| 124                                 | 1 | 118499                      | 7.2   | 21.8 | .0   | .3      | 33   | 87.6   | 119437     | 92518   | 3          | .030 | .039 |
| 124                                 | 2 | 127490                      | 7.8   | 23.9 | .0   | .3      | 27   | 75.8   | 141986     | 131204  | 4          | .028 | .037 |
| 144                                 | 0 | 182664                      | 11.1  | 25.1 | .0   | .3      | 21   | 89.9   | 354311     | 396086  | 5          | .025 | .033 |
| 144                                 | 1 | 3091                        | .2    | .9   | .2   | .1      | 1    | 28.0   | 5633       | 150     | 0          | .013 | .013 |

Figure 9-8. First DISCO Screen

|                                     |   |                             |       |      |      |        |         |       |            |      |            |      |  |
|-------------------------------------|---|-----------------------------|-------|------|------|--------|---------|-------|------------|------|------------|------|--|
| Aug 7, 1985                         |   | AOS/VS DISC MOnitor Program |       |      |      |        |         |       | 11:08:20   |      |            |      |  |
| Function key #11 to Exit            |   |                             |       |      |      |        |         |       |            |      |            |      |  |
| D i s c U n i t S t a t i s t i c s |   |                             |       |      |      |        |         |       |            |      |            |      |  |
| Actual time                         |   | 90.5 seconds                |       |      |      |        |         |       | Cycle time |      | 90 seconds |      |  |
| U                                   |   | Per Cycle                   |       |      |      |        |         |       |            |      |            |      |  |
| D                                   | n |                             |       | Reqs |      |        |         |       |            |      |            | Avg  |  |
| e                                   | i | # of                        | # of  | per  | % of | % of   | Avg/Max | Avg   | Blocks/sec | % of | Serv       |      |  |
| v                                   | t | Reqs                        | Total | sec  | Busy | Interf | Queue   | Seek  | Read Write | Util | Time       |      |  |
| -----                               |   |                             |       |      |      |        |         |       |            |      |            |      |  |
| 25                                  | 0 | 1552                        | 37.2  | 17.1 | 7.5  | .00    | .08/15  | 2.4   | 12.1       | 9.5  | 16.7       | .010 |  |
| 27                                  | 0 | 1050                        | 25.2  | 11.6 | 47.6 | .00    | .76/15  | 178.7 | 14.6       | 6.5  | 44.4       | .038 |  |
| 27                                  | 1 | 181                         | 4.3   | 2.0  | 5.5  | .00    | .06/ 5  | 169.9 | 5.4        | .2   | 5.6        | .028 |  |
| 67                                  | 0 | 62                          | 1.5   | .7   | 1.6  | .00    | .02/ 6  | 32.1  | 2.4        | .0   | .0         | .000 |  |
| 67                                  | 1 | 89                          | 2.1   | 1.0  | 18.0 | .00    | .19/24  | 75.9  | 2.1        | .9   | 3.3        | .034 |  |
| ===== second IOC =====              |   |                             |       |      |      |        |         |       |            |      |            |      |  |
| 124                                 | 0 | 340                         | 8.1   | 3.8  | 17.6 | .00    | .21/40  | 79.6  | .9         | 4.0  | 11.1       | .029 |  |
| 124                                 | 1 | 53                          | 1.3   | .6   | 20.8 | .00    | .26/33  | 28.5  | .3         | .4   | 1.1        | .019 |  |
| 124                                 | 2 | 276                         | 6.6   | 3.0  | 26.4 | .00    | .39/27  | 114.6 | 1.0        | 3.5  | 6.7        | .022 |  |
| 144                                 | 0 | 127                         | 3.0   | 1.4  | 1.6  | .00    | .02/21  | 68.9  | 1.1        | .3   | 5.6        | .039 |  |
| 144                                 | 1 | 386                         | 9.2   | 4.3  | .0   | .00    | .00/ 1  | 8.2   | 4.3        | .0   | 4.4        | .010 |  |

Figure 9-9. Second DISCO Screen

DISCO can display on the screen information about 10 disk units at once. It describes all initialized disks. When a disk is released, DISCO stops describing it.

On the second screen, DISCO includes the columns “% of Util” and “Avg Serv Time” only if the cycle time is 60 seconds or more. The reason for this is that a shorter cycle time would not produce a sufficient number of samples.

If the system has disks on a second IOC (I/O Controller), DISCO displays secondary IOC disk information after primary IOC disk information.

## DISCO Commands

While DISCO is running on your screen, you can type any of the following commands to it.

### Command What It Does

|        |                                                                                                                                                                                    |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| < or > | Increases (>) or decreases (<) cycle time, by 1 second each time you press the key. The default cycle time (if you don't start DISCO via X DISCO/CYCLE=n) is 10 seconds.           |
| ^ or V | Scrolls up (^) or down (V) a line. SHIFT-6 scrolls up; V scrolls down. This is useful when more than 10 disks are initialized and you want to check one whose data doesn't appear. |
| ?      | Gives Help; displays DISCO commands.                                                                                                                                               |
| S      | Displays the other DISCO screen.                                                                                                                                                   |
| Z      | Zeros the counters; DISCO starts accumulating numeric data from scratch. This is useful when you want to accumulate data from a specific time.                                     |

## What DISCO Column Heads Mean

The DISCO columns have the following meanings (listed alphabetically, with # and % symbols first):

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| % of Busy                 | <p>The percentage of I/O requests made to this unit while one or more requests were already queued to it. It appears on both DISCO screens (on the second screen only if the cycle is 60 or more seconds).</p> <p>Comparing “% of Busy” to “% of Util” (first screen) can be useful. If “% of Busy” is relatively high and “% of Util” is relatively low, this means the disk load tends to spike; it's not constant. This may mean that an application program is too-frequently accessing the disk — a situation that you might be able to improve after discovering why the program is doing this.</p> <p>If both “% of Busy” and “% of Util” are relatively high, you might want to consider moving part of the load on this unit to another unit.</p> |
| # of Reqs                 | <p>Shows I/O requests made to the unit. On the main DISCO screen, it shows total requests since the disk was initialized (or since you pressed the Z key). On DISCO's rate screen, it shows requests in the last DISCO cycle. (This distinction also applies to numbers under other column heads that appear on both screens.)</p> <p>On a system with multiple disks, during memory contention, the disk(s) that holds directories SWAP and PAGE often shows more accesses and a higher percentage of I/O than others.</p>                                                                                                                                                                                                                                |
| % of Interf and % of Intf | <p>The percentage of requests to this unit that had to wait at the controller level because the disk's controller was processing another request. It appears on both DISCO screens.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|                |                                                                                                                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | The interference number should be very low — below 5%. If it exceeds 5%, you should consider putting the unit on its own controller.                                                                                                          |
| % of Total     | The percentage of all disk I/O that was performed by this unit. It appears on both screens.                                                                                                                                                   |
| % of Util      | The percentage of time the disk was found busy. The system checks a disk status flag every second; this number indicates the percentage of times the flag indicated busy. (Relates to “% of Busy” above.) This appears on both DISCO screens. |
| Avg Queue      | The average queue length for this unit (the average number of requests at any moment). It appears on both screens.                                                                                                                            |
| Avg Resp Time  | The service time (described next) plus time spent waiting in the disk queue.                                                                                                                                                                  |
| Avg Seek       | The average number of cylinders crossed in a seek to fulfill a read or write command. It appears on both DISCO screens.                                                                                                                       |
|                | Seek distance indicates two important things: the amount of free disk space available and the amount of file fragmentation. Large figures show a relatively full disk and/or a high level of fragmentation.                                   |
| Avg Serv Time  | The average time in seconds for each request — from reaching the head of the queue to completion. It appears on both DISCO screens.                                                                                                           |
| Blocks Read    | Shows total disk blocks read from the unit.                                                                                                                                                                                                   |
| Blocks/sec     | The Read and Write columns show the average number of disk blocks read from and written to the unit, during the last DISCO cycle. It appears on the DISCO rate screen.                                                                        |
| Blocks Written | Shows the total disk blocks written to the unit.                                                                                                                                                                                              |
| Dev            | The device code of the disk controller (octal). It appears on both screens.                                                                                                                                                                   |
| Max Queue      | The largest number of I/O requests ever queued to this unit at once: the longest queue it has had. It appears on both screens.                                                                                                                |
| Read           | See “Blocks/sec”.                                                                                                                                                                                                                             |
| Reqs per sec   | The average requests per second during the last DISCO cycle.                                                                                                                                                                                  |
| Unit           | The unit number of the disk. It appears on both screens.                                                                                                                                                                                      |
| Written        | See “Blocks/sec”.                                                                                                                                                                                                                             |

DISCO accumulates data as each request is made. Its data pool includes information gathered during all requests since the disk was initialized. Since data shows status during requests only, DISCO percentages may not give a purely objective picture of disk activity (this applies to average queue figures).

If you have Logical Disk Mirroring, note that DISCO cannot report average seek distances. DISCO will report the combined statistics for each element of the mirror. In order to keep the percentages accurate, DISCO counts only one copy in the totals it uses for computational purposes.

## Using DISCO Productively

If your system has multiple disks, DISCO information can help you balance disk load and distribute files for best performance.

In any system, DISCO's "Avg Seek" figures can help you check the impact of disk fragmentation. If the "Avg Seek" figures grow over time, you might consider rebuilding your LDU(s) to reduce fragmentation.

DISCO's "% of Busy" and "% of Intf" can also tell you, respectively, about the constancy of load on a disk, and whether you should consider an additional controller.

To get the big picture from DISCO, start it up. Then make sure that all needed system software is running and all pertinent applications software is ready to run. Press the Z key to zero DISCO numbers. Then, start and run your applications software as usual.

With multiple disks, DISCO figures can help you equalize processing load, perhaps by moving often-used files. In any system, if you create a base of reference, the average seek figures can help tell you whether file fragmentation is hurting performance.

One way to create a base of reference is to create a standard disk-exercising procedure. For example, try a procedure that involves creating three directories, moving all help files — :HELP:# — to them, and having three user processes issue F/AS/S # commands in these directories. During this, run DISCO and check the Avg Seek figures. Afterward, delete the directories. Ideally, you'd try the disk-exercising procedure when your disks were new (no fragmentation). Later, whenever you suspect fragmentation, you would run the procedure again. If the average seek numbers are larger with each run, file fragmentation is probably slowing down your system. There's more detail on fragmentation in Chapter 15.

## SPRED Selective Preamble Editor Utility

The Selective Preamble Editor (SPRED) utility allows you to change the behavior of a program when it runs. Using SPRED, you can

- change paging or swapping parameters;
- change PID-size type; and
- change program locality.

SPRED allows you to edit a program's *preamble*, the part of a program the system reads when it initializes the process in which the program runs. SPRED by itself doesn't change the process's behavior: other system parameters must also allow or enable these actions.

### Changing Paging or Swapping Parameters

The paging and swapping operations you can specify with SPRED are

- loading one or more program pages into memory when the program is executed. The VSGEN questions that enable this are *Max program load pages-noncontention* and *Max program load pages-contention*.
- adding two or more pages to the process' working set when the process takes a page fault. The VSGEN question that enables this is *Fault time prepaging maximum*.
- maintaining a nonstandard size swap file for the process. The VSGEN question to enable this is *Do you want to use variable swapfiles*, followed by questions that set a maximum and a default size.

No value set with SPRED can override the value given in the corresponding VSGEN question. For example, if the value for *Max program load pages* is 35 and the default VSGEN number is 30, the system will ignore the SPRED setting for it.

The paging operations you specify with SPRED can speed up a program with many unshared pages if the program takes many unavoidable page faults. An example is a program with large, static data tables built in. By having the system load many pages at once, or swap without needing to reduce a working set, you reduce overhead, since some faults do not occur. Also, the system can optimize the reading of pages from disk — improving process response.

Like all performance tools, SPRED requires care. If a program is faulting because of memory contention, SPRED operations won't help and may hurt. (In memory contention, reducing the contention is more effective than any SPRED-related operation.) Nor can SPRED reduce shared-page overhead.

## Changing PID-size Type

Before AOS/VS Revision 7.00, programs ran as processes with PIDs up to 255. Effective with Revision 7.00, AOS/VS permits processes to run with PIDs greater than 255. You may not need this feature, called big PIDs, on your system. But on large systems with many user processes, you may want to use big PIDs.

To allow big PIDs, an AOS/VS system must have been generated with a nondefault answer to the VSGEN question *Maximum number of processes*. You may also have to change a program's PID-size type.

SPRED allows you to view or change a program's PID-size type. Briefly, the three PID-size types are:

- ul style="list-style-type: none;">
- smallPID     A program that can run only with a PID below 255.
- hybrid        A program that can run only with a PID below 255 but can create sons below and above 255. The CLI, EXEC, and most other AOS/VS system programs are hybrid programs.
- anyPID        A program that can run above 255 and create sons above and below 255.

Before changing a program's PID-size type, read "Running More than 255 Processes on Your System" in Chapter 15, which explains some reasons for and consequences of changing PID-size type.

## Changing Program Locality

When AOS/VS schedules a process to run, it looks at the process priority and other factors. If you have purchased the optional Class Assignment and Scheduling Package (CLASP) software (or use class system calls and write your own program), you can alter the scheduling of processes.

Briefly, CLASP lets you define classes for processes. A *class* is a set of processes for which you want special scheduling treatment (usually, some percentage of processing time). Each class has one or more user localities (set by PREDITOR) and one or more program localities (set by SPRED). A process will run in a class if its user and program localities match those defined (with CLASP) for the class.

## SPRED Format and Switches

The SPRED command line has the form

**XEQ SPRED** *[/ARGFILE=argfile]*  $\left[ \begin{array}{c} \text{/DISPLAY} \\ \text{/D} \end{array} \right] \left[ \begin{array}{c} \text{/LOGFILE=logfile} \\ \text{/LOG=logfile} \end{array} \right] \left[ \begin{array}{c} \text{/S=symtable} \\ \text{programfile} \end{array} \right]$

Everything except XEQ SPRED is optional; SPRED will ask interactively for the information it needs. But if you use the /ARGFILE or /DISPLAY or /D switch, you must specify the program filename. The switches have the following meanings:

*/ARGFILE=argfile* Tells SPRED to take settings from the filename (pathname) *argfile* and write them into the *programfile*. File *argfile* must be an argument file created during a previous SPRED run. Argument files allow you to apply SPRED edits noninteractively (even in batch, via QBATCH if desired). For example,

```
) X SPRED MYPROG.PR )
```

... (SPRED session. After changing settings, create argument file) ...

```
)
```

Time passes. Someone relinks MYPROG.PR, overwriting the SPRED-edited version.

```
) QBATCH X SPRED /ARGFILE=MYPROG_1.ARG& )  
&) MYPROG.PR )
```

This sequence shows how to use an argument file to implement SPRED edits easily.

For a display of the program's preamble, also include the */D* switch.

*/DISPLAY* or  
*/D*

Tells SPRED to display the program preamble and terminate.

*/LOGFILE=logfile*  
or */LOG=logfile*

Tells SPRED to create (or append to) the file named in *logfile*. SPRED records all dialog just as you see it on the screen.

*/S=symtable*

Names the program symbol table (to resolve symbolic references). This switch is needed *only* if the symbol table has been renamed or moved.

*programfile*

Identifies the program (.PR) file whose preamble you want to edit.

During a SPRED session, SPRED displays settings in square brackets, followed by (*from session*) or (*from file*) if someone changed the original setting in a previous SPRED session. If the original setting is unchanged, it displays the value as [*none*]. For example, the first time you choose to edit the swap file setting, SPRED displays

*Swap file size (in decimal): [none] (from session)*  
*New value:*

If you type a new value, say 400 ↵, then, during this session, SPRED will display the swap file question as

*Swap file size (in decimal): [400] (from session)*  
*New value:*

If, after you initialize the program file, you run SPRED again on this file, it will display

*Swap file size (in decimal): [400] (from file)*  
*New value:*

## Before Running SPRED

To make informed decisions about the values you can change through SPRED, you need to know something about the target process and its relationship to other processes.

If you want to affect program loading and prepaging, you need to know about the form of data storage. For example, is it static storage (in the .PR file) or on a runtime stack or heap?

Changing PID-size type is needed *only* if you want to run more than 255 processes on your system; it's needed to allow a process to run with a PID over 255. Changing PID-size type doesn't directly affect performance. To *check* a program's PID-size type, you needn't run SPRED directly; instead, use the macro PIDSIZE.CLI, supplied with AOS/VS.



Changing program locality is needed only if you want to use process classes on your system — and to base one or more classes on program locality. You might want to change program locality if you have purchased CLASP.

Generally, you should plan to work with only one program at a time; then check performance under typical conditions, and repeat this change/check procedure until you see some improvement (or decide that using SPRED won't make any difference).

After you find SPRED settings that you like for a program, we suggest you create an argument file (and perhaps a log file) with them. This will allow you to implement the settings easily in the future, whenever the program file is rebuilt.

SPRED is shipped in :UTIL, with a help topic file (`()HELP *SPRED )`). To use SPRED, you need read/write access to the program file, read access to the program symbol table, and execute access to SPRED.PR. These are *all* the privileges needed to run SPRED as it is shipped.

SPRED doesn't check VSGEN parameters, so you should check them yourself before starting SPRED. Type `TYPE :SYSGEN:sys.CSF )` to see which options the current AOS/VS system allows. Anything not enabled in VSGEN won't work. SPRED won't report an error, and the program will run as usual, but the action you specified with SPRED won't happen. To enable the SPRED option, you'll have to rerun VSGEN.

SPRED treats all addresses as *octal* and other numbers (like sizes) as decimal numbers of pages.

## SPRED Menu Choices

When you start SPRED interactively (without the `/ARGFILE` switch) and give needed information, it displays a menu. The choices are

- 1) *Display settings from preamble of program file*
- 2) *Clear preamble of program file*
- 3) *Edit variable swap files*
- 4) *Edit program loading regions*
- 5) *Edit prepaging regions*
- 6) *Edit PID-size type*
- 7) *Edit program locality*
- 8) *Apply settings to preamble of program file*
- 9) *Create argument file*

You select a choice by typing its number, then `);` e.g., `1 )`. Or, you can specify multiple choices if you separate them with a comma. To get help, type `HELP )`. You can exit with `BYE )`. Some detail on the choices follows.

1) *Display settings from preamble of program file* Describes program loading, prepaging, swap file settings, PID-size type, program locality, and other information in the program preamble. If SPRED hasn't run on the program before, it displays the system default settings. The initial settings don't change until you initialize the new settings using menu choice 8.

2) *Clear preamble of program file* Restores the original system default (0) to the program loading, prepaging, swap file, and program locality settings, and changes PID-size type to smallPID type. You can then either leave SPRED or specify other settings.

3) *Edit variable swap files* Allows you to change the variable swap file setting. The new setting isn't written to the program until you select choice 8. Here's some background.

During memory contention, sometimes a process must be swapped to disk. If the process's working set has grown while the process was running, the swap file might not be large enough to hold the working set. If this happens, the system must strip pages from the working set until it fits in the swap file. Later when the process swaps back in, it may need the stripped pages back, and take many page faults to get them. These operations take a lot of time. You may be

able shorten this time by setting up a swap file large enough to hold the working set. Working set sizes are displayed by the PED utility, column WSS.

The default maximum swap file size is 126 pages. The default swap file size for all processes not given a custom size (with SPRED) is also 126 pages.

Neither allowing variable swap files nor specifying a large swap file will prevent or inhibit a program from running. The only negative aspect is the loss of disk space. But small swap files can cause problems: do not specify a swap file smaller than the process' WSMIN or the number of pages it wires.

To check or change the swap file value, type 3 ). Then type the new value (limit 512 pages) and ). Or, to retain the old setting (in square brackets), press ).

**4) Edit program loading regions** Allows you to specify pages to be loaded into memory when the process is created. The maximum number for noncontention and contention situations was specified at VSGEN.

Normally, when a process is created, its working set has only a few pages (nominally 0). Program loading multiple pages may be useful if the process will use many unshared pages — it's faster to load most (or all) of the needed pages when the process is created than to fault the pages in later.

Program loading is useful only for static storage — information that's kept in the program file. For example, in FORTRAN, a variable or array that's named or blank COMMON is static. Program loading is *not* useful for information kept on a runtime stack (FORTRAN) or heap (PL/I).

To check or change the program loading regions, type 4 ). SPRED asks

*Do you want to program load whole unshared space? [No]:*

If you decide to program load, it's simple and effective to answer Y ). If you say N (), you'll need to specify start and end addresses, which isn't easy for a high-level language. Even a Link map gives no clear definition of program symbols and their addresses.

To load the entire unshared space, type Y ). To specify addresses, press ); and SPRED will ask for the *Start address* and *End address*.

**5) Edit prepaging regions** Allows you to specify that more than one page will be added to the working set on a page fault. Normally, when a process takes a page fault, the system adds only one page to its working set.

Having a process prepage can help when you know the process will often need more than one page when it takes a fault. (If it needs only one page, only one page will be faulted in.) Prepaging can be useful for *both* static information (stored in the .PR file) and information stored on the runtime stack or heap. It's relevant for high level languages.

To check or change the prepaging setting, type 5 ). SPRED then asks

*Do you want to prepage the whole nonshared space? [No]:*

This pertains to the part of the program in which you want prepage to occur. It doesn't imply that the whole unshared space can be read on a fault. If you decide to prepage, we recommend a Y ) answer. This will enable prepage to occur from the bottom of unshared space to the bottom of shared space. (If you answer ), SPRED will ask for start and end addresses. It's hard to discover meaningful values for these.)

After you answer this question, SPRED asks

*Prepage cluster size (in decimal):*

The range of good answers is 2 (double the norm) to 8 (the size of page files). We suggest that you try a value (say 2 ), run the program, and check performance. If desired, try another value and check performance again. To restore the original default, type 0 ). *Default argument file name: program-pathname\_n.ARG*

*New name:*

6) *Edit PID-size type* Allows you to tell AOS/VS to recognize this program as a SMALLPID, ANYPID, or HYBRID program.

When you select this option, SPRED asks

*PID-size type: [default]*

*Choices are: (SMALLPID, HYBRID, or ANYPID) new value:*

A smallPID program can run only in the PID range 1 through 255. It can't create a process with a PID above 255 (this means it can't create a process if 255 processes are running). It can communicate with a process based on any PID-size type *except* — possibly — a process based on an anyPID program.

A hybrid program can run only in the PID range 1 through 255 — but it can create a process with *any* PID. It can communicate with a process of any PID-size type.

An anyPID program can run in the entire PID range — 1 through the maximum specified at VSGEN. It can create a process with any PID. It can communicate with a process based on any PID-size type *except* — possibly — a process based on a smallPID program.

Generally, you shouldn't change the PID-size type of a smallPID program with SPRED until the program has been checked for any smallPID restrictions. This check is relatively easy to perform; you can do it with the macro PIDCALL\_CHECK.CLI, shipped with AOS/VS.

You can change hybrid programs to anyPID programs without checking, as needed by your environment, if doing so won't jeopardize its communications with smallPID programs on your system. Or, you can change an anyPID program to hybrid without checking it, as needed by your environment, if doing so won't prevent it from running (a hybrid can't run if 255 processes are running).

All these issues, and using macro PIDCALL\_CHECK.CLI, are explained in more detail in Chapter 15, section "Running More than 255 Processes on Your System."

7) *Edit program locality* Allows you to specify a program locality other than the default program locality.

A program's program locality helps determine the class in which the process will run. (The other determining factor is user locality, selectable by PREDITOR.) The default user and program localities are 0 — which, by default, puts every process in the default class.

The main reason to select a nondefault program locality is to give a process a specific percentage of CPU (job processor) time. Other steps involve using the optional Class Assignment and Scheduling Package utility (CLASP) to define a class including this program locality, allotting processor time to the class, and enabling class scheduling. Classes and the optional CLASP utility get a little more detail in Chapter 15, heading "Running More than 255 Processes on Your System;" they are explained fully in the manual *Using the Class Assignment and Scheduling Package*.

When you choose this option, SPRED asks

*Program locality (in decimal): [default]*

Type a number you want and press ↵. The valid range is 0 through 15.

8) *Apply settings to preamble of program file* Tells SPRED to write the current settings to the program file — overwriting the settings already there. You must do this if you want your efforts to be written to the program. Skip it when you're creating an argument file and don't want the values written, or when you want to cancel the session and start again.

When you type 8 ↵, SPRED validates your answers syntactically: it doesn't check VSGEN limits or the program file. If the answers are okay, SPRED writes them to the program file. It verifies by displaying a *...settings applied successfully* message.

9) *Create argument file* Allows you to create an argument file from the current settings. You can use the file later in an X SPRED/ARGFILE=argfile... command to edit a program without a SPRED session. When you type 9 ↵, SPRED asks

The default name is the program name (without .PR), plus \_n (n is the sequence number, 1 for the first argument file for this program, 2 for the second, 3 for the third, and so on), plus .ARG. For the first argument file for :UDD:JONATHAN:TESTPROG.PR, the default name would be :UDD:JONATHAN:TESTPROG\_1.ARG.

Take the default name or type a new one as desired.

When you're done with SPRED, type BYE ↵ to terminate it and return to the CLI.

## SPRED Example

The following example (Figure 9-10) shows a SPRED session for changing PID-size type.

```
) X SPRED TESTPROG.PR ↵

      SPRED - SELECTIVE PREAMBLE EDITOR

      Revision - n
      Filename   - :UDD:JONATHAN:TESTPROG.PR
      Symbol table - :UDD:JONATHAN:TESTPROG.ST

      Do you want to:

          1) Display settings from preamble of program file
          2) Clear preamble of program file
          3) Edit variable swap files
          4) Edit program loading regions
          5) Edit prepaging regions
          6) Edit PID-size type
          7) Edit program locality
          8) Apply settings to preamble of program file
          9) Create argument file

      Type HELP for help, or BYE to exit from program

      Enter choices, separated by commas:  6 ↵

      PID-size type: [SMALLPID] (from program file)
      Choices are: (SMALLPID, HYBRID, or ANYPID)  new value:  anypid ↵

      . . . (header and menu display) . . .

      Enter choices, separated by commas:  8 ↵

      PID-size type setting applied successfully

      . . . (header and menu display) . . .

      Enter choices, separated by commas:  BYE ↵

      )
```

*Figure 9-10. Sample SPRED Session*

## What Next?

In this chapter, you've read about many of the runtime tools other than EXEC: the master CLI, templates, ACLs, and filename suffixes; LOCK\_CLI, for security; PED, for an overview of system activity; SYSLOG and REPORT, for a *record* of system activity; CONTEST for testing; and SPRED for various operations.

System backup is one of the most important operations procedures. Commands and utilities to back up and restore your vital disk-based material are described in the next chapter.

Some tools to handle unusual system conditions — serious problems — include the SCP log and DTOS CPU diagnostics, described in the next chapter.

Other tools include the Disk Formatter, described in Chapter 11. Or, you might want to read about system management considerations, in Chapter 14.

End of Chapter

# Chapter 10

## Backing Up and Restoring Disk Files

Read this chapter

- when you want to decide which program to use for backup;
- when you want to use a command or utility for backup.

AOS/VS runtime programs and tools described in earlier chapters include PREDITOR, EXEC, the CLI, and the display and logging programs. This chapter describes tools for the most important operation *outside* runtime: backup.

This chapter describes the commands and utilities available for backup. They include DUMP or DUMP\_II, PCOPY, and MSCOPY. One, or at most two, of these will fill your needs. Major sections in the chapter are

- Choosing a Backup Program
- Preparing for Backup
- Backup Using DUMP — with Tape
- Backup Using DUMP — with Diskettes
- Backup Using PCOPY (Physical Copy)
- Backup Using MSCOPY (Modified Sector Copy)

Your site should regularly make backup copies of its entire disk file system. Then, if files are lost or accidentally deleted, you can restore them from your backup media. (Backup procedures are sometimes called *archiving*, and the media used sometimes called *archives*). How often you back up your system depends on the size of your installation. You can do it daily, on alternate days, or weekly. It's prudent to do it daily, if possible.

There are several approaches to backup. They are

the DUMP-oriented approach (uses CLI command DUMP or the DUMP\_II program — a faster version of the DUMP command);

the physical copy approach (uses PCOPY program); and

the modified sector approach (uses MSCOPY program and works with model 6236- and 6239-class disk units only).

There are other backup utilities available with specific DG products, but you need one of the ones described above to do system-level backup (to restore LDUs to a state where the other products can work).

DUMP, PCOPY, and MSCOPY are meant for backup on your *local* system: the system that produces the material for backup. Some systems provide for *remote* backup, and use a XODIAC network to move copies of files to a larger central DG system. The file copies on the central system then serve for backup. For details on backup over the network, see the latest revision of the manual *Managing and Operating the XODIAC™ Network Management System*.

## Choosing a Backup Program

The DUMP approach is file oriented. It can back up specific files and directories, allowing some or all of them to be restored with the LOAD command or LOAD\_II program. DUMP runs while AOS/VS is up. You can use it with labeled or unlabeled tape, or labeled diskettes. You can use DUMP to copy entire directories (a full backup) or only those files that have changed since a given date (incremental backup).

PCOPY copies all occupied space on an LDU — no more, no less. There are two versions of PCOPY: a stand-alone PCOPY that runs when AOS/VS is down and can copy any LDU; and a stand-among version that runs when AOS/VS is up (but cannot copy the master LDU).

MSCOPY deals with disk sectors (disk blocks). It can copy only modified sectors: those that have changed since the last full MSCOPY backup. MSCOPY runs while AOS/VS is up; but it can copy only with a nonmaster LDU. MSCOPY is most useful for sites that have very large files where relatively few changes occur (like very large INFOS II or DG/DBMS database files). It takes a long time to back up these files with DUMP or PCOPY; it takes less time to back up only the changed sectors with MSCOPY.

DUMP and PCOPY can both be used for backup; for example, you can run PCOPY once a week and do incremental backups on the intervening days.

MSCOPY does not work well in conjunction with either DUMP or PCOPY, since it relies on its own full-incremental mechanism. If you choose MSCOPY for a nonmaster LDU, you need to use DUMP or PCOPY for backup on the system LDU.

Tradeoffs between the approaches are shown on the facing page.

Generally, you might consider the DUMP approach if

- its versatility appeals to you; and/or
- your system cannot be shut down for an hour or so each day to copy the master LDU; and/or
- you don't have very large database files on a separate LDU (built from model 6236 or 6239 disks);
- you must use diskettes for backup; and/or
- you don't have two identical disk units with removable packs (three for a multiple-disk LDU).

You might consider PCOPY if

- you like the idea of doing only full backups of entire LDUs;
- you must use cartridge tape for backup;
- you have two identical disk units, with removable packs (three for a two-disk LDU); and
- your system can be shut down for a while each day to copy the master LDU.

PCOPY can be used with DUMP (with a little care); this has many benefits with cartridge tape.

You might consider MSCOPY if

- you have a nonmaster LDU composed of model 6236- or 6239-class disks that has one or more large database files — the file(s) undergoing relatively little change (say 10% of a file's records) between backups; and
- your system can be shut down for a while each day to copy this nonmaster LDU; and
- you're willing to use DUMP or PCOPY to back up the master LDU (if needed).

DUMP, DUMP\_II, PCOPY, or MSCOPY work well with *logical disk mirroring*, an approach that maintains logically identical copies of an LDU. For more about logical disk mirroring, and special requirements for backup, see "Using Logical Disk Mirroring for High Availability" in Chapter 15.

**DUMP/DUMP\_II and  
LOAD/LOAD\_II**

Run on any LDU while  
AOS/VS is up.

Are selective, allowing you to  
specify files by date modified  
and/or template.

Allow you to dump or load  
files onto more than one  
LDU in a single command.

Can be run in batch, and  
allows you to create friendly  
CLI macros that prompt the  
system operator.

Cannot dump or restore an  
installed AOS/VS system or  
SYSBOOT; you must install  
these from a system tape or  
diskettes via the Installer if  
desired. They will dump and  
restore system .PR files, and  
you can always bring up a  
system .PR file without in-  
stalling it.

Transfers data slower than  
other programs (but since  
you can be selective, backup  
with DUMP requires less  
data transfer).

Works best in a cycle with  
one full backup followed by  
several incrementals.

Works with any disk model;  
tape or diskette are the pre-  
ferred backup media.

**PCOPY**

Runs only on a nonmaster  
LDU (not the master) while  
AOS/VS is up.

Copies all occupied disk  
blocks; you cannot specify  
date modified or template.

Copies or restores one LDU  
per run.

Requires correct tape or disk  
mounting and issues its own  
prompts.

Copies all occupied blocks,  
including those of an in-  
stalled system and  
SYSBOOT.

Transfers data much faster  
than DUMP (a little faster  
than DUMP\_II). PCOPY is  
fastest for transfer to car-  
tridge tape. But, PCOPY  
copies everything, whether or  
not you need it; DUMP and  
MSCOPY can copy only  
things that have changed.

Works best in sites that have  
large-scale changes. It copies  
all occupied blocks and can't  
do incremental backups.

Works with any disk model;  
tape, diskette, or disk work  
as backup media.

**MSCOPY**

Runs only while AOS/VS is  
up but can back up only a  
nonmaster LDU.

Can do either a full backup  
or incremental backup by  
modified sector. You can't  
specify date or template.

Copies or restores one LDU  
per run.

Requires correct tape mount-  
ing and issues its own  
prompts.

Cannot copy the master  
LDU. MSCOPY works only  
on nonmaster LDUs, but can  
copy the entire LDU, includ-  
ing the installed system and  
bootstraps, if any.

\*



## Preparing for Backup

Before starting a backup, be sure you have enough time and ample backup media. Specifics are given below.

If you use the DUMP approach, all important files must be closed during a dump. (With PCOPY and MSCOPY, all files *are* closed, since the LDU to be backed up is not initialized.) If a file is open when dumped, changes may have been made that have not yet been written to disk. This means that the file dumped is not current — and can make the backup useless.

Ideally, during backups, all timesharing users will be logged off. All CEO, INFOS II, or DG/DBMS processes should have been shut down normally. If abnormal shutdown has occurred since the last backup, be sure that recommended verification programs have been run (to ensure the integrity of databases).

## Backup Using DUMP — with Tape

This section gives some pointers on using the DUMP approach, with tape, and describes some macros to help you do it. All comments on DUMP apply to DUMP\_II. To use DUMP with diskettes, see the next major section.

DUMP and LOAD are very versatile, with switches that are fully detailed in the CLI manual. DUMP\_II accepts all the switches that DUMP does; it produces the same output as DUMP. LOAD or LOAD\_II can load files dumped with either DUMP or DUMP\_II.

The DUMP and LOAD commands (as well as DUMP\_II and LOAD\_II) accept templates. (The system matches templates, dumping or loading the files in the order it finds them, not necessarily in the order you expect. This is also true of the CLI FILESTATUS command.)

DUMP, without a directory name template, copies all files and directories in the working directory to a dump file. It writes a header before each file, with the file's name, date of creation, ACL, and other data. The directory structure is maintained; later, if you load the dump file into the directory from which DUMP was issued, the system will try to recreate the original structure. So, it's *very important* that the working directory be the same for LOAD as it was for DUMP. The root directory (:) is the best directory from which to start backups and restorations.

The dump file (which becomes the input file for load) can be a labeled tape file like ROOT or LDU2, or tape file number like @MTB0:3. For tape, we recommend labeled tapes, although they are not mandatory. Labeled tapes allow a dump to span more than one tape volume.

You can label tapes using the LABEL program, from any CLI process, at any time. Use the tape unit name, then the label (maximum and recommended length six characters). For example,

```
) X LABEL @MTB0 FULL00 )
```

The structure of tape labels and headers is explained in Chapter 8, section "About User Mount Requests". But you don't need to know about label structure to use LABEL for backups.

## Backup Sets of Tapes

The number of reels (or cartridges) you need for backup depends on the amount of disk space you have, change rate of your files, the tape length, the recording density, the buffer size used to dump, and how many tape sets you want to retain. (A tape set includes all volumes of the full backup and all following incrementals, up to the next full backup.) Approximate capacities of different tapes (and diskette) are shown in Table 10-1.

**Table 10-1. Approximate Capacities of Tapes and Diskettes**

| Tape Length                | Recording Density | Buffer Size | Approximate Capacity in Megabytes | Approximate Capacity in Disk Blocks |
|----------------------------|-------------------|-------------|-----------------------------------|-------------------------------------|
| Cartridge                  | 6,400 bpi         | 2,048       | 8                                 | 15,500                              |
|                            |                   | 8,192       | 14                                | 27,000                              |
|                            |                   | 16,384      | 20 (model 6351)                   | 39,000                              |
|                            |                   |             | 74 (model 6352)                   | 144,000                             |
| 1,000 feet<br>(305 meters) | 1,600 bpi         | 8,192       | 16                                | 31,000                              |
| 2,400 feet<br>(732 meters) | 1,600 bpi         | 8,192       | 38                                | 74,000                              |
|                            | 6,250 bpi         | 32,768      | 130                               | 250,000                             |
| Diskette                   | n/a               | default     | .74                               | 1,400                               |

To get the approximate number of tape volumes needed for a full backup of any LDU, type `SPACE ldu-name` and divide the CUR figure by the pertinent capacity in blocks figure. For the master LDU, subtract 20,000 blocks — for system files — from the CUR figure before dividing. (System files usually aren't backed up, since you can restore them from an AOS/VS system tape.)

For incremental backup, take 20% of the number of full backup tapes. Multiply this number by the number of incremental backups you plan between full backups. Add the total incremental backup number to the full backup number. This gives the approximate number of tapes needed for one backup set.

You should have two or more backup sets of tapes. With two sets, you can keep the last backup set intact, and use the *previous* backup set for the new backup. Ideally, you'll have three or more backup sets of tapes.

Remember that dump density and label density must match; if they do not, you will get the message that there is a density mismatch. So, plan ahead: if you want to dump at 6250 bpi (MTD tape drives only), prepare labeled tapes by setting the density switch to 6250 or use the LABEL program's /DENSITY switch (X LABEL/DENSITY=6250).

Tapes and diskettes should have paper labels on them — on which you should write the date, volume ID, and other information you might need to restore the backed up material.

Whatever schedule and plan you come up with, be sure you have enough tapes on hand when you start a backup. If you run out of tapes and can't complete a backup normally, the backup will be incomplete. To make it complete, you'll need to start again from the beginning, with enough tapes.

On an MTB unit, a 2400-foot tape takes roughly 12 minutes to fill (DUMP\_II program) or 20 minutes to fill (DUMP command).

On an MTC unit, model 6125, filling a 1000-foot tape may take about 12 minutes (DUMP\_II) or 20 minutes (DUMP). A cartridge tape, used with a buffer size of 8192, can hold about 14.5 megabytes; but if you use DUMP or DUMP\_II, a cartridge takes 40–50 minutes to fill.

With a cartridge tape, you can shorten backup dramatically by using PCOPY instead of DUMP/DUMP\_II. With a buffer size of 2 Kbytes, PCOPY can fill a cartridge in 6 minutes — but stores only 8 megabytes instead of 15. Thus, with cartridge tape, you may want to use PCOPY for full backups and DUMP for incrementals.

## Storing and Handling Tapes

If you handle and store your reel-to-reel tapes properly, they will last a long time — up to 10,000 reads. And, the data stored on them will remain intact indefinitely. Some handling cautions and hints follow.

- Cold, heat, and dryness can harm tapes. Store tapes between 50° and 90°F, between 10 and 40 C. Use tapes between 60° and 90°F. Relative humidity should be 20%–90%. If you move a tape to a warmer or colder place, give it some time (ideally, 24 hours) to adapt before using it.
- Store tape reels in their outer plastic covers; remove the cover from the tape just before you use it.
- A magnetic field can erase part or all data on a tape. Keep tapes away from electric motors, magnets, and transformers.
- Always handle the tape reel by its hub (center). If you hold the outer flanges, you might squeeze them — compressing and damaging tape edges. Edge damage is a common cause of tape failure.
- If a tape has no paper label, apply one. Write on the label before applying it to the reel, to avoid bending reel flanges. If a label is already on a reel, use only a felt-tipped pen.
- Don't allow tape to rest or drag on the floor. Dust on the tape could prevent data transfer from the heads.
- Never touch tape in the data area. Touch only the tape that precedes the BOT marker (or follows the EOT marker). These reflective markers define the bounds of data. They are adhesive foil strips on the back (nonrecording surface), about 16 feet after the beginning and 25 feet before the end of the tape. If you touch the data area, the oil on your finger could make that part of the tape unreadable.
- Don't bend or twist tape when threading it (if your units have reels). Bending can dislodge the magnetic coating, causing data loss.
- Tapes last a long time, but eventually they wear out. A growing number of *SOFT ERROR* messages are a warning. (A few *SOFT ERROR* messages are normal.)

A *HARD ERROR* or *PHYSICAL UNIT FAILURE* message means that the rest of the tape is unreadable or unwritable. If this message appears during backup, use another tape. If it appears during a restoration, restart the restoration. If the hard error recurs, this probably means you cannot restore data from the rest of the this tape and from subsequent tapes in this set. Try the tape on another unit, if you have one; or clean the unit heads with an alcohol-soaked swab. When all readable tapes have been read, you should bring down AOS/VS and run FIXUP on your LDU, since inconsistent information may have been copied to it.

- Before covering a tape reel, place a foam retainer or plastic strip on the leading edge of the tape. This prevents the tape from unwinding in storage.

## DUMP Macros for Tape

Macros for full and incremental dumps to tape are shown in Figures 10-1 and 10-2. A macro to restore from tape follows later on, in Figure 10-3. DG shipped these macros with AOS/VS to ease backup. You must change a specified character as described in each macro (type `FULL_DUMP` ) before it will work.

Macro `FULL_DUMP.CLI`, Figure 10-1, does a full backup of all initialized LDUs, excluding system-only directories. `INC_DUMP.CLI`, Figure 10-2, does an incremental backup of all initialized LDUs. `INC_DUMP.CLI` dumps only those files created or modified since the last backup — based on file `LAST_DUMP_DATE`, which contains the date and time of the last backup. The backup macros establish tape volume IDs for each dump, and prompt the system operator through each step. They specify a volume ID list of 10 tapes — and allow this volume ID list to be extended.

A dump can back up fewer than 8 megabytes of material (on one 400-foot tape), or include up to 800 megabytes at 1600 bpi or 3.2 gigabytes at 6250 bpi (on 21 2400-foot tapes). The limiting factor is the volume ID list, which can't exceed 128 characters for a single `MOUNT` command. Volume IDs of less than 6 characters would allow more volumes to be specified.

You may want to use these macros — or expanded versions of them — at your own site. Each macro dumps with the `/RETAIN=0` switch. This allows the tape set to be reused immediately, if desired, without relabeling. You may want to use a nonzero retention period — for example, `/RETAIN=28` for full backups and `/RETAIN=7` for incremental backups.

If you have MTB or MTD tape units, you might want to specify the highest density (`/DENSITY=n` switch) in the `DUMP_II` commands; this would ensure the highest density. With an MTD unit, specify a buffer size of 32768 (`/BUFFERSIZE=32768`), in the dump commands.

### Text of `FULL_DUMP.CLI`

```
[!EQUAL,1,2]
[!equal,comment,]
This macro does a full dump of the entire system, excluding system
directories and files, to labeled tape, in batch. It also sets up the
labeled tape volume IDs to be used. The tape volume IDs are FULLnn,
where nn is the sequence number of the tape in the dump.

The tape fileset name used for the dump is ROOT. The macro also explains
how to specify a dump to a second fileset (like UDD), if your system is
large enough to make a second tape fileset worthwhile.

This template used for the dump excludes DG-supplied directories. You
can restore these from your system SYSTAPE and from the INC_DUMP tapes.

A file named LAST_DUMP_DATE is needed in the root directory to start
things off. If it doesn't exist when you run this macro, the macro will
create it.

To execute the macro, the person acting as system operator must go to a
user console, log on as a Superuser (like OP), and type the macro name.
The macro will then help him/her through the procedure. Tape mounts
and CONTROL @EXEC MOUNTED commands at the system console will be needed.

The command and pseudo macro syntax used is explained in the CLI manual.[!end]
```

Figure 10-1. `FULL_DUMP.CLI` Macro, for a Labeled Tape Dump (continues)

```

[!equal,comment,] Make sure EXEC operator mode is on. [!end]

[!nequal,(ON),([!operator])]
  write Error - Operator is not on. Please go to the system console and type
  write [!read CONTROL @EXEC OPERATOR ON newline. Return here and press newline.]
[!end]

[!equal,comment,] Check for file LAST_DUMP_DATE. If it doesn't exist,
tell user, then create it. [!end]

push
dir :
superuser on

[!nequal,([!filenames LAST_DUMP_DATE]),()]
  [!equal,([!filenames DATE_DUMP_STARTED]),()]
    write Last dump was done on ..., [LAST_DUMP_DATE]
    write/1=DATE_DUMP_STARTED [!date]:[!time]
  [!else]
    write Full dump was started at ..., [DATE_DUMP_STARTED]
  [!end]
[!else]
  write File LAST_DUMP_DATE doesn't exist! I am creating a LAST_DUMP_DATE
  write file that specifies today's date and the current time as follows:
  write [!date]:[!time]
  write If you don't do a full dump today please delete LAST_DUMP_DATE
  write/1=LAST_DUMP_DATE [!date]:[!time]
[!end]

write
write *** ,, Full dump of directory [!dir] on [!date]:[!time] ,, ***
write
[!equal,comment,] Get person's name and write to file DUMPERS_NAME.[!end]

delete/2=ignore :DUMPERS_NAME
write/1=:DUMPERS_NAME [!read Please type your name: ]
pop
dir/i

[!equal comment,] Post the needed mount and dump commands in batch.[!end]
qbatch/m/operator
superuser on
dir :

[!equal,comment,] Issue a mount command for 10 labeled tape volumes.
The volids for full backup are full100, full101,...full109. (First, to prevent
problems, delete any linkname of the name MYTAPE in user's directory.)[!end]

delete/2=ignore :udd:[!username]:MYTAPE

mount/extend/volid=full100/volid=full101/volid=full102/volid=full103&
/volid=full104/volid=full105/volid=full106/volid=full107/volid=full108&
/volid=full109 MYTAPE Please mount the longest tape you can.

```

Figure 10-1. FULL\_DUMP.CLI Macro, for a Labeled Tape Dump (continued)

```
[!equal,comment,] Now dump to the labeled tape file. The fileset name
used here is ROOT. The template does not exclude UDD or any nonmaster
LDUs. If you want a dump separate from ROOT (like UDD), exclude the
directory(s) via the dump template. Then insert a "mount/volid=dirnn"
and "dump ... dir:#" command after the dismount command. For example,
to exclude UDD from the ROOT dump and include it in a separate dump:
1. Add the text \UDD:# to the ROOT dump template.
2. Add commands mount/volid=UDD00/vol=UDD01... MYTAPE Please and
dump ... MYTAPE:UDD UDD:#\?+.BRK\+.ED\+.LS\?+.TMP
after the dismount command.
```

```
The listing file (/l) in batch is the line printer. [!end]
```

```
write/l This is a full backup of directory [!dir] started at
write/l [!date]:[!time] by [DUMPERS_NAME]
```

```
dump_II/v/l/buffersize=8192/retain=0 &
:UDD:[!username]:MYTAPE:ROOT &
#\HELP\NET\PAGE\PATCH\PER\PROC\QUEUE\SWAP\SWAP.SWAP\SYSGEN\UTIL&
\?+.BRK\+.ED\?+JOB\+.LS\?+.TMP NET:NETGEN:+
```

```
dismount MYTAPE Full dump of directory [!dir] is done.
pause 5
send 2 ,, Check the printer -- file [!username].OUTPUT.n -- for errors.
send 2 ,, A list of files dumped is printed in file [!username].LIST.n
```

```
[!equal,comment,] Delete and rename file LAST_DUMP_DATE... but do it
only if file DATE_DUMP_STARTED exists. This prevents LAST_DUMP_DATE
from being deleted if the batch job was aborted. The terminating )
is needed for qbatch/m syntax. [!end]
```

```
[!nequal,([!filenames DATE_DUMP_STARTED]),()]
delete/2=ignore LAST_DUMP_DATE
rename/2=ignore DATE_DUMP_STARTED LAST_DUMP_DATE
[!end]
)
[!ELSE]
write This macro is nonexecutable. To make it executable you must use a
write text editor to change the 2 in line 1 to 1 -- both numbers must be 1.
write
write Backup is very important. Before using the edited macro routinely
write for backup you should understand how it works. Please test this
write macro. Use it to back up files. Then try restoring files using
write the RESTORE_TAPE macro -- before relying on this macro for backup.
[!END]
```

Figure 10-1. FULL\_DUMP.CLI Macro, for a Labeled Tape Dump (concluded)

## Text of Macro INC\_DUMP.CLI

```
[!EQUAL,1,2]
[!equal,comment,]
This macro does an incremental dump of the entire system, excluding
system directories and files, to labeled tape, in batch. It also sets up
the labeled tape volume IDs to be used. The tape volume IDs are INCRnn,
where nn is the sequence number of the tape in the dump.

The tape fileset name used for the dump is ROOT. The macro also explains
how to specify a dump to a second fileset (like UDD), if your system is
large enough to make a second tape fileset worthwhile.

This template used for the dump includes DG-supplied directories. You
can restore these from your system SYSTAPE and from dumps produced by
this macro.

A file named LAST_DUMP_DATE is needed in the root directory to start
things off. If it doesn't exist when you run this macro, the macro will
recommend recovery steps and stop.

To execute the macro, the person acting as system operator must go to a
user console, log on as a Superuser (like OP), and type the macro name.
The macro will then lead him/her through the procedure. Tape mounts
and CONTROL @EXEC MOUNTED commands at the system console will be needed.

The command and pseudo macro syntax used is explained in the CLI manual.[!end]

[!equal,comment,] Make sure EXEC operator mode is on. [!end]

[!nequal,(ON),([!operator]])
  write Error - Operator is not on. Please go to the system console and type
  write [!read CONTROL @EXEC OPERATOR ON newline. Return here and press newline.]
[!end]

[!equal,comment,] Check for file LAST_DUMP_DATE. If it doesn't exist,
skip to end, give recovery advice, and stop. [!end]

push
dir :
superuser on

[!nequal,([!filenames LAST_DUMP_DATE]),()]
  [!equal,([!filenames DATE_DUMP_STARTED]),()]
    write This dump will back up all dumpable files created or
    write modified since [LAST_DUMP_DATE]
    write/1=DATE_DUMP_STARTED [!date]:[!time]
  [!else]
    write The last incremental dump was started at [DATE_DUMP_STARTED]
  [!end]

write
write *** ., Incremental dump of directory [!dir] on [!date]:[!time] ., ***
write
```

Figure 10-2. INC\_DUMP.CLI Macro, for an Incremental Labeled Tape Dump (continues)

```

[!equal,comment,] Get person's name and write to file :DUMPERS_NAME.[!end]
delete/2=ignore :DUMPERS_NAME
write/1=:DUMPERS_NAME [!read Please type your name: ]

pop
dir/i
[!equal comment,] Post the needed mount and dump commands in batch.[!end]
qbatch/m/operator
superuser on
dir :

[!equal,comment,] Issue a mount command for 10 labeled tape volumes. The
valids for incremental backup are INCR00, INCR01, etc. (First, to prevent
problems, delete any linkname of the name MYTAPE in user's directory.)[!end]

delete/2=ignore :udd:[!username]:MYTAPE

mount/extend/volid=incr00/volid=incr01/volid=incr02/volid=incr03&
/volid=incr04/volid=incr05/volid=incr06/volid=incr07/volid=incr08&
/volid=incr09 MYTAPE Please mount the longest tape you can.

[!equal,comment,] Now dump to the labeled tape file. The fileset name
used here is ROOT. The template does not exclude UDD or any nonmaster
LDUs. If you want a dump separate from ROOT (like UDD), exclude the
directory(s) via the dump template. Then insert a "mount/volid=dirnn"
and "dump ... dir:#" command after the dismount command. For example,
to exclude UDD from the ROOT dump and include it in a separate dump:
1. Add the text \UDD:# to the ROOT dump template.
2. Add commands mount/volid=UDD00/vol=UDD01... MYTAPE Please and
dump ... MYTAPE:UDD UDD:#\+.BRK\+.ED\+.LS
after the dismount command.

The listing file (/1) in batch is the line printer. [!end]

write/1 This is an incremental backup of directory [!dir] started at
write/1 [!date]:[!time] by [DUMPERS_NAME]
string [LAST_DUMP_DATE]
write/1 It dumps all files created or modified since [!string]

dump_II/v/1/buffersize=8192/retain=0/after/tlm=[!string] &
:UDD:[!username]:MYTAPE:ROOT &
#\NET\PAGE\PER\PROC\QUEUE\SWAP\SWAP.SWAP\SYSGEN&
\?+.BRK\+.ED\?+JOB\+.LS\?+.TMP NET:NETGEN:+

dismount MYTAPE Incremental dump of directory [!dir] is done.
pause 5
send 2 ,, Check the printer -- file [!username].OUTPUT.n -- for errors.
send 2 ,, A list of files dumped is printed in file [!username].LIST.n

[!equal,comment,] Delete and rename file LAST_DUMP_DATE... but do it
only if file DATE_DUMP_STARTED exists. This prevents LAST_DUMP_DATE
from being deleted if the batch job was aborted. The terminating
paren is needed for qbatch/m syntax. [!end]

```

Figure 10-2. INC\_DUMP.CLI Macro, for an Incremental Labeled Tape Dump (continued)



```

[!inequal,([!filenames DATE_DUMP_STARTED]),()]
  delete/2=ignore LAST_DUMP_DATE
  rename/2=ignore DATE_DUMP_STARTED LAST_DUMP_DATE
[!end]
)

[!else]
  write Error - File LAST_DUMP_DATE doesn't exist! Cannot do incremental
  write dump without it. Suggest full dump. If you can remember the
  write date of the last backup -- full or incremental -- create a
  write file named LAST_DUMP_DATE containing this date and retry %0%
  write The form of the date is dd-mmm-yy -- for example
  write 09-MAY-85
  pop
[!end]
[!ELSE]
  write This macro is nonexecutable. To make it executable you must use a
  write text editor to change the 2 in line 1 to 1 -- both numbers must be 1.
  write
  write Backup is very important. Before using the edited macro routinely
  write for backup you should understand how it works. Please test this
  write macro. Use FULL_DUMP and this macro to back up files. Then try
  write restoring files using the RESTORE_TAPE macro -- before relying on
  write this macro for backup.
[!END]

```

Figure 10-2. INC\_DUMP.CLI Macro, for an Incremental Labeled Tape Dump (concluded)

A typical sequence with the backup macros might go as follows.

### Full Dump Example

You make sure timesharing users are logged off and that CEO, INFOS II, and/or DG/DBMS processes (if you have them) are shut down.

You log onto a user console with a privileged username and password. Then type

) FULL\_DUMP )

*Last dump was done on 22-MAY-85:17:56:22*

(The first time it's run, the macro displays a *does not exist* and *creating* message about file LAST\_DUMP\_DATE.)

\*\*\* Full dump of directory : on 23-MAY-85:18:22:40 \*\*\* Please type your name: SAM )

... (Pause) ...

Go to system console, which beeps and says

From Pid n (EXEC): \*\* EXPLICIT LABELLED MOUNT \*\*

From Pid n : MID=n, USER=xxx, PID=n, EXEC SUB\_TREE PID=n

From Pid n : CURRENT VOLUME: full00, ALL VOLUME(S): full00, full01,

From Pid n : full02, full03, full04, full05, full06, full07, full08, full09

From Pid n : REQUEST IS 'Please mount the longest tape that you can.'

From Pid n : UNIT(S) ARE: NONE

From Pid n : RESPOND: CONTROL @EXEC MOUNTED @UNITNAME

From Pid n : OR: CONTROL @EXEC REFUSED

Write enable the longest tape your largest tape unit can hold. Mount the tape on a unit, say MTB0. Use unit switches to select the highest density (if there's a choice). If you've already used the macro, the tape's already labeled and you needn't relabel it. If you haven't run the macro on this tape, relabel it via

```
) X LABEL @MTB0 FULL00 )
```

Tell EXEC that the tape is mounted:

```
) CX MOUNTED @MTB0 )
```

The dump begins on this volume. If all specified material fits, the macro issues DISMOUNT and EXEC prompts for a dismount on the system console. But probably, all material won't fit on one volume — and, at the end of tape mark, EXEC will say

```
From Pid n (EXEC): ** NEXT VOLUME **  
From Pid n : MID=n, USER=xxx, PID=n, EXEC SUB_TREE PID=n  
From Pid n : CURRENT VOLUME: full01, ALL VOLUME(S): full00, full01,  
From Pid n : full02, full03, full04, full05, full06, full07, full08, full09  
From Pid n : REQUEST IS 'Please mount the longest tape you can.'  
From Pid n : UNIT(S) ARE: @MTB0  
From Pid n : RESPOND: CONTROL @EXEC MOUNTED  
From Pid n : OR: CONTROL @EXEC REFUSED
```

Remove volume FULL00 from the tape unit, mount volume FULL01 on it, and type CX MOUNTED ). (If you have several tape units, you can premount volume FULL01 and maybe FULL02 on other units, saving steps.) If you mount a volume that has the wrong label or file set ID, EXEC will say MOUNT ERROR and WRONG VOLUME, and prompt for the correct volume from the MOUNT volume ID list. You can either dismount the current tape and find and mount the correct tape, or use X LABEL to relabel the tape; then type CX MOUNTED ).

This sequence repeats until the system has dumped all files (excluding those excluded in the dump template) to the tape fileset.

If ten volumes aren't enough for the full backup, EXEC prompts for another tape. Mount one, using LABEL to label it if needed (use the same volume ID sequence: FULL11, FULL12, and so on). When you see the following message on the system console

```
From Pid n : (EXEC) ** WAITING TO BE DISMOUNTED **  
...  
From Pid n : REQUEST IS 'Full dump of directory : done.'  
From Pid n : RESPOND CONTROL @EXEC DISMOUNTED
```

You can dismount the tape(s) and type CX DISMOUNTED ). This completes the full dump. You can file the unused volumes (if any). If you needed extra volumes, note their names on the dump listing and think about adding their volume IDs to the dump macro MOUNT command.

As with any user mount, you can refuse a request (CX REFUSED ) to restart. Or you can cancel the batch job with QCANCEL sequence-number ) or CX FLUSH sequence-number ). Cancelling the batch job will abort a dump in progress; and you will need to type CX DISMOUNTED ) on the system console.

After the dump completes, make sure each reel has a paper label with its volume ID, the file set name (ROOT), and the date. Store the reels safely, in order. You can use them again for another full dump.

You can reuse the backup tapes as often as desired — for example, every 6 weeks for full dumps, and every 10 working days for incremental dumps. This depends on how many backup sets (full and all incremental) you want to keep.

## Incremental Dump Example

As with the full dump, you make sure timesharing users are logged off and that CEO, INFOS II, and/or DG/DBMS processes (if you have them) are shut down.

You log on to a user console with a privileged username and password. Then:

) INC\_DUMP )

*Last dump was done on 23-MAY-85:18:22:40* (If the file with the last dump date doesn't exist, it will tell you to run a full dump and stop.)

*This dump will back up all dumpable files created or modified since 23-MAY-85:18:22:40*

\*\*\* Incremental dump of directory : on 24-MAY-85:18:10:30 \*\*\*

Please type your name: SAM )

... (Pause) ...

Go to system console, which beeps and says

*From Pid n (EXEC): \*\* EXPLICIT LABELLED MOUNT \*\**  
*From Pid n : MID=n, USER=xxx, PID=n, EXEC SUB\_TREE PID=n*  
*From Pid n : CURRENT VOLUME: incr00, ALL VOLUME(S): incr00, incr01,*  
*From Pid n : incr02, incr03, incr04, incr05, incr06, incr07, incr08, incr09*  
*From Pid n : REQUEST IS 'Please mount the longest tape that you can.'*  
*From Pid n : UNIT(S) ARE: NONE*  
*From Pid n : RESPOND: CONTROL @EXEC MOUNTED @UNITNAME*  
*From Pid n : OR: CONTROL @EXEC REFUSED*

As with the full backup, write-enable the longest tape your largest tape unit can hold. Mount it on a unit, say MTB0. Use drive switches to select the highest density (if there's a choice). If you've already used the macro, the tape's already labeled and you needn't relabel it. If you haven't run the macro on this tape, relabel it via

) X LABEL @MTB0 INCR00 )

Tell EXEC that the tape is mounted:

) CX MOUNTED @MTB0 )

The dump begins on this volume. If all modified files fit, the macro issues DISMOUNT and EXEC prompts for a dismount on the system console. Often, all incremental dump material will fit on one volume. But if it won't fit, the system will reach the end of tape and EXEC will say

*From Pid n (EXEC): \*\* NEXT VOLUME \*\**  
*From Pid n : MID=n, USER=xxx, PID=n, EXEC SUB\_TREE PID=n*  
*From Pid n : CURRENT VOLUME: incr01, ALL VOLUME(S): incr00, incr01,*  
*From Pid n : incr02, incr03, incr04, incr05, incr06, incr07, incr08, incr09*  
*From Pid n : REQUEST IS 'Please mount the longest tape you can.'*  
*From Pid n : UNIT(S) ARE: @MTB0*  
*From Pid n : RESPOND: CONTROL @EXEC MOUNTED*  
*From Pid n : OR: CONTROL @EXEC REFUSED*

If EXEC prompts for another volume, remove the old one from the unit, mount the next (here, volume INCR01), and type CX MOUNTED ). (If you have several units available, you can premount volume INCR01 on another unit, saving a step.) If you mount a volume that has the wrong label or file set ID, EXEC will say MOUNT ERROR and WRONG VOLUME, and prompt you to mount the correct volume from the MOUNT volume ID list. You can either find and mount the correct tape or type X LABEL ) to relabel a scratch tape, then type CX MOUNTED ).

This sequence repeats until the system has dumped all files (excluding those excluded in the dump template) to the tape file set.

Nearly always, 10 volumes will be enough for an incremental backup. (If not, EXEC will ask for another tape. Mount one and label it if needed using LABEL and the original volume ID sequence — INCR11, INCR12, and so on.) When you see the following message on the system console

*From Pid n : (EXEC) \*\* WAITING TO BE DISMOUNTED \*\**

...

*From Pid n : REQUEST IS 'Incremental dump of directory : done.'*

*From Pid n : RESPOND CONTROL @EXEC DISMOUNTED*

You can dismount the tape(s) and type CX DISMOUNTED ). This completes the incremental dump. You can file the unused volumes. If you needed extra volumes, note their names on the dump listing and think about adding their volume IDs to the dump macro.

As with any user mount, you can refuse a request (CX REFUSED ) to restart; or you can cancel the batch job with QCANCEL sequence-number ) or CX FLUSH sequence-number ). Cancelling the batch job will abort a dump in progress; you will need to type CX DISMOUNTED ) at the system console.

After the dump completes, make sure each reel has a paper label with its volume ID, the file set name (ROOT), and the date. Store the reels safely, in order. You can use them again for another incremental dump.

You can reuse the backup tapes as often as desired — for example, every 6 weeks for full dumps, and every 10 working days for incremental dumps. This depends on how many backup sets (full and all incremental) you want to keep.

These dump macros, with the restore macro, can save a lot of time, effort, confusion — and data.

## Verifying Dumped Material on Tape

Nearly always, dumped material will load perfectly, restoring your old file structure. But, if you really need to make sure there are no tape errors, you can do so quite quickly via the CLI command COPY. To verify a dumped tape, mount it on a tape unit and type the following commands

|                                      |                          |
|--------------------------------------|--------------------------|
| ) COPY/IMTRSIZE=80 @NULL @MTxn:0 )   | (Tape unit name, file 0) |
| ) COPY/IMTRSIZE=8192 @NULL @MTxn:1 ) | (Tape unit name, file 1) |
| ) COPY/IMTRSIZE=80 @NULL @MTxn:2 )   | (Tape unit name, file 2) |

These COPY commands do fast reads on the physical devices. They use a buffer size (IMTRSIZE for COPY) of 80 for the labeled tape leader, 8192 (specified in the DUMP) for the data on tape, and 80 for the trailer. The output file is generic file @NULL, so the data read is not written; this speeds things up. If all tape volumes read without errors, you can be virtually certain that it will load without errors.

You can verify each tape from the system console, if desired, after the entire dump or while EXEC is prompting for the next volume.

### **Verifying Material Dumped on a Model 6351 Tape Drive**

On most tape drives, dumped material will load correctly because the tape drives have a read head that verifies material when it is dumped (written by the write head). There is an exception to this general design. Model 6351 tape drives have only one head. For this reason, it is possible, especially with old tape, to dump to a tape that cannot be read. An easy way to verify a tape in this instance is to rewind the tape after the dump, and then use the LOAD command with the /N (name) switch. If the system can read the tape, it will display the names of file dumped on your screen. For example

```
REWIND @MTJ0 ;  
LOAD /N @MTJ0 ;
```

```
... (names of dumped files) ...
```

```
)
```

### **Restoration Macro for Tape**

Macro RESTORE\_TAPE.CLI, Figure 10-3, restores material from either a full or incremental backup. By default, it uses the volume IDs used for incremental backups, but you can tell it to restore from a full backup. RESTORE\_TAPE.CLI requires only the starter system disk structure — as created by an AOS/VS system tape — to restore incremental and full backups.

## Text of Macro RESTORE\_TAPE.CLI

```
[!EQUAL,1,2]
[!equal,comment,]
This macro restores files from either an incremental or full dump (done
by the FULL_DUMP or INC_DUMP macros), in batch. The macro expects the tape
volume IDs to be of the form FULLnn or INCRnn, as created by the dump
macros. The default is INCRnn. The macro accepts pathname arguments, so
you can use it to restore individual files. To work, the macro requires
a basic system file structure, which you can restore using your system
SYSTAPE tape if needed.

The tape fileset name used for the restoration is ROOT. The macro also
explains how to specify a dump to a second fileset (like UDD), if you
have dumped files to filesets other than ROOT.

To execute the macro, the person acting as system operator must go to a
user console, log on as a Superuser (like OP), and type the macro name.
Tape mounts and CONTROL @EXEC MOUNTED commands at the system console
will be needed. The most efficient course is to restore the last
incremental backup first, then move backwards though the most recent full
backup.

The command and pseudo macro syntax used is explained in the CLI manual.[!end]

[!equal,comment,] Make sure EXEC operator mode is on. [!end]

[!nequal,(ON),([!operator]])
  write Error - Operator is not on. Please go to the system console and type
  write [!read CONTROL @EXEC OPERATOR ON newline. Return here and press newline.]
[!end]

write The default restoration assumes you are restoring from incremental
write dump tapes -- with volume IDs INCR00 and INCR01 and INCR02 and
write so on. If you want to restore a full backup -- with volume IDs
write FULL00 and FULL01 and FULL02 and so on -- you must specify FULL.
write
write For incremental press newline.
string [!read For full type FULL and press newline. ]
write

delete/2=ignore :UDD:[!username]:?DUMP_TYPE.TMP
[!equal,([!string]),(FULL)]
  write ,, *** Restoring full backup. Need volume IDs FULL01 FULL01 etc. ***
  write/l=:UDD:[!username]:?DUMP_TYPE.TMP FULL
[!else]
  write *** Restoring incremental backup. Need volume IDs INCR01 INCR01 etc. ***
  write/l=:UDD:[!username]:?DUMP_TYPE.TMP INCR
[!end]

[!equal,comment,] Get person's name and write to file :RESTORERS_NAME.[!end]
push
superuser on
dir :
```

Figure 10-3. RESTORE\_TAPE.CLI Macro, to Restore Dumped Files (continues)

```

delete/2=ignore :RESTORERS_NAME
write
write/1=:RESTORERS_NAME [!read Please type your name: ]
pop
dir/i

[!equal comment,] Post the needed mount and dump commands in batch.[!end]
qbatch/m/operator
superuser on
dir :

[!equal comment,] Issue a mount command for 10 labeled tape volumes. The
volids depend on the choice above -- INCRnn or FULLnn. (First, to
prevent problems, delete any linkname of the name MYTAPE in the user's
directory.) [!end]

delete/2=ignore :udd:[!username]:MYTAPE
string [:UDD:[!username]:?DUMP_TYPE.TMP]

mount/extend/volid=[!string]00/volid=[!string]01/volid=[!string]02&
/volid=[!string]03/volid=[!string]04/volid=[!string]05/volid=[!string]06&
/volid=[!string]07/volid=[!string]08/volid=[!string]09 MYTAPE &
Please mount the correct tape volume.

[!equal comment,] Now load from the labeled tape file. If the person
included pathname arguments 1-n, include them in the load command line.
If he/she omitted arguments, restore the entire dump.

The fileset name used here is ROOT. It does not include any directory
that was excluded from ROOT in the dump macros. If you have a dump
fileset separate from ROOT, you must load it separately, by fileset
name. Use the syntax shown in the mount and load commands above, with
your own custom volid names and fileset name. If the dump file includes
any nonmaster LDUs, be sure they're initialized before you load from
the dump tape. (Otherwise, the load command will recreate the
dump file directory on the master LDU.)

The listing file (/1) in batch is the line printer. [!end]

write/1 This is an [!string] restoration of directory [!dir] started
write/1 at [!date]:[!time] by [RESTORERS_NAME]

load/v/1/buffersize=8192/recent &
:udd:[!username]:MYTAPE:ROOT &
%1-%

dismount MYTAPE [!string] restoration of directory [!dir] is done.
pause 5
send 2 ,, Check the printer -- file [!username].OUTPUT.n -- for errors.
send 2 ,, A list of files restored is printed in file [!username].LIST.n
send 2 ,, Don't forget to restore the other dumps, if this applies.
delete/2=ignore :UDD:[!username]:?DUMP_TYPE.TMP

[!equal comment,] The following paren is needed for qbatch/m syntax. [!end]
)

```

Figure 10-3. *RESTORE\_TAPE.CLI Macro, to Restore Dumped Files (continued)*

```
[!ELSE]
write This macro is nonexecutable. To make it executable you must use a
write text editor to change the 2 in line 1 to 1 -- both numbers must be 1.
write
write Backup is very important. Before using the edited macro routinely
write for backup you should understand how it works. Please test this
write macro. Back up some files using FULLDUMP and INC_DUMP. Then
write restore files using this macro before relying on the macro set for
write backup.
[!END]
```

Figure 10-3. *RESTORE\_TAPE.CLI Macro, to Restore Dumped Files (concluded)*

## About Restoring Files from Dump Tapes

Restoring falls into two categories: restoring one or more files, and restoring one or more LDUs. The first category is more common, and easier and faster.

### Restoring One or More Files

Usually, people restore one or more files when someone has accidentally deleted a file (perhaps a directory) or group of files. Perhaps someone was careless with DELETE and a template character — or, for whatever reason, you want to restore files that were backed up to tape.

There are two things to consider when you plan this kind of restoration — the tape set(s) needed, and the pathname template.

The tape set(s) you use for restoration depend on the date that the lost file(s) were last modified. If the files were created since the last backup, then they weren't backed up, thus cannot be restored. Otherwise, use the backup that occurred soonest after the files were modified (incremental or full).

If you can't determine when the files were last modified, check the backup listings. If the name of a lost file appears in any listing, then you know the file is in that backup. In the worst case, without a listing or dates, you must restore the last full backup set, then the earliest incremental backup, then the next incremental backup, and so on. This is a good reason to keep your backup listings — especially for incremental backups.

After deciding on the tape set, you must choose one or more pathname templates (unless you want to restore the entire backup). The RESTORE macro allows template arguments in which you can specify a directory, a specific file, or a directory and pathname template.

You can restore all files in and below a directory (including subordinate directories), with the template

pathname-from-root:#

You can restore all files in and below a user's directory with the template

UDD:username:# (omit the leading : from UDD)

For CEO files, the directory structure and restoration procedure differs from that for standard AOS/VS files. To restore CEO files, see *Managing the CEO System*.



## File Restoration Example

As an example, assume Andy accidentally deleted two files named REPORT.MAY and SUMMARY. He last modified them a week ago. (If lost files were last modified on different dates, it may be most efficient to use the last full backup). In the role of system operator, you find and get the appropriate set of tapes.

You need a template for the restoration. The two filenames have the letters MA in common. So, you could use the template

```
UDD:ANDY:#:+MA+
```

This would work, but it might restore many matching, unwanted files. You can be more specific. The two names each have at least one character — and no period — following the A. So you could refine the template to

```
UDD:ANDY:#:+MA*-
```

Or, if you know which directory the files were in, you could use the specific pathnames:

```
pathname-from-root:REPORT.MAY  pathname-from-root:SUMMARY
```

Let's say you decide on the most general course — the +MA+ template — to cover many possibilities.

You log on to a user console with a privileged username and password. Then type

```
) RESTORE_TAPE  UDD:ANDY:#:+MA+ )  (Start macro, specifying the desired tem-
                                     plate.)
```

```
The default restoration assumes you are....  (Macro describes the two
.   kinds of restorations.)
.
.
```

```
For incremental press newline.              (Press ) to select incremental.)
```

```
For full type FULL newline.  )
```

```
Restoring incremental backup -- expect volume IDs INCR00...
```

```
Please type your name:  SAM )
```

```
... (Pause) ...
```

Go to system console, which beeps and says

```
From Pid n (EXEC): ** EXPLICIT LABELLED MOUNT **
```

```
From Pid n : MID=n, USER=xxx, PID=n, EXEC SUB_TREE PID=n
```

```
From Pid n : CURRENT VOLUME: INCR00, ALL VOLUME(S): INCR00, INCR01,
```

```
From Pid n : INCR02, INCR03, INCR04, INCR05, INCR06, INCR07, INCR08, INCR09
```

```
From Pid n : REQUEST IS 'Please mount the correct tape volume.'
```

```
From Pid n : UNIT(S) ARE: NONE
```

```
From Pid n : RESPOND:          CONTROL @EXEC MOUNTED @UNITNAME
```

```
From Pid n : OR:              CONTROL @EXEC REFUSED
```

Mount the first tape in the file set on a unit, say MTB0.

Tell EXEC that the tape is mounted:

```
) CX MOUNTED  @MTB0 )
```

The restoration begins from this volume. If this is the only volume in the tape set, or if the system has restored all files you specified (you must have specified entire filenames, not templates), then the macro issues DISMOUNT and EXEC prompts for a dismount on the system console. For the sake of this example, assume another volume is needed. At the end of tape mark on volume INCR00, EXEC says

```
From Pid n (EXEC): ** NEXT VOLUME **
From Pid n : MID=n, USER=xxx, PID=n, EXEC SUB_TREE PID=n
From Pid n : CURRENT VOLUME: INCR01, ALL VOLUME(S): INCR00, INCR01,
From Pid n : INCR02, INCR03, INCR04, INCR05, INCR06, INCR07, INCR08, INCR09
From Pid n : REQUEST IS 'Please mount the longest tape you can.'
From Pid n : UNIT(S) ARE: @MTB0
From Pid n : RESPOND: CONTROL @EXEC MOUNTED
From Pid n : OR: CONTROL @EXEC REFUSED
```

Remove volume INCR00 from the tape unit, mount volume INCR01 on it, and type CX MOUNTED ). (If you have several tape units, you can premount volume INCR02 on another units, saving a step.) If you mount a volume that has the wrong label or file set ID, EXEC will say MOUNT ERROR and WRONG VOLUME, and prompt you to mount the correct volume in the MOUNT volume ID list. Dismount the tape; find and mount the correct tape, then type CX MOUNTED ).

This sequence repeats until the system has restored the files or read the entire file set of tapes. When you see the following message on the system console

```
From Pid n : (EXEC) ** WAITING TO BE DISMOUNTED **
...
From Pid n : REQUEST IS 'INCR restoration of directory : is done.' From Pid n : RE-
SPOND CONTROL @EXEC DISMOUNTED
```

You can dismount the tape(s) and type CX DISMOUNTED ). This completes the restore. Check the printer for verification of files restored; and store the tape reels safely.

As with any user mount, you can refuse a request (CX REFUSED ) to restart; or you can cancel the batch job with QCANCEL sequence-number ) or CX FLUSH sequence-number ). Cancelling the batch job will abort a restoration in progress; and you will need to type CX DISMOUNTED ) on the system console.

With the files restored, tell Andy to check them — and to check his directories for unwanted, restored files. He can then delete the unwanted files.

(If Andy had created the files in CEO (the full product, not CEO Word Processor — Independent), and had accidentally deleted “documents” named REPORT.MAY and SUMMARY, suggest that he check the CEO Wastebasket. In the full CEO, documents are not actually deleted until a program called Janitor has been run. Until then, documents that people delete can be retrieved from their Wastebaskets. If Andy’s documents are not in his Wastebasket, you can restore them from the last backup — as described in *Managing the CEO System*.)

### Shortening a Restoration

When you mention a specific filename (like UDD:SAM:MYFILE) in a restoration, the restoration will end and the CLI prompt will return *as soon as the file has been copied to disk*.

The restoration will take longer if you use a template like UDD:SAM:MYF+ because the system will continue through the last tape, even after the desired file has been copied. This happens because AOS/VS can’t tell, until it reaches the end of the last tape, that there is no matching filename in the tape fileset.

Generally, this means that it’s desirable to give a specific filename, if you can. But if you do, be sure it’s the correct one — if you make a mistake with a specific filename, the system will take you all the way through the tape set, and not restore the file you want restored. If you think this may be happening, cancel the batch job via QCANCEL n ) (n is the batch job sequence number, displayed by the QDISPLAY command). Then start again.

## Restoring an Entire LDU Using Dump Tapes — When and How

The time may come when you need to restore all backup material to an LDU. This can happen when a disk wears or fails in such a way that the system can no longer read it.

If you have checked with DG, and either acquired a new disk or decided to rebuild the old one, follow these steps.

1. To restore the master LDU, continue. To restore a nonmaster LDU, skip to step 6.
2. Get the tailored system tape you made with SYSTAPE after testing your tailored AOS/VS system. (If you don't have a tailored system tape, use the latest system tape you received from DG; later, you'll need to generate a tailored system.)
3. Return to Chapter 3 (or 2) and execute all the numbered steps there, using your tailored system tape or the DG tape. (If you're not using a tailored system tape, generate a tailored AOS/VS system, patch it, start it, and make a system tape — all as described in Chapter 4.)
4. If you have any DG software products that were not backed up (those under :UTIL, for example), install these as described in the software manuals.
5. Use PREDITOR to create an operator profile; then bring up EXEC and create line printer/batch queues (as shown in Chapter 5).
6. To restore a nonmaster LDU, make sure this LDU is formatted with the Disk Formatter and has the desired name. Run FIXUP on it for for good measure. Then initialize it into your system as usual.

If the nonmaster LDU needs DG software installed (for example, FORTRAN 77), and that software was not backed up, make that LDU the working directory and install the software from release media.

Follow this step for all nonmaster LDUs you want to restore.

7. Get all your incremental backup sets and your last full backup set of tapes.
8. Log on to a user console that's physically close to the system console. Restore your most recently dumped incremental backup tape set. Move backwards chronologically through the incrementals until you have restored them all. Then restore the most recent full backup.

After each restoration ends, check the printed batch output file for error messages. If you see a *CONTROL POINT DIRECTORY MAX SIZE EXCEEDED* message, the LDU is full. You (or other users) must delete some previously deleted (but restored) files to free some space, before you can continue the restoration process.

The files to delete may be in user directories, where they can be deleted with the CLI DELETE command, or in CEO, where they can be deleted with the "Delete" menu choice. In the full CEO system, you will also need to run the Janitor to complete the deletions.

When you have some disk space free, say 1000–5000 blocks or more (use SPACE : J), proceed with the next restoration.

9. Make sure you return all tapes to their covers and store them safely.
10. You're done! You've recreated the entire LDU(s) — with luck, losing only a little work (the files created or changes made since the last backup occurred).

If you have XODIAC networking software, the :NET:NETGEN files were backed up and have been restored; you can regenerate host and RMA files by running NETGEN and specifying the network spec filename.

The RESTORE macro restores files with their original creation times, but it *changes the time last modified* to the time you restore the files. This means that your next backup must be a full backup, via the FULL\_DUMP macro, since the dates last modified aren't real. It also means that the FILESTATUS command with the /BEFORE/TLM= switches won't help identify "old" files after the restoration.

## Backup Using Dump — with Diskettes

This section gives some pointers on using diskettes for backup: handling diskettes, using DUMP with diskettes, and some macros to help you do it. (To use DUMP with tape, see the preceding major section.)

### Backup Sets of Diskettes

One hard disk can hold 120 megabytes (about 230,000 disk blocks); a diskette can hold 720 Kbytes (about 1400 disk blocks). Thus over a hundred diskettes are needed to back up the biggest disk available on a diskette-only system. For smaller disks (70 or 38 megabytes), you need proportionately fewer diskettes. At the beginning, you can get by with very few diskettes because your disk will not have filled up. To get the approximate number of diskettes needed, type `SPACE :l` and divide the CUR figure by 1400; then subtract 10 diskettes for system files (which won't be backed up, since you can restore them from system diskettes).

Assume three to ten diskettes for each incremental backup, and multiply this number by the number of incremental backups you plan between full backups. Add the total incremental backup number to the full backup number. This gives the approximate number of diskettes needed for one backup set.

You *can* get along with one backup set — but ideally, you should have two or more sets. With two sets, you can keep the last backup set intact, and use the *previous* backup set for the new backup.

Whatever schedule and plan you come up with, be sure you have enough diskettes on hand when you start a full backup. If you run out of diskettes and can't complete a `FULL_BACKUP` normally, the backup will be incomplete. To make it complete, you'll need to start again from the beginning, with enough diskettes. (This caution also applies to incremental backups, but with less force, since only a few minutes are wasted if you need to restart.)

### Handling and Storing Diskettes

Diskettes are important — and fragile. Some handling cautions and hints follow.

- Store diskettes in their outer envelopes; remove a diskette from its outer envelope just before you use it.
- Hold a diskette by the edges of the envelope only. Avoid touching the diskette surface (exposed in oval cutout on the inner envelope). The oil on your finger could make that part of the diskette unreadable.
- If a diskette has no paper label, apply one. Properly labeled diskettes make life easier. Labels go on the smooth, seamless side of the inner envelope, at the top (with the write-enable notch to the right). *Avoid the oval cutout.* Remove the sticky-backed label from its backing and apply it to inner envelope.
- To write on a diskette label, use only a felt-tipped pen. A pencil or ball-point pen can score the diskette surface — destroying some or all data on it.
- A diskette must be properly inserted — the system can't read one that's improperly inserted. When you insert a diskette, hold it by the edge, with label (seamless) side facing right and the write-enable notch up. The diskette should slide in smoothly and come to a firm stop.
- Diskettes wear. If you see the message *SOFT ERROR, DEVICE 20 n*, this is a warning. Consider substituting a new diskette for the one in unit *n*.

A *HARD ERROR* or *PHYSICAL UNIT FAILURE* message means that the rest of the diskette is unreadable or unwritable. If this message appears during backup, replace the diskette. If it appears during a restoration, restart the restoration. If the hard error recurs, this probably means you cannot restore data from the rest of the diskettes in this set. (Perhaps there is another, earlier set you can use.) When the restoration is complete, you should bring down AOS/VS and run FIXUP on your LDU, since inconsistent information may have been copied to it.

- Don't bend or twist a diskette. A crease on the surface means data loss.
- Cold and heat can harm diskettes. Keep them temperate (between 10 and 50 C, between 50° and 125°F).
- A magnetic field can erase part or all data on a diskette. Keep diskettes away from electric motors, magnets, and transformers.
- Don't turn computer power off while a diskette is inserted; remove diskettes first. Turning off power while a diskette is inserted can lead to data loss.
- Diskettes must be hardware formatted (different from software formatting, which is done by the Disk Formatter). Diskettes you get from DG are shipped formatted, but diskettes from another vendor are *not* hardware formatted.

A diskette that is not hardware formatted will produce a *HARD ERROR* or *PHYSICAL UNIT FAILURE* message. To hardware format a diskette, run the hardware formatting program described in the hardware documentation. It's a good idea to hardware format non-DG diskettes immediately after you purchase them.

- Generally, you should not write-protect diskettes. AOS/VS can't access a write-protected diskette as a directory, or write to it in any way.

## Dumping to Labeled Diskettes

The CLI DUMP and LOAD commands (as well as the FILESTATUS command) accept templates. (The system matches templates, dumping or loading files in the order it finds them, not necessarily in the order you expect.)

The DUMP command, without a directory name template, copies all files and directories in the working directory to a dump file. It writes a header before each file, with the file's name, date of creation, ACL, and other data. The directory structure is maintained; later, if you load the dump file into the directory from which DUMP was issued, the system will try to recreate the original structure. So, it's *very important* that the working directory be the same for LOAD as it was for DUMP. The root directory (:) is the best directory from which to start backups and restorations.

The CLI can read, write, and label diskettes — allowing you to dump and load material using a sequence of labeled diskettes. This kind of sequence, with multiple diskette volumes, is essential for backup if your system doesn't have a tape unit. Labeled diskettes are needed in any situation where someone wants to write to diskette and the material involved won't fit on one diskette.

The command that enables the CLI to access labeled diskettes is OPERATOR. It is available to any process, on any console. The CLI command OPERATOR is very different from EXEC's command of the same name (described in Chapter 8).

The CLI OPERATOR command has the form

```
OPERATOR  $\left[ \begin{array}{l} \text{ON} \\ \text{/LABEL ON} \\ \text{OFF} \end{array} \right]$ 
```

If you omit arguments, the CLI displays the current status of Operator mode. If you include ON, the CLI turns on Operator mode (if not already on). If you include OFF, the CLI turns off Operator mode (if on).

When Operator mode is on, the CLI can dump to, label, and load from labeled diskettes. Operator mode can be turned on by any CLI process, on any console. It stays on until turned off or until the CLI process terminates.

When Operator mode is off, the CLI cannot access a diskette by label. An attempt to do so provokes a *NO OPERATOR AVAILABLE* error message. The CLI can — as usual — access a diskette by physical unit name; for example, via the DUMP or LOAD commands, as in DUMP/V @DPJ10 MYFILE ).

## The OPERATOR /LABEL Switch

The /LABEL switch tells the CLI to label diskettes — during a dump operation — without warning you before doing so.

On any dump to a labeled diskette, the CLI checks the diskette before starting to write. If the diskette has the volume ID (valid) expected, the CLI starts writing to it.

If the diskette does not have the valid expected, the CLI's action depends on whether you included the /LABEL switch when you turned operator on. If you omitted /LABEL, the CLI displays an error message and asks if you want it to relabel the diskette. If you included /LABEL (for example, OPERATOR/LABEL ON ), the CLI relabels the diskette without asking for your okay.

The /LABEL switch is useful for dumps when the diskettes you want to use are not labeled, or when you don't care about their labels. It eliminates the label specification step on a label conflict. /LABEL is useful if you don't care what's on the diskettes.

Whether or not you include /LABEL, the CLI will create valids for you as described in the next section, under "valid."

## Labeled Diskette Access

After you turn Operator mode on (with or without the /LABEL switch), you can use labeled diskettes. To access a labeled diskette, use the form

command @LFD:valid:filename

where:

command is the DUMP command (to write to) or the LOAD command (to read from) one or more labeled diskettes.

On a dump, if you omitted /LABEL from the OPERATOR command, the CLI checks to see if the retention period specified in the previous dump has elapsed. If it has not elapsed, the CLI asks if you want to relabel the diskette. The default retention period is 90 days. With the DUMP /RETAIN= switch, you can specify a different period, including 0 days (which allows the diskette set to be reused immediately).

@LFD is the filename that indicates a labeled diskette (labeled floppy disk). You must include @LFD for labeled diskette access.

valid is the volume ID that's on the first diskette (on a load) or volume ID you want written on the first diskette (on a dump). A valid can be written to a diskette either by the CLI or by the LABEL utility. The CLI's labeling mechanism is more convenient. Valids are limited to six legal filename characters.

On a load, the valid you specify must match the valid on the first diskette. If not, the CLI will signal an error when it checks the diskette label.

On a dump, the CLI checks the diskette label. If the label is correct, the dump proceeds. If the label is wrong, the CLI's message depends on whether you included the /LABEL switch when you turned Operator mode on. If you omitted /LABEL, the CLI warns you that the label doesn't match the one expected. Then it gives you the choice of relabeling the diskette or inserting another diskette. If you included /LABEL, the CLI relabels the diskette without comment.

For access to the second and subsequent diskettes, the CLI creates default volids, based on the original valid you specified. It creates a numeric sequence by adding 1 to each valid. If the valid you originally specified doesn't end with a number, the CLI will add a number, space permitting. If there isn't room for the CLI to add a number, it will drop as many characters as needed to create the next valid. For example:

| <b>Valid you specify</b> | <b>Default volids created by CLI</b>                                                                                                                                      |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VOL1                     | VOL1 (for first diskette)<br>VOL2 (for second diskette, if needed)<br>.<br>.<br>.<br>VOL9 (for ninth diskette, if needed)<br>VOL10 (for tenth diskette, if needed)        |
| SYSTEM                   | SYSTEM (for first diskette)<br>SYSTE1 (for second diskette, if needed)<br>.<br>.<br>.<br>SYSTE9 (for ninth diskette, if needed)<br>SYST10 (for tenth diskette, if needed) |

When you choose a valid, we suggest that you end it with a number, for consistency with the CLI's label-creating sequence (VOL1, VOL2, VOL3, and so on).

**filename** is the filename of the diskette fileset (on a LOAD command); or it is the filename you want to create for the diskette fileset (on a DUMP command).

This filename applies to the entire fileset of one or more diskettes. The same filename used for a labeled diskette dump must be used to load the diskette set; if not, the CLI will report a *FILE DOES NOT EXIST* message when it checks the label of the first diskette. The filename is limited to 17 legal filename characters.

With Operator mode on, after you type a command of the form @LFD:valid:filename, the CLI will prompt you to insert a diskette in a specific unit, like this:

```
PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED
UNIT [@DPJ10] VOLUME ID [valid] ? [Y]
```

The default diskette unit is @DPJ10. The displayed valid is the one you specified (first diskette) or the next sequential number *after* the preceding valid. If you want to override the default unit, type N ). The CLI then allows you to specify a different default unit.

The valid and filename you specify cannot be changed during a dump or load operation. To use a different valid or filename, you must interrupt the command (using CTRL-C CTRL-A) and restart it. For example, assume you type

```
) DUMP/V @LFD:XVOL1:MYFILE )
```

The CLI displays the *PLEASE INSERT* message shown above. But then you decide that you prefer VOL1 to XVOL1 as a first valid. To change the valid, abort the dump by typing CTRL-C CTRL-A; then retype the command with the new valid. In this case, you'd type DUMP/V @LFD:VOL1:MYFILE ).

For any dump, each diskette must be hardware formatted, but need not be software formatted with the Disk Formatter. During any load operation, the first diskette must have the valid you specify, and each of the following diskettes must have the valid that the CLI expects. If you make a mistake, like typing the wrong valid or filename, abort the command via CTRL-C CTRL-A and restart it, as explained above.

## Diskette Access Control

The default ACL for any diskette unit does not allow user access. If you want users without Superuser privilege to be able to use diskettes, you should set the unit ACL to allow this. The best place to do this is in the system UP macro, with a command like

```
ACL @DPJ10 +,WARE
```

While you are loading from (or dumping to) diskette, the system does not automatically protect your diskette from access by other users. For example, user Jack can write to a diskette that you (OP) are trying to read. With Superuser on, or if you have owner (O) access to the diskette unit, you can change the unit ACL to prevent other users from accessing it. For example, you might type

```
*) ACL/V @DPJ10 ↓
```

```
DPJ10 +,WARE (It displays the ACL.)
```

```
*) ACL @DPJ10 OP,OWARE ↓ (Set ACL for your use only.)
```

Then use the unit. When you're finished with the unit, restore its original ACL so others can use it.

## Labeled Diskette Example

The following example shows a full backup of the entire system. CLI macros to make such backups easier are shown in the next section. We're including a full backup example, without macros, here to show how it works.

In this example, the diskettes have not been used for a system backup. They have not been labeled and the person doing the backup chooses to include the /LABEL switch for labeling without the extra step of typing the new labels.

```
. (Ensure that all users have logged off and that
. all server processes — like CEO and INFOS
. II, if present — are shut down.)

) DIR : ↓ (Get to the root directory.)

) OPERATOR/LABEL ON ↓ (Turn operator mode on, with /LABEL.)

) SUPERUSER ON ↓ (Turn Superuser on for file access.)

*) ACL @DPJ10 OP,OWARE ↓ (Give yourself sole access to diskette unit.)

*) DUMP/V/L=DFILE @LFD:FULL01:BACKUP ↓ (Start the dump.)
PLEASE INSERT A DISKETTE IF NOT ... INSERTED (CLI prompts for diskette.)
UNIT [@DPJ10] VOLUME ID [FULL01]? [Y] ↓ (You insert a diskette and
   press ↓.

   (Since /LABEL was includ-
   ed, the CLI labels the disk-
   ette without asking for con-
   firmation. The dump pro-
   ceeds, with filenames listed
   to file DFILE. Each diskette
   takes about 2 minutes to fill.)
```



*PLEASE INSERT NEXT DISKETTE.*  
*UNIT [@DPJ10] VOLUME ID [FULL02]? [Y]*

(After the diskette has been filled, the CLI prompts for the next one, incrementing the volid. You remove the diskette, insert the next one; press ).

(Again, the CLI labels the diskette and the system continues dumping files. The dump proceeds through other diskettes.)

*PLEASE INSERT NEXT DISKETTE.*  
*UNIT [@DPJ10] VOLUME ID [FULL19]? [Y]*

Again, after a number of diskettes, the CLI prompts for the next diskette.)

)

(You remove the diskette, insert the next one; press ).

(Again, the CLI labels it and the system starts dumping files. Then...)

*PLEASE REMOVE THE DISKETTE*

*\*) QPRINT DFILE )*

(The full backup is done. You print the listing file...)

*QUEUED...*

*\*) DELETE/V DFILE )*

(Delete the listing file.)

*DELETED DFILE*

*\*) ACL @DPJ10 +,WARE )*

(Restore the old ACL.)

*\*)*

The full backup is done. You can now remove the diskette from unit DPJ10 and store all diskettes safely. Later on, if needed, all files could be restored to the disk via the commands:

*) DIR : )*

*) OPERATOR ON )*

*) SUPERUSER ON )*

*\*) ACL @DPJ10 OP,OWARE )*

*\*) LOAD/V/R @LFD:FULL01:BACKUP )*

## Diskette Backup Macros

CLI macros for full and incremental backup are shown in Figures 10-4 and 10-5. A macro to restore follows later on, in Figure 10-6. DG shipped these macros with AOS/VS to ease backup on systems without tape. You must change a specified character as described in the macros (type `FULL_BACKUP` ) before they will work.

The backup macros do not turn Operator mode on, so you will need to turn it on before using a macro. The first time you create any full or incremental diskette file set, we suggest that you turn Operator on with the `/LABEL` switch, to avoid extra keystrokes. Since you need to label each diskette the first time through, you can save typing effort by using `/LABEL`.

To reuse a diskette set, you should use operator without `/LABEL`, so the CLI will check labels and allow you to change diskettes if you make a mistake and insert the wrong diskette. If you need more diskettes (as you probably will), the CLI will let you label and use them as needed.

The `DUMP` command in the macros specifies a retention period of 0 days, allowing you to reuse the diskette set immediately. You may want to use a nonzero retention period for the macros. For example, you might use `/RETAIN=7` for full backup and `/RETAIN=2` for incremental backup. (If you ever want to reuse a diskette set before its expiration date, you will need to have the CLI relabel all diskettes.) If desired, you can use a text editor to change the `/RETAIN=` numbers.

Generally, it's best to use `OPERATOR` without `/LABEL` whenever you can. With `OPERATOR` and `/LABEL`, the CLI will label any diskette without asking for confirmation. Labeling a diskette effectively destroys data stored on that diskette and all subsequent diskettes. So, it's very important to avoid mixing up diskette sets. Keep the sets separate, and make sure their paper labels are current and accurate.

The backup macros use the following volids for diskettes.

| <b>FULL_BACKUP</b> | <b>INC_BACKUP</b> |
|--------------------|-------------------|
| FULL01             | INC01             |
| FULL02             | INC02             |
| ...                | ...               |
| FULLn              | INCn              |

These are good, descriptive general-purpose volids. They allow you to restore using valid `FULL01` (to restore all files) or `INC01` (to restore an incremental backup). If you want different volids, use a text editor to change the name `FULL01` or `INC01` within the macro file. The CLI will then create volids based on yours. To restore, you'll specify your valid — instead of `FULL01` or `INC01` — when you start the `RESTORE` macro.

The *filename* used by all the macros is `BACKUP`, and you should not change this name.

The incremental backup macro depends on a file named `LAST_BACKUP` — which is created by the last macro (full or incremental) to run. If an error occurs and the backup is not valid, this file will contain an invalid last backup date. So, if ever a backup is invalid (for example, if you abort it and don't restart it that day), you should delete the file `LAST_BACKUP`. Then copy file `LAST_BACKUP.BU` to `LAST_BACKUP`; for example, `COPY LAST_BACKUP LAST_BACKUP.BU` ).

Generally, you should standardize backup procedures. This means reusing volids, keeping each backup diskette set discrete, and keeping a paper label — with filename and valid/sequence number — on each diskette. Also, on the label of first diskette in a set, you should write the date the diskette was last written to. This date covers the whole set.

Users without Superuser privilege can use these macros to back up and restore their own directories. For this to work, the unit ACL must be something like `+,WARE` (perhaps set via the `UP` macro, as described above).

```

[!equal,1,2]
comment This macro does a full labeled diskette backup from the
comment working directory. To do a full system backup, it requires
comment the process that runs it to be PID 2.
push
prompt pop
comment Check for arguments -- none is allowed.
[!nequal,%1-%,]
    write
    write This macro backs up copyable files in and below [!DIRECTORY] --
    write excluding DG-supplied files in the root and excluding directories
    write HELP,,PATCH,,and,,UTIL.
    write It doesn't allow arguments. Please try again via ,, %0% ,, when ready.
    write
[!else]
    string ok_to_proceed
    comment Check for the root directory -- if so the PID must be 002.
    class(1 2) ignore
    [!equal,[!directory],:]
        [!equal,[!pid],002]
            superuser on
        [!else]
            string non_master
        [!end]
    [!else]
        comment Not in the root - check for write access. If we can create
        comment and read from a file, assume we have needed access.
        permanence =?[!pid].[!username].tmp off
        delete =?[!pid].[!username].tmp
        write/l==?[!pid].[!username].tmp test
        string [=?[!pid].[!username].tmp]
        delete =?[!pid].[!username].tmp
        [!equal,[!string],test]
            string ok_to_proceed
        [!else]
            string no_access
        [!end]
    [!end]
    comment If it's not ok to proceed, describe error and stop.
    [!nequal,[!string],ok_to_proceed]
        [!equal,[!string],non_master]
            Write Only the master CLI can back up from the root.
        [!else]
            [!equal,[!string],no_access]
                write
                write Error - [!username] does not have write access to [!directory].
                write .....You cannot back up this directory.
                write
            [!end]
        [!end]
    pop

```

Figure 10-4. FULL\_BACKUP.CLI Macro, for a Full Labeled Diskette Backup (continues)

```

[!else]
    comment Check if CLI operator mode is on. If not, stop with message.
    permanence =?[!pid].[!username].tmp off
    delete =?[!pid].[!username].tmp
    operator/1==?[!pid].[!username].tmp
    string [=?[!pid].[!username].tmp]
    delete =?[!pid].[!username].tmp
    [!nequal,([!string]),(OFF)]
    comment Operator mode is on -- proceed.
    class1 error
    class2 warning
    write
    write ** Full backup from directory [!DIRECTORY] at [!TIME] on [!DATE] **
    write
    write Please insert the first diskette to receive backup material in
    write the primary -- rightmost -- unit. The default first-void for
    write full backups is FULL01. The CLI can label diskettes if needed.
    write The first diskette and any others used for backup will be
    write overwritten -- so don't use diskettes that have material you
    write want to keep.
    write
    write Please number the paper label of each diskette as it is filled so
    write that -- if needed -- the diskettes can be restored in correct order.
    write
    write ..... -- Beginning file backup --
    [!equal,[!directory],:]
    comment Backup from root directory. Set diskette unit ACL
    comment for exclusive access, then do the backup and reset ACL.
    acl @dpj10 op, oware
    DUMP/RETAIN=0/V%0/L% @LFD:FULL01:BACKUP &
    #\HELP\NET\PATCH\SYSGEN\UTIL\SWAP\PAGE\PER\PROC\QUEUE&
    \SWAP.SWAP\?+.BRK\?+.ED\?+.JOB\?+.LS\?+.TMP NET:NETGEN:+
    comment Note: If you want to back up files in HELP, SYSGEN, or UTIL,
    comment insert the pathname(s) in the macro BEFORE the #\HELP...
    comment exclusion. For example, the template UTIL:MYDATA+ before &
    comment in the DUMP command line will back up all :UTIL:MYDATA+ files.
    acl @dpj10 +,ware
[!else]
    DUMP/RETAIN=0/V%0/L% @LFD:FULL01:BACKUP #
[!end]
write
write ** Full backup of [!DIRECTORY] complete at [!TIME] **
permanence/2=ignore =LAST_BACKUP.BU OFF
delete/2=ignore =LAST_BACKUP.BU
rename/2=ignore LAST_BACKUP LAST_BACKUP.BU
write/1==LAST_BACKUP [!DATE]:[!TIME]

write
write This backup has created file LAST_BACKUP in this directory for
write future backups. Don't delete this file.
[!else]
    write Operator mode is not on. Turn OPERATOR ON and retry the command.
[!end]
[!end]
[!end]

```

Figure 10-4. FULL\_BACKUP.CLI Macro, for a Full Labeled Diskette Backup (continued)

```

[!else]
write This macro is nonexecutable. You can make it executable by
write changing the 2 to a 1 in line 1 -- make both numbers 1.
write
write Backup is very important. Before using the edited macro routinely
write for backup you should understand how it works. Please test this
write macro. Use it to back up files. Then try restoring files using
write the RESTORE macro -- before relying on this macro for backup.
[!end]

```

*Figure 10-4. FULL\_BACKUP.CLI Macro, for a Full Labeled Diskette Backup (concluded)*

#### **Text of INC\_BACKUP.CLI**

```

[!equal,1,2]
comment This macro does an incremental labeled diskette backup from the
comment working directory -- based on the last backup, stored in file
comment LAST_BACKUP. To back up from the root directory, the macro
comment requires the process that runs it to be PID 2.
push
prompt pop
comment Check for arguments -- none is allowed.
[!nequal,%1-%,]
write
write This macro doesn't allow arguments. Please try again by typing
write ,, %0% ,, when ready.
write
[!else]
string ok_to_proceed
comment Check for the root directory -- if so the PID must be 002.
class(1 2) ignore
[!equal,[!directory],:]
[!equal,[!pid],002]
superuser on
[!else]
string non_master
[!end]

```

*Figure 10-5. INC\_BACKUP.CLI Macro, for an Incremental Labeled Diskette Backup (continues)*

```

[!else]
    comment Not in the root - check for write access. If we can create
    comment a file, assume write access.
    permanence =?[!pid].[!username].tmp off
    delete =?[!pid].[!username].tmp
    write/l==?[!pid].[!username].tmp test
    string [=?[!pid].[!username].tmp]
    delete =?[!pid].[!username].tmp
    [!equal,[!string],test]
        string ok_to_proceed
    [!else]
        string no_access
    [!end]
[!end]
comment If it's not okay to proceed, describe error and stop.
[!nequal,[!string],ok_to_proceed]
    [!equal,[!string],non_master]
        Write Error - only the master CLI can back up from the root.
    [!else]
        [!equal,[!string],no_access]
            write
            write Error - [!username] does not have write access to [!directory].
            write .....You cannot back up this directory.
            write
        [!end]
    [!end]
pop
[!else]
    [!equal,[!pathname =LAST_BACKUP],.]
        Write
        Write Error - Incremental backup requires file LAST_BACKUP -- which does
        Write ..... not exist. Suggest either doing FULL_BACKUP or retry
        Write ..... incremental backup from directory in which you have
        Write ..... done your most recent backup.
        Write
    [!else]
        comment Check to see if CLI operator mode is on. If not, stop with message.
        permanence =?[!pid].[!username].tmp off
        delete =?[!pid].[!username].tmp
        operator/l==?[!pid].[!username].tmp
        string [=?[!pid].[!username].tmp]
        delete =?[!pid].[!username].tmp
        [!nequal,([!string]),(OFF)]
            comment Operator mode is on -- proceed.
            class1 error
            class2 warning
            write
            write ** Incremental backup from directory [!DIRECTORY]&
            at [!TIME] on [!DATE] **

```

Figure 10-5. INC\_BACKUP.CLI Macro, for an Incremental Labeled Diskette Backup  
(continued)

```

string [=LAST_BACKUP]
write This backup will dump all files created or modified since [!string].
write
write Please insert the first diskette to receive backup material in
write the primary -- rightmost -- unit. The default first-valid for
write full backups is INC01. The CLI can label diskettes if needed.
write The first diskette and any others used for backup will be
write overwritten -- so don't use diskettes that have material you
write want to keep.
write
write Please number the paper label of each diskette as it is filled so
write that -- if needed -- the diskettes can be restored in correct order.
write
write ,,,,,,,,,, -- Beginning file backup --
[!equal,[!directory],:]
    comment Backup from root directory. Set the diskette unit ACL
    comment for exclusive access, then do backup and reset ACL.
    acl @dpj10 op, oware
    DUMP/RETAIN=0/AFTER/TLM=[!STRING]/V%0/L% @LFD:INC01:BACKUP &
    #\NET\PAGE\PER\PROC\QUEUE\SWAP\SWAP.SWAP\SYSGEN\?+.BRK\+.ED&
\?+.JOB\+.LS\?+.TMP NET:NETGEN:+
    acl @dpj10 +,ware
[!else]
    DUMP/RETAIN=0/AFTER/TLM=[!STRING]/V%0/L% @LFD:INC01:BACKUP #
[!end]
write
write ** Incremental backup of [!DIRECTORY] complete at [!TIME] **
permanence/2=ignore =LAST_BACKUP.BU OFF
delete/2=ignore =LAST_BACKUP.BU
rename/2=ignore LAST_BACKUP LAST_BACKUP.BU
write/1==LAST_BACKUP [!DATE]:[!TIME]
write
write This backup has created file LAST_BACKUP in this directory for
write future backups. Don't delete this file.
[!else]
    write Operator mode is not on. Turn OPERATOR ON and retry the command.
[!end]
[!end]
[!end]
[!end]
[!end]
[!else]
    write This macro is nonexecutable. You can make it executable by
    write changing the 2 to a 1 in line 1 -- make both numbers 1.
    write
    write Backup is very important. Before using the edited macro routinely
    write for backup you should understand how it works. Please test this
    write macro. Use FULL_BACKUP and this macro to back up some files.
    write Then try restoring files using the RESTORE macro before relying
    write on this macro set for backup.
[!end]

```

*Figure 10-5. INC\_BACKUP.CLI Macro, for an Incremental Labeled Diskette Backup  
(concluded)*

## Diskette Backup Example

For this example, assume that an AOS/VS system is built in October. Information starts accumulating on it immediately. The person acting as system manager decides on a weekly full backup and daily incremental backups.

The full backup will occur each Friday (with provision for Friday holidays). Incremental backups will be done the following Monday through Thursday. All backups will be done from the root directory (:).

The first full backup in October takes only 14 diskettes; and the related incremental backups take only 2 diskettes each. The November full backups average 20 diskettes and incrementals take 2 or 3 diskettes each.

The next sections show the actions and dialog at the system console for the first Friday in December and for the first following incremental backup, on Monday.

All diskette sets have been labeled — with the default names shown in the sample macros (FULL01 or INC01), filename BACKUP.

### The Full Backup

At the sample site, Friday afternoon arrives — time for the full backup.

1. Joan, the person who does backups, prepares to bring the multiuser environment down, making sure that no users will lose work when this happens (described in Chapter 6, section “Shutdown”).
2. She returns to the master CLI, PID 2, on the system console:  

```
) WHO ↓  
PID: 13  OP  CON0  :CLI.PR          (This CLI is PID 13, not PID 2.)  
)  
) BYE ↓                             (Sign off this CLI.)  
AOS/VS CLI TERMINATING ...  
  
You are now  
PID: 2   OP  OP   :CLI.PR          (PID 2 — the master.)
```
3. She brings the multiuser environment down with  

```
) DOWN ↓  
... (Termination messages) ...
```
4. She makes the root the working directory:  

```
) DIR : ↓
```
5. She turns Operator on:  

```
) OPERATOR ON ↓
```

Since the diskettes have already been labeled, and the expiration date (default 0 days from the last backup) has been reached, Joan omits the /LABEL switch from OPERATOR.



6. She starts the full backup, including the /L switch to specify a listing file of filenames dumped. This is your decision, but we recommend it — the listing tells which files were backed up. (She ignores the access control issue, since the multiuser environment is down.)

) FULL\_BACKUP /L=FILES\_BACKED\_UP )

**\*\* Full backup from directory : at 16:45:05 on 07-DEC-85 \*\***

...

PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED  
UNIT [@DPJ10] VOLUME ID [FULL01] ? [Y]

7. She inserts the first full backup diskette, FULL01, in the primary (right) unit.
8. She presses ).

-- Beginning file backup --

... (System writes filenames backed up to the disk file ... diskette fills up.) ...

... (Each diskette takes about 2 minutes to fill.) ...

PLEASE INSERT NEXT DISKETTE  
UNIT [@DPJ10] VOLUME ID [FULLn] ? [Y]

9. She replaces the diskette with the next one and presses ).
10. She repeats steps 8 and 9 until she's out of previously labeled diskettes. Let's say there are 22 of these, and she has used them all. It displays

PLEASE INSERT NEXT DISKETTE  
UNIT [@DPJ10] VOLUME ID [FULL23] ? [Y]

11. She removes the diskette, inserts an unlabeled, hardware formatted diskette, and presses ).

AN UNLABELED DISKETTE HAS BEEN INSERTED  
DO YOU WANT TO RELABEL THIS DISKETTE ? [N]

12. She types Y ).

**\*\*\* RELABELED DISKETTE \*\*\* NEW VOLUME ID: FULL23**

13. She repeats steps 11 and 12 as long as the CLI prompts for another diskette. Let's say that only one additional diskette (FULL23) is needed. Some files are copied to the diskette. Then:

PLEASE REMOVE THE DISKETTE

**\*\* Full backup of directory : complete at ... on 07-DEC-85**

)

The full backup is done. The listing file (shown here as FILES\_BACKED\_UP) remains in the root directory. You can print it (when the multiuser environment is up) and delete it as desired. Each backup listing should be stored in the same place as its diskette fileset. If you specify a listing file each time you do a full backup, simply delete the old one before starting the next next full backup.

14. Joan stores all FULL BACKUP diskettes safely, in order, in their outer covers, away from strong magnetic fields.

After a backup, AOS/VS can be shut down or the multiuser environment can be brought back via UP ). In this case, Joan would probably shut down, turn everything off, and leave.

## The Incremental Backup

At the sample site, Monday afternoon rolls around — time for the incremental backup.

1. As she did last week, Joan prepares to bring the multiuser environment down, making sure that no users will lose work.

2. She returns to the master CLI, PID 2, on the system console:

```
) WHO ↓  
PID: 13 OP CON0 :CLI.PR      (PID 13, not PID 2.)  
) BYE ↓                      (Sign off this CLI.)  
AOS/VS CLI TERMINATING ...  
  
You are now  
PID: 2 OP OP :CLI.PR        (PID 2 — the master.)
```

3. She brings it down with

```
) DOWN ↓  
... (Termination messages) ...
```

4. She makes the root the working directory:

```
) DIR : ↓
```

5. She turns Operator mode on:

```
) OPERATOR ON ↓
```

Again, since the diskette set has been labeled, and the retention period (0 days in the INC\_BACKUP macro shown) has expired, Joan omits the /LABEL switch.

6. She starts the incremental backup, using the /L switch to specify another listing file of filenames copied. This can be very helpful when restoring incrementals — we recommend it.

```
) INC_BACKUP /L=FILES_BACKED_UP.DEC.10 ↓  
  
** Incremental backup from directory : at .... on 10-DEC-85.  
This backup will dump all files created or modified since 07-DEC-85...  
... (Messages) ...
```

```
PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED  
UNIT [@DPJ10] VOLUME ID [INC01] ? [Y]
```

7. She gets the first backup diskette, valid INC01, and inserts it in the primary (right) unit.

8. She presses ↵.

— Beginning file backup —

... (It writes filenames backed up to the disk file) ...

```
PLEASE INSERT NEXT DISKETTE  
UNIT [@DPJ10] VOLUME ID [INCn] ? [Y]
```

9. She removes the diskette, writes the date on its paper label (using a felt-tipped pen to avoid scoring the diskette surface). Then she replaces the diskette in its envelope and inserts the next diskette in the unit.
10. She repeats steps 8 and 9 as long as the CLI prompts for another diskette. Let's assume she's on the third diskette. Some files are dumped to the diskette. Then:

*PLEASE REMOVE THE DISKETTE*

*\*\* Incremental backup of directory : complete at ... on 10-DEC-86*  
)

This incremental backup is done. Additional diskettes (as shown for the full backup) were not needed. The listing file (shown here as FILES\_BACKED\_UP.DEC.10) remains in the root directory. It can be printed (when the multiuser environment is up) and deleted as desired. AOS/VS can be shut down or it can stay up.

11. Joan stores all INC BACKUP diskettes safely, in order, in their outer covers, away from strong magnetic fields.

The next day, Tuesday, Joan does another incremental backup. The steps are the same as the last incremental backup, except that the date differs and she uses a different listing filename.

As you can see, the procedure is methodical — and repetitive. But it can be extremely important.

### **Restoration Macro for Diskettes (RESTORE.CLI)**

Macro RESTORE.CLI, Figure 10-6, restores material from either a full or incremental backup. The macro allows templates. It requires the backup set filename BACKUP (created by the backup macros, earlier). And it requires you to supply the volume ID of the first diskette in the command line; for example,

) RESTORE VOL1 )

## Text of RESTORE.CLI

```
[!equal,1,2]
comment This macro restores files from either a full or incremental
comment labeled diskette backup. To restore into the root directory,
comment the macro requires the process that runs it to be PID 2.
push
prompt pop
comment Check for at least one argument.
[!equal,%1%,]
  write
  write This macro requires at least one argument: the volid of the first
  write diskette in the fileset. The volid used by the FULL_BACKUP macro
  write is FULL01 and the first volid used by the INC_BACKUP macro is
  write INC01. After the volid argument, you can specify one or more
  write templates. If you omit templates, all files in the fileset will
  write be restored.
  write Run the macro via  , , %0% , , volid , , {template} ...., when ready.
  write
[!else]
  string ok_to_proceed
  comment Check for the root directory -- if so the PID must be 002.
  class(1 2) ignore
  [!equal,[!directory],:]
    [!equal,[!pid],002]
    superuser on
    [!else]
      string non_master
    [!end]
  [!else]
    comment Not in the root - check for write access. If we can create
    comment and read from a file, assume we have needed access.
    permanence =?[!pid].[!username].tmp off
    delete =?[!pid].[!username].tmp
    write/1==?[!pid].[!username].tmp test
    string [=?[!pid].[!username].tmp]
    delete =?[!pid].[!username].tmp
    [!equal,[!string],test]
      string ok_to_proceed
    [!else]
      string no_access
    [!end]
  [!end]
  comment If it's not ok to proceed, describe error and stop.
  [!nequal,[!string],ok_to_proceed]
    [!equal,[!string],non_master]
      Write Only the master CLI can restore the root directory.
    [!else]
      [!equal,[!string],no_access]
        write
        write Error - [!username] does not have write access to [!directory].
        write , , , , , , , , You need Superuser on to restore this directory.
        write
      [!end]
    [!end]
  pop
```

Figure 10-6. RESTORE.CLI Macro, to Restore Files from Labeled Diskettes (continues)

```

[!else]
comment Check if CLI operator mode is on. If not, stop with message.
permanence =?[!pid].[!username].tmp off
delete =?[!pid].[!username].tmp
operator/1==?[!pid].[!username].tmp
string [=?[!pid].[!username].tmp]
delete =?[!pid].[!username].tmp
[!nequal,[!string]),(OFF)]
comment Operator mode is on -- proceed.
class1 error
class2 warning
write
write ** Restoration within directory [!DIRECTORY] at [!TIME] on [!DATE] **
write
write Please insert the first diskette of the backup fileset in
write the primary -- right -- unit.
write
write Later, you'll insert diskettes in the same order in which
write these diskettes were originally dumped.
write
write ,,,,,,,,, -- Beginning file restoration --
comment Restore the fileset, using the supplied valid, filename
comment BACKUP, and any supplied template(s).
[!equal,[!pid],002]
acl @dpj10 op,oware
[!end]
LOAD/V/RECENT%0/L% @LFD:%1%:BACKUP &
[!equal,%2%,]#[!else]%2-%[!end]
write
write ** Restoration of [!DIRECTORY] complete at [!TIME] **
write
[!equal,[!pid],002]
acl @dpj10 +,ware
[!end]
[!else]
write Operator mode is not on. Turn OPERATOR ON and retry the command.
[!end]
[!end]
[!end]
[!else]
write This macro is nonexecutable. You can make it executable by
write changing the 2 to a 1 in line 1 -- make both numbers 1.
write
write Backup is very important. Before using the edited macro routinely
write for backup you should understand how it works. Please test this
write macro. Use FULL_BACKUP and INC_BACKUP to backup some files.
write Then try restoring files using this macro before relying on this
write macro set for backup.
[!end]

```

Figure 10-6. RESTORE.CLI Macro, to Restore Files from Labeled Diskettes (concluded)

## About Restoring Files from Dump Diskettes

Restoring falls into two categories: restoring one or more files, and restoring one or more LDUs. The first category is more common, and easier and faster.

### Restoring One or More Files

Usually, people restore one or more files when someone has accidentally deleted a file (perhaps a directory), or group of files. Perhaps someone was careless with DELETE and a template character — or, for whatever reason, you want to restore files that were backed up to diskette.

There are two things to consider when you plan this kind of restoration — the tape set(s) needed, and the pathname template(s).

The diskette set you use to restore depend on the date that the lost file(s) were last modified. If the files were created since the last backup, then they weren't backed up, thus cannot be restored. Otherwise, use the backup (incremental or full) that occurred soonest after the files were modified.

If you can't determine when the files were last modified, check the backup listings. If the name of a lost file appears in any listing, then you know the file is in that backup. In the worst case, without a listing or dates, you must restore the last full backup set, then the earliest incremental backup, then next incremental backup, and so on. This is a good reason to keep your backup listings — especially for incremental backups.

After deciding on the diskette set, you must choose one or more pathname templates (unless you want to restore the entire backup). The RESTORE macro allows template arguments, in which you can specify directory/pathname template(s).

You can restore all files in and below a directory (including subordinate directories), with the template

`pathname-from-root:#`

You can restore all files in and below a user's directory with the template

`UDD:username:#` (Omit the leading : from UDD)

For CEO files, the directory structure and restoration procedure differs from that for standard AOS/VS files. To restore CEO files, see *Managing the CEO System*.

### File Restoration Example

As an example, assume Andy accidentally deleted two files named REPORT.MAY and SUMMARY. He last modified them a week ago. (If lost files were last modified on different dates, it may be most efficient to work from the last full backup). Acting as operator, you find and get the appropriate diskette set — which happens to be from an incremental backup.

You need a template for the restoration. The two filenames have the letters MA in common. So, you could use the template

`UDD:ANDY:#:+MA+`

This would work, but it might restore many matching, unwanted files. You can be more specific. The two names each have at least one character — and no period — following the A. So you could refine the template to

`UDD:ANDY:#:+MA*-`

Or, if you know which directory the files were in, you can use the specific pathnames:

`pathname-from-root:REPORT.MAY` `pathname-from-root:SUMMARY`

Let's say you decide on the most general course — the +MA+ template — to cover many possibilities.

You go to the system console, get back to PID 2 (perhaps by typing BYE ↵, if needed). Then you type

) RESTORE INC01 UDD:ANDY:#:+MA+ ↵ (Start macro, specifying an incremental backup and the desired template.)

*Restoration with in directory : at 18:33 ...* (Macro prompts for next steps.)

*Please insert the first diskette of the ...*

PLEASE INSERT A DISKETTE IF NOT ALREADY ...

(CLI prompts for diskette.)

UNIT [@DPJ10] VOLUME ID [INC00] ? [Y] ↵

(Make sure diskette is inserted and press ↵.)

(CLI runs through the diskette, looking for matching files. Since you specified no listing file, it will display matching pathnames that it restores on the screen.)

PLEASE INSERT NEXT DISKETTE.

(CLI prompts for next diskette.)

UNIT [@DPJ10] VOLUME ID [INC01] ? [Y]

(Make sure diskette is inserted and press ↵.)

↵

... (System spins though the diskette, looking for files)...

UDD:ANDY:SUMMARY

(It restores one of the files you want, and ... some unwanted files.)

UDD:ANDY:BDIR:SUMMARIES

UDD:ANDY:BDIR:SUMMARIES.ED

PLEASE INSERT NEXT DISKETTE.

(CLI prompts for next diskette.)

UNIT [@DPJ10] VOLUME ID [INC02] ? [Y]

(Insert it and press ↵.)

↵

(Time passes...)

:UDD:ANDY:REPORTS:REPORT.MAY

(It restores the other lost file, and some other files.)

:UDD:ANDY:REPORTS:REPORT.MAY.BU

:UDD:ANDY:REPORTS:REPORT.MAY.ED

PLEASE INSERT NEXT DISKETTE.

(CLI prompts for next diskette.)

UNIT [@DPJ10] VOLUME ID [INC02] ? [Y]

CTRL-C CTRL-A

(Since all lost files were restored, you can interrupt the restore; you're done.)

\*ERROR\*

CONSOLE INTERRUPT

*Restoration of : complete at 18:48:06*

)

With the files restored, tell Andy to check them — and to check his directories for unwanted, restored files. He can then delete the unwanted files.

(If Andy had created the files in the full CEO system, not the CEO Word Processor — Independent, and had accidentally deleted “documents” named REPORT.MAY and SUMMARY, you could suggest that he check his CEO Wastebasket. In the full CEO, documents are not actually deleted until a program called Janitor has been run. Until then, documents that people delete can be retrieved from their Wastebaskets. If Andy’s documents are not in his Wastebasket, you can restore them from the last backup — as described in *Managing the CEO System*.)

### **Shortening a Restoration**

When you mention a specific filename (like UDD:SAM:MYFILE) in a restoration, the restoration will end and the CLI prompt will return *as soon as the file has been copied to disk*.

The restoration will take longer if you use a template like UDD:SAM:MYF+ (as shown in the example) because the system will continue through the last tape, even after the desired file has been copied. This happens because AOS/VS can’t tell, until it reaches the end of the last tape, that there is no matching filename in the tape set. When you see that the files you want have been restored, there’s no need to restore others; you can interrupt the restoration as shown above.

Generally, this means that it’s desirable to give a specific filename, if you can. But if you do, be sure it’s the correct one — if you make a mistake with a specific filename, the system will take you all the way through the diskette set, and not restore the file you want restored. If you think this may be happening, cancel the restoration with CTRL-C CTRL-A. Then start again.

### **Restoring an Entire LDU Using Diskettes — When and How**

The time may come when you need to restore all backup material to an LDU. This can happen when a disk wears or fails in such a way that the system can no longer read it.

If you have checked with DG, and either acquired a new disk or decided to rebuild the old one, follow these steps.

1. To restore the master LDU, continue. To restore a nonmaster LDU, skip to step 6.
2. Get the tailored system diskette you made after testing your AOS/VS AOS/VS system. (If you don’t have a tailored system diskette, use the latest system diskette you received from DG; later, you’ll need to generate a tailored system.)
3. Return to Chapter 2 and execute all the numbered steps there, using your tailored system diskette or the DG diskette. (If you don’t use a tailored system diskette, generate a tailored AOS/VS system, patch it, start it, and make a system diskette as described in Chapter 4.)
4. If you have any DG software products that the macros didn’t back up, (those under :UTIL, for example), install these products as described in the software manuals.
5. Use PREDITOR to create an operator profile; then bring up EXEC and create the line printer/batch queues (as shown in Chapter 5).
6. To restore a nonmaster LDU, make sure this LDU is formatted with the Disk Formatter and has the desired name. Run FIXUP on it for for good measure. Then initialize it into your system as usual.

If the nonmaster LDU needs DG software installed (for example, FORTRAN 77), and that software was not backed up, make that LDU the working directory and install the software from release media.

7. Get all your incremental backup sets and your last full backup set of diskettes.



8. Log on to a user console that's physically close to the system console. Restore your most recently dumped incremental backup diskette set. Proceed backwards through the incrementals until you have restored them all. Then restore the most recent full backup.

If you see a *CONTROL POINT DIRECTORY MAX SIZE EXCEEDED* message, the LDU is full. You, (or other users) must delete some previously deleted (restored) files to free some space before you can continue the restoration process.

The files to delete may be in user directories, where they can be deleted with the CLI DELETE command, or in CEO, where they can be deleted with the "Delete" menu choice. In the full CEO system, you will also need to run the Janitor to complete the deletions.

When you have some disk space free, say 1000–2000 blocks or more (use SPACE : J), proceed with the next restoration.

9. Make sure you return all diskettes to their covers and store them safely.
10. You're done! You've recreated the entire LDU(s) — with luck, losing only a little work (the files created or changes made since the last backup occurred).

If you have XODIAC networking software, the :NET:NETGEN files were backed up and have been restored; you can regenerate host and RMA files by running NETGEN and specifying the network spec filename.

The RESTORE macro restores files with their original creation times, but it *changes the time last modified* to the time you restore the files. This means that your next backup must be a full backup, via the FULL\_DUMP macro, since the dates last modified aren't real. It also means that the FILESTATUS command with the /BEFORE/TLM= switches won't help identify "old" files after the restoration.

## Using PCOPY

There are two versions of PCOPY: a stand-alone version, which can copy to and from any LDU; and a stand-among version, which can copy to and from any uninitialized LDU (this excludes the master LDU, since, when AOS/VS is running, the master LDU *is* initialized).

You can start stand-alone PCOPY directly from disk, as if it were an operating system. It is file PCOPY in the root directory. You can start stand-among PCOPY from the CLI (via XEQ); it is file PCOPY.PR in directory :UTIL. To run the stand-among PCOPY, you must have the following privileges in your user profile: *Change type* and *Change address space type*.

PCOPY is useful if you must use cartridge tapes for backup, since it can work much faster than DUMP with these tapes.

PCOPY is ideal for disk-to-disk backup if you have two or more identical disk units with removable disks, and LDUs of one physical disk. It is also useful for disk-to-disk backup if you have three or more identical disk units with removable packs.

PCOPY can also copy to and from diskette.

## PCOPY Requirements

To copy to tape or diskettes, have enough tapes or diskettes ready. A 2400-foot tape, on an MTB unit set at high density, can hold about 74,000 disk blocks (38 megabytes) of information. It takes 10–22 minutes to fill. An MTC unit, with a 1000-foot tape, can hold about 31,000 blocks (16 megabytes) and takes about 12 minutes. An MTC cartridge tape — if you use the buffer size that allows PCOPY to run the tape fast — can hold about 15,500 blocks (8 megabytes). An MTD unit, with a 2,400-foot tape, at 6250 bpi, can hold about 250,000 blocks (130 megabytes). An MTJ reel-to-reel unit, with a 1000-foot tape, can hold about 31,000 blocks (16 megabytes) and takes about 12 minutes. At a buffer size of 16 Kbytes, an MTJ cartridge tape holds 120 Mbytes (model 6352) or 20 Mbytes (model 6351). A 737,000-byte diskette can hold about 1,400 disk blocks.

Use the CLI command **SPACE : 1** to find the number of blocks used on the LDU; then divide by the pertinent number of blocks to see how many tapes or diskettes you need. The tapes/diskettes may already be labeled or you can have PCOPY label them.

When you copy to disk (from tape, diskettes, or disk), PCOPY has some restrictions. The destination LDU must be similar to the original LDU. PCOPY *requires* that the bitmap and remap area addresses be the same as those on the original LDUs. If the original LDU was (is) a system disk, the destination LDU must have the same overlay area address as the original.

When you copy to disk from tape or diskette, the destination LDU's unique ID should be the same as the original's. (If the IDs differ, PCOPY will issue a warning, but let you continue if you want.) When you copy from disk to disk, PCOPY assumes that LDU unique IDs are different. For any copy, PCOPY does not check the source LDU name against the destination LDU name. This means that the LDU names can differ for disk-to-disk work — but you will probably want them to be the same when you restore from tape or diskette.

All this sounds formidable, but PCOPY error messages will tell you what to do if the LDUs differ. Usually, it's simply a matter of running the Disk Formatter on the destination LDU to move an area.

### **If You Make a Mistake Running PCOPY**

If you make a typing error and notice it before pressing **1**, press the DEL key to erase the bad characters one by one. The system echoes an underscore (**\_**) for each character erased. Then type the correct characters and press **1**. Or, you can type CTRL-U to delete the entire line.

If you have already pressed **1**, and PCOPY has not yet written to the destination medium, you can restart it by typing CTRL-C CTRL-A when PCOPY asks the next question. If PCOPY has started writing, you can stop it only via the break sequence and RESET **1**.

If PCOPY displays an error message that you can't understand, see the PCOPY error messages in Table 10-2, at the end of the PCOPY description. You can restart PCOPY if it aborts by typing **CONTINUE 1**.

When you are ready, start PCOPY as in the following sections, from disk, tape, or diskette.

### **Starting PCOPY from Disk**

For stand-alone PCOPY, shut down AOS/VS normally (typing **DOWN 1**, **BYE 1**, etc.). On the Operating System Load Menu, choose option 2, "Enter the Technical Maintenance Menu". On the Technical Maintenance Menu, choose option 6, "Run a specified program". When prompted, type **:PCOPY 1**. For example:

**) BOOT 27 1** (Or other master LDU device code)

*Operating System Load Menu*

*1 Continue immediately with operating system load*

*2 Enter the Technical Maintenance Menu*

*...*

*Enter choice [1]: 2 1*

*Technical Maintenance Menu*

*...*

*6 Run a specified program*

*...*

*Enter choice [1]: 6 1*

*Pathname? :PCOPY 1* (Specify PCOPY)

To start stand-alone PCOPY, type

```
) SUPERUSER ON ↓  
*) XEQ :UTIL:PCOPY ↓
```

When PCOPY starts up, skip to the desired “PCOPY Dialog” section below. The sections are

- PCOPY Dialog, Disk to Disk, with All Disks On-Line
- Using PCOPY, Disk to Disk, with All Disks Not On-Line
- PCOPY Dialog, Disk to Tape
- PCOPY Dialog, Tape to Disk
- PCOPY Dialog, Disk to Diskette
- PCOPY Dialog, Diskette to Disk

## Starting PCOPY from Tape

Starting PCOPY is easier from disk. But you might want to start it from tape if you can’t start from disk. Only the stand-alone PCOPY runs from tape.

Before doing it, you need to make a stand-alone PCOPY tape. This is easy to do when AOS/VS is running. Mount tape, ring in, on a tape unit (for example, MTB0); put the unit on line; and type

```
) SUPERUSER ON ↓  
*) DIR : ↓  
*) COPY/V @MTB0:0 TBOOT ↓ (Use correct tape unit name)  
TBOOT  
*) COPY/V @MTB0:1 PCOPY ↓ (Use correct tape unit name)  
PCOPY  
*) REWIND @MTB0 ↓ (Use correct tape unit name)  
*)
```

This gives you a stand-alone PCOPY tape. When this tape is mounted on unit 0 on the first tape controller, you can boot it and specify the tape file number you want. You can do this with *any* stand-alone program, if you put TBOOT on file 0 of the tape.

Before starting PCOPY, if CPU microcode is not loaded, you must load it from the SYSTEM MEDIA tape (described in Chapter 2, step 3 up to step 13). To start PCOPY from your PCOPY tape, mount the tape on unit 0. Then, from the SCP CLI, continue as follows:

```
SCP-CLI> BOOT 22 ↓ (Or 23 for MTJ, or 62 for MTD)  
Tape file number? 1 ↓ (File 1 is the PCOPY file)
```

Skip to the desired “PCOPY Dialog” section below — probably “PCOPY Dialog, Tape to Disk” to restore from tape.

## Starting PCOPY from Diskette

Starting PCOPY is easier from disk. But you might need to start it from diskette if you can’t start from disk. Only the stand-alone PCOPY runs from diskette — you can’t start the stand-alone PCOPY from diskette.

If you’re building or restoring an AOS/VS system LDU, you must load the IOC emulator and microcode and format the LDU as described in Chapter 2, step 3 through step 27. Specify the same LDU name and addresses (for example, for the bitmap) as were given for the original LDU.

At this point, AOS/VS diskette number 1 should be in unit 0. This diskette has a copy of PCOPY on it. To start PCOPY from the diskette, proceed as follows:

SCP-CLI> BOOT 64 ↵ (Device code of diskette)

*Operating System Load Menu*

1 Continue immediately with operating system load

2 Enter the Technical Maintenance Menu

...

Enter choice [1]: 2 ↵

*Technical Maintenance Menu*

...

6 Run a specified program

...

Enter choice [1]: 6 ↵

Pathname? :PCOPY ↵ (Specify PCOPY)

Skip to "PCOPY Dialog, Diskette to Disk" to restore material from diskettes.

## **PCOPY Dialog, Disk to Disk, with All Disks On-Line**

Have all disks in your source and destination LDUs ready. For a multiple-disk LDU, you can put the source LDU disks in the first group of disk units, and the destination disks in the second group of disk units. For example, the source LDU might go in units DPF0 and DPF1, and the destination LDU in units DPF10 and DPF11. (If all disks in the source and destination LDUs will not be mounted throughout the copy, go to the next section.)

As described earlier, in "PCOPY Requirements", your destination disk(s) must have been formatted with the Disk Formatter — with system tables in specific places. As a safeguard, you may want to write-disable the unit(s) that hold your source LDU before you start. This will prevent an accidental wrong answer from overwriting the source LDU.

Start PCOPY as described earlier. The disk-to-disk dialog goes as follows. If PCOPY reports an error, see Table 10-2.

*AOS/VS Disk Copier REV n*

*Enter today's date (mm dd yy)?*

1. This *date* question is asked only by stand-alone PCOPY; stand-alone PCOPY gets today's date from the system calendar. If asked, type today's date, with numbers separated by one space — for example,

11 19 85 ↵

*Will this be a disk to disk PCOPY [N] ?*

2. Type Y ↵.

*Will all disks in each LDU be on-line at all times [Y] ?*

3. Press ↵ for the default (shown in brackets) or type Y ↵.

*Specify source LDU*

*Enter the name of each disk in the LDU (Press NEW LINE when done)*

*Disk unit name?*

4. Type the name of the first disk in the LDU; e.g., DPF0 ↵.

*Device code [default] ?*

This question is skipped by stand-alone PCOPY.

Unless you know that this disk is connected to a nondefault device code, press *↓* for the default. Otherwise, type the device code of the unit controller and press *↓*.

*Disk unit name?*

PCOPY repeats the *Disk unit name* questions until you respond *↓* to *Disk unit name?*. Be sure to specify all disks in the LDU, if a multiple-disk LDU was originally created with the Disk Formatter. When you've specified all disks, press *↓* at *Disk unit name?* PCOPY then describes the source LDU and asks for the destination LDU:

*LDU unique ID is 'id'*

*LDU name is 'name'*

*Specify destination LDU.*

*Enter the name of each disk in the LDU (Press NEW LINE when done)*

*Disk unit name?*

5. Type the unit name of the first disk in the destination LDU; e.g., DPF10 *↓*.

*Device code [default]?*

6. This device code question is skipped by stand-alone PCOPY. If this disk is on the default device code for its name, press *↓*; otherwise, type the device code and *↓*.

*Disk unit name?*

As with the source LDU, PCOPY repeats the *Disk unit* questions until you answer *Disk unit name?* with *↓*. Then it displays the destination LDU ID and name and asks for confirmation:

*LDU unique ID is 'id'*

*LDU name is 'name'*

*Copy to Disk from Disk. Please confirm (N/Y)?*

7. If there are any files you want on the destination LDU, type *N ↓* and begin again. A PCOPY overwrites all files on the destination medium. PCOPY asks this question to give you a chance to reconsider. To proceed, type

*Y ↓*

*Confirmed.*

PCOPY now copies the whole disk structure from the source to the destination LDU. A full 190-megabyte LDU takes roughly 15 minutes to copy. If PCOPY hits an error, it will display one of the error messages shown in Table 10-2. (But if either LDU is not ready, PCOPY will wait in silence until you make the LDU ready.) When PCOPY is done, it says

*Done!*

8. The PCOPY is done. If you write-disabled any disk units, you should write-enable them.

To copy another LDU, place its disks in their units (if applicable). Then type *CONTINUE ↓* (stand-alone) or *XEQ PCOPY ↓* (stand-alone), and return to step 1 in this section.

## \* **Example of Disk-to-Disk PCOPY Dialog with All Disks On-Line**

*Pathname? PCOPY ↓*

*AOS/VS Disk Copier REV n*

*Enter today's date (mm dd yy)? 11 19 85 ↓* (Stand-alone PCOPY only)

*Will this be a disk to disk PCOPY [N] ? Y ↓*

*Will all disks in each LDU be on-line at all times [Y] ↓*

*Specify source LDU*

*Enter the name of each disk in the LDU (Press NEW LINE when done)*

Disk unit name? DPF0 ↵

Device code [27] ? ↵ (Stand-alone PCOPY only)

Disk unit name? ↵

LDU unique ID is 'ROOT1'

LDU name is 'ROOT1'

*Specify destination LDU.*

*Enter the name of each disk in the LDU (Press NEW LINE when done)*

Disk unit name? DPF10 ↵

Device code [67] ? ↵ (Stand-alone PCOPY only)

Disk unit name? ↵

LDU unique ID is 'ROOT1A'

LDU name is 'ROOT1A'

Copy to Disk from Disk. Please confirm (N/Y)? Y ↵

Confirmed.

... (Time passes) ...

Done!

\*

## Using PCOPY, Disk to Disk, with All Disks Not On-Line

Do this only if you want to copy a multiple-disk LDU, have units with removable packs, and you don't have twice as many identical disk units as there are disks in the LDU.

To copy disk to disk without all disks in each LDU on line, you need three (or more) identical disk units with removable packs. The disk with the LDU's bitmap must be in the first disk unit, and will stay in this unit throughout the LDU copy. (The bitmap disk is usually the first in the LDU, since the Disk Formatter puts the bitmap on this disk by default.) The destination disk packs must be formatted to be similar to the source packs (described earlier, in "PCOPY Requirements").

The sequence (with three disk units) goes like this:

- The bitmap disk is in the first unit (unit 0). You might want to write-disable this unit so that you won't accidentally overwrite it. Unit 1 holds the copy disk for the bitmap disk. Unit 2 (the third unit) doesn't matter for this step.
- PCOPY asks about source and destination units, and you specify unit 0 as the source and unit 1 as the destination. PCOPY copies the bitmap disk to the disk in unit 1, then prompts you to dismount unit 1.
- The bitmap disk stays in unit 0. Remove the disk from unit 1 and put the second source disk in unit 1. Write-disable unit 1 so that, if you accidentally specify unit 1 as the destination, the disk in unit 1 won't be overwritten. Put the second destination disk in unit 2 (the third unit). PCOPY copies the second source disk (unit 1) to the second destination disk (unit 2).
- If you're copying a two-disk LDU, you're done; remove the second disk copy from unit 2. The source LDU remains in units 0 and 1. Write-enable all write-disabled units.

If there are more disks in the LDU, remove the source disk from unit 1 and the copy disk from unit 2. Insert the next source disk in unit 1 and the next destination disk in unit 2. PCOPY copies the source in unit 1 to the destination in unit 2.

Repeat this step until you have copied all the disks in the source LDU. Then remove the last copy disk from unit 2. The bitmap source disk remains in unit 0; the last source disk remains in unit 1. Put the desired disks in units 1 and 2 to resume system operations. Write-enable all write-disabled disks.

(If you have four or more identical disk units with removable packs, you'll be able to think up other disk/unit placements for the PCOPY. This section just gives the *approach*. The only restriction is that the bitmap disk must remain on line and ready at all times.)

## PCOPY Dialog, Disk to Disk, with All Disks Not On-Line

Have the LDU source and destination disk ready as described above.

Start PCOPY as described earlier. The disk-to-disk dialog goes something like the following. If PCOPY reports an error, see Table 10-2.

*AOS/VS Disk Copier REV n*

*Enter today's date (mm dd yy)?*

1. This *date* question is asked only by stand-alone PCOPY; stand-among PCOPY gets today's date from the system calendar. If asked, type today's date, with numbers separated by one space — for example,

11 19 85 )

*Will this be a disk to disk PCOPY [N] ?*

2. Type Y )

*Will all disks in each LDU be on-line at all times [Y] ?*

3. Type N ). (To copy disk to disk with all disks on line, see the previous section.)

*Specify source LDU*

*Enter first physical disk name (Must contain bitmap):*

4. Respond with the unit name that holds the first (bitmap) disk in the LDU; e.g., DPF0 ).

*Device code [default] ?*

This is skipped by stand-among PCOPY.

Unless you know that this disk is connected to a nondefault device code, press ) for the default. Otherwise, type the device code of the unit controller. PCOPY gives the source LDU ID and name, then asks about the second LDU:

*LDU unique ID is 'id'*

*LDU name is 'name'*

*Specify destination LDU.*

*Enter first physical disk name:*

5. Type the unit name of the first disk in the *destination* LDU; e.g., DPF1 ).

*Device code [default] ?*

6. This is skipped by stand-among PCOPY. If this disk is on the default device code for its name, press ); otherwise type the device code. PCOPY displays the destination LDU ID and name, then asks for confirmation:

*LDU unique ID is 'id'*

*LDU name is 'name'*

*Copy to Disk from Disk. Please confirm (N/Y)?*

7. If there are any files you don't want overwritten on the destination disk, type N ) and begin again. A PCOPY overwrites all files on the destination medium. PCOPY asks this question to give you a chance to reconsider. To proceed, type

Y )

*Confirmed.*

PCOPY now copies the bitmap disk to the destination disk. A full 190-megabyte disk takes roughly 15 minutes to copy. If PCOPY hits an error, it will display one of the error messages explained in Table 10-2. (But if either disk is not ready, PCOPY will wait in silence until you make it ready.) When PCOPY is done, it says

*Processing completed on current disks.*

*Dismount destination disk #1*

*Enter source disk #2 name:*

8. Dismount the destination disk (the one in the second unit, unit 1, if you followed the procedures given above). Mount the next source disk and the next destination disk. (Leave the bitmap disk alone.) Then type the source disk name; for example, DPF1 ↵.

*Device code [default] ?*

9. If this question is asked, press ↵ for the default code; or for a nonstandard code, type the code and ↵.

*Enter destination disk #2 name:*

10. Type the name of the second destination disk; e.g., DPF2 ↵.

*Device code [default] ?*

If this question is asked, press ↵ for the default or type the device code.

11. PCOPY now copies the new source disk to the new destination disk. If the new source disk is the last disk in the LDU, the LDU copy is done and PCOPY says *Done!*. Go to step 17. (PCOPY knows the number of disks in the LDU from the Disk Information Block (DIB) in the first disk.)
12. If the source LDU contains more disks, PCOPY prompts you to dismount the disks and asks for the new source and destination names, as follows:

*Processing completed on current disks.*

*Dismount source disk #n*

*Dismount destination disk #n*

*Enter source disk # n+1 Name:*

13. Dismount the last source and destination disks (leaving the bitmap disk alone). Put the next source and destination disks in available units (unit 1 and 2, if you're following the procedures given above.) Then type the unit name of the next source disk; e.g., DPF1 ↵.

*Device code [default] ?*

14. If this question is asked, press ↵ for the default code, or type the code.

*Enter destination disk # n+1 Name:*

15. Type the unit name of the next destination disk name; e.g., DPF2 ↵.

*Device code [default] ?*

16. If this question is asked, press ↵ for the default code or type the code. PCOPY now copies the source disk to the destination disk. If this is the last source disk in the LDU, PCOPY says *Done!*; proceed to step 17. If there are more disks in the source LDU, return to step 12.
17. The PCOPY is done. You can dismount the last copy disk and mount the disks needed for normal AOS/VS operations. Be sure to write-enable all disk units.

To copy another LDU, ready the source and destination disk(s). Then type CONTINUE ↵ (stand-alone) or XEQ PCOPY ↵ (stand-among) and return to step 1 in this section.

\*



## Example of Disk-to-Disk PCOPY Dialog with All Disks Not On-Line

This example shows a PCOPY of a two-disk LDU.

Pathname? PCOPY ↓

AOS/VS Disk Copier REV n

Enter today's date (mm dd yy)? 11 19 85 ↓ (Stand-alone PCOPY only)

Will this be a disk to disk PCOPY [N]? Y ↓

Will all disks in each LDU be on-line at all times [Y] N ↓

Specify source LDU

Enter first physical disk name (Must contain bitmap): DPF0 ↓

Device code [27]? ↓ (Stand-alone PCOPY only)

LDU unique ID is 'SYS'

LDU name is 'SYS'

Specify destination LDU.

Enter first physical disk name: DPF1 ↓

Device code [27]? ↓ (Stand-alone PCOPY only)

LDU unique ID is 'SYS1'

LDU name is 'SYS1'

Copy to Disk from Disk. Please confirm (N/Y)? Y ↓

Confirmed.

... (Time passes) ...

Processing completed on current disks.

Dismount destination disk # 1

Dismount the destination disk; mount the new source and destination disks.

Enter source disk #2 name: DPF1 ↓

Device code [27]? ↓ (Stand-alone PCOPY only)

Enter destination disk # 2 name: DPF10 ↓

Device code [67]? ↓ (Stand-alone PCOPY only)

... (Time passes) ...

Done!

\*

## PCOPY Dialog, Disk to Tape

Have all the tape units set to DENSITY HIGH (if this applies), to conserve tape. Then mount all the tapes you can and put them on line. Mounting multiple tapes reduces the number of tape changes you must make. Next, start PCOPY as described above.

AOS/VS Disk Copier REV n

Enter today's date (mm dd yy)?

1. This *date* question is asked only by stand-alone PCOPY; stand-alone PCOPY gets today's date from the system calendar. If asked, type today's date, with numbers separated by one space — for example,

11 19 85 ↓

Will this be a disk to disk PCOPY [N]?

2. Press ↓ for the default answer, No, shown in square brackets.

Is source a logical Disk(D), labeled Tape (T), or Floppy(F)?

3. Type D ↵

*Specify source LDU*

*Enter the name of each disk in the LDU (Press NEW LINE when done)*

*Disk unit name?*

4. Type the name of the first disk in the LDU; e.g., DPF0 ↵.

*Device code [default] ?*

5. This question is skipped by stand-alone PCOPY. Unless you know that this disk is connected to a nonstandard device code, press ↵ for the default. Otherwise, type the device code of the unit controller.

*Disk unit name?*

PCOPY repeats *Disk unit* questions until you respond ↵ to *Disk unit name?*. Be sure to specify all disks in the LDU, if a multiple-disk LDU was originally created with the Disk Formatter.

When you've specified each disk, press ↵ at *Disk unit name?*. PCOPY then describes the source LDU and asks for the destination medium:

*LDU unique ID is 'id'*

*LDU NAME is 'name'*

*Copy to Disk (D), labeled Tape (T), or Floppy (F)?*

Type T ↵.

6. *Tape unit name?*

You must specify a tape unit name and volume ID for each tape PCOPY will use. This means that, if you'll need 10 tapes, you'll need to specify 10 tape unit names and 10 volume IDs.

If you have several tape units, you can specify their unit names and the volume IDs in sequence; PCOPY will then copy to them in sequence — allowing you to leave the console for a while. For example, you might type the sequence MTB0 ↵, PCOP01 ↵, MTB1 ↵, PCOP02 ↵, and MTB2 ↵, PCOP03 ↵. Then PCOPY would copy to all tapes needed. If PCOPY needed more tapes, it would ask *Tape unit name?* again. Then, you'd remove the tapes, mount the second set of tapes, and type MTB0 ↵, PCOP04 ↵, MTB1 ↵, PCOP05 ↵, and MTB2 ↵, PCOP06 ↵.

After PCOPY has filled the first tape or tape set, this *Tape unit?* question prompts you to dismount the current tape set and mount the next one. When you see this prompt, *be sure to dismount the newly filled tape or tape set, and mount the new one, before continuing.* If you don't do this, you might forgetfully type a unit name and volume ID — and PCOPY would write new material to the tape (set). This would invalidate the whole backup and you'd need to restart it.

When you type the unit name, omit @; for example,

MTC0 ↵

*Device code ? [22]*

This is asked by stand-alone PCOPY only. For a tape unit on the default device code, press ↵. For a tape unit on any other device code, type the device code and ↵.

7. For an MTD unit, PCOPY asks

*Recording density: 0=6250, 1=1600, 2=800 [0] ?*

Generally, with an MTD unit, you should select the highest density (6250 bpi); if so, press ↵. For a lower density (which will consume much more tape), type the appropriate number and press ↵. PCOPY doesn't ask this question again for this copy.

*Specify volume ID?*

8. You must specify a volume ID for each tape reel or cartridge. Since you usually need several volumes of tape for a PCOPY, a naming convention — like PCOP01, PCOP02, PCOP03, and so on — is desirable.

Type the volume ID that you want on the tape. If you tell PCOPY to label the tapes, it will write this volume ID to the tape. If you tell PCOPY not to label the tapes, it will expect the tape to have the volume ID you type here.

Tape volume IDs are one to six filename characters long. The volume ID should be written somewhere on a paper label on the tape reel or cover; if it's not there, write it there now.)

For example, for the first volume, you might type PCOP01 ↵.

*Tape unit name?*

9. PCOPY repeats *Tape unit name?...volume ID?* questions until you respond ↵ to *Tape unit name?*. Press ↵ unless you have another unit and volume to identify (as described above).

*Expiration date (default is mm dd yy)*

10. The default expiration date is 90 days from the current date. If you tell PCOPY not to label tapes, and try to copy to a tape whose expiration date has not been reached, PCOPY will ask for confirmation before proceeding.

The expiration date can be a useful tool — a time limit that can be overridden. You can select the 90-day default by pressing ↵. Or you can type the date after which you want the tape to be reused; e.g., 4 14 86 ↵. Or, you can type 0 ↵, which marks the tape as already expired, so it can be reused at any time. If you specify a date (not 0), it must be at least one day later than today's date. When you answer, PCOPY asks

*Should PCOPY label the tape(s)? [Y]*

11. You can have PCOPY label each tape. If so, PCOPY will ignore any existing expiration date and write a new label, with the volume ID you specify, to every tape. The new label will replace any existing one.

If you don't have PCOPY label the tapes, the existing labels — with the original volume ID, expiration date, LDU name, and other information — will remain on the tapes. You should tell PCOPY not to label only if most of the tapes are already labeled (perhaps by an earlier PCOPY run).

If you say No to labeling, and later PCOPY encounters an invalid label, it will ask you to respecify the tape unit, then ask again if you want it to label the tapes. This lets you recover from label mistakes. For example, assume you tell PCOPY not to label tapes (because you think you have enough labeled volumes ready). But, after PCOPY uses two tapes, it needs another tape. And there are no more labeled tapes. You can tell PCOPY to start labeling. An example sequence is

...

*Tape unit name?*      MTC0 ↵

*Specify volume ID?*      PCOP01 ↵

*Should PCOPY label the tape(s)? [Y]*      N ↵      (No PCOPY labeling.)

... (This tape has the right label; PCOPY copies to it and rewinds it) ...

*Tape unit name?*

Remove the tape and mount the next one.

MTC0 ↵

*Specify volume ID?*      PCOP02 ↵

... (This tape has the right label; PCOPY copies to it and rewinds it) ...

Remove the tape and mount the next one.

MTC0 ↓

Specify volume ID? PCOP03 ↓

Invalid or missing VOL1 label. (This tape has wrong label.)

Respecify tape units starting at reel 3. (It gives you a chance to back up...

Tape unit name? MTC0 ↓

Should PCOPY label the tapes? [Y] ↓ ...and choose PCOPY labeling if needed.)

...

PCOPY labels this tape using the volume ID of PCOP03, and copies to the tape. PCOPY auto-labeling will stay in force for the rest of the copy. The expiration date and other label information on the first tape are retained — allowing the next PCOPY to occur without auto-labeling.

Generally, the first time you run PCOPY on an LDU, you should have PCOPY label the tapes. This labels the tape set for future backups of this LDU. To have PCOPY label each tape, answer Yes by pressing ↓ or typing Y ↓.

Later, after most tapes you need have been labeled, you might *not* want to have PCOPY label the tapes. Keeping the existing labels allows PCOPY to check volume IDs, expiration dates, and the tape generation number. If you need start labeling during the backup, you can do it as shown in the sequence above. To have PCOPY not label the tapes, type N ↓.

Whatever you decide, you should keep track of the volume IDs used. You will need to type these to restore any LDU from tape. So, write the volume ID (and date and LDU name, if you have more than one) on a paper label attached to the tape reel or cartridge.

After you answer the *label the tape(s)* question, PCOPY says

*Copy to Tape from Disk. Please confirm (N/Y)?*

12. PCOPY gives you this chance to confirm the tape write. To confirm, type

Y ↓

*Confirmed.*

*What buffer size do you want in Kbytes (1, 2, 4, 8,...) [n]*

13. This question sets the buffer size for the copy. A larger buffer size means a larger record, which reduces the number of records; this saves tape by reducing the number of interrecord gaps.

Choose the maximum buffer size selected at VSGEN. For MTD units, the VSGEN default maximum buffer size is 32 Kbytes — which produces a backup you can load only with stand-alone PCOPY. Thus, with an MTD unit, unless you know can reload using stand-alone PCOPY, use a buffer size of 8 Kbytes. The recommended sizes are

| Unit Type          | VSGEN Default Buffer Limit<br>(Max Kbyte Transfer) | Recommended Buffer Size for PCOPY                 |
|--------------------|----------------------------------------------------|---------------------------------------------------|
| MTD                | 32 Kbytes                                          | 32 Kbytes (stand-alone)<br>8 Kbytes (stand-alone) |
| MTB                | 8 Kbytes                                           | 8 Kbytes                                          |
| MTC                | 8 Kbytes                                           | 8 Kbytes                                          |
| MTJ<br>(reels)     | 8 Kbytes                                           | 8 Kbytes                                          |
| MTJ<br>(cartridge) | 8 Kbytes                                           | 16 Kbytes                                         |

If you need to restore from this PCOPY tape set, PCOPY will select the correct buffer size automatically when you restore.

For an MTD unit, type 32 ↵. For an MTB unit or MTC unit, take the default, 8, by pressing ↵.

*Generation number [current]*

14. The generation number is the part of the tape header label that describes the number of copies to the tape. It is an indicator of tape "mileage".

If you told PCOPY to label the tapes, it resets the generation number to 0001 automatically. If you told PCOPY not to label the tapes, it adds 1 to the existing tape number and writes the new number to the label.

To have PCOPY use the displayed number, press ↵. To specify a different number, type the number and press ↵.

After you reply to the *Generation* question, PCOPY starts copying the LDU to labeled tape. A 2400-foot tape takes 6 to 9 minutes; an 800-foot tape on an MTC unit takes 5 to 6 minutes. If PCOPY hits an error, it will display one of the error messages shown in Table 10-2. (But if a disk or tape unit is not ready, PCOPY will wait in silence until you make everything ready.)

15. After PCOPY fills each tape, it rewinds the tape, then asks for the next unit and volume ID (unless you specified a set as shown in step 6 above). You'll mount the next tape volume(s), specify the unit name(s) and volume ID(s), and PCOPY will proceed.

When PCOPY has copied the entire LDU to tape, it says

*PCOPY to tape complete. Do you want to verify the tape(s)? [N]*

16. PCOPY can verify the tapes that it wrote by reading them back. If all tapes read back without errors, you can be nearly certain that they will restore properly later. (But bad storage conditions can make tapes deteriorate *after* you've verified them.) Verifying takes about as long as copying, and is especially recommended for model 6351 tape drives.

When you verify, PCOPY must read the tapes in the same order that it wrote them. So, for a multiple-tape copy, you must dismount the last tape(s) and mount the first tape(s). PCOPY then reads the label and tape, and prompts for others as needed. When done, it will confirm the verification and proceed to step 17. (If PCOPY hits a fatal read error, replace the bad tape with another, restart PCOPY if needed, and redo the PCOPY dump from the beginning, at step 6.)

If you decide to verify the tapes, type Y ↵ and go to step 6. If you don't want to verify the tapes, press ↵ or type N ↵.

17. PCOPY is done. It says

*Done!*

Remove the write-enable rings from the tapes (if this applies); make sure they have paper labels with the correct volume IDs; and store them in a safe place.

To copy another LDU, place its disks in their units (if applicable). Then type CONTINUE ↵ (stand-alone) or XEQ PCOPY ↵ (stand-among) and return to step 1 in this section.

## Example of Disk-to-Tape PCOPY Dialog

Pathname? PCOPY ↵  
AOS/VS Disk Copier REV n  
Enter today's date (mm dd yy)? 11 19 85 ↵ (Stand-alone PCOPY only)  
Will this be a disk to disk PCOPY [N]? ↵  
Is source a logical Disk (D), labeled Tape (T), or Floppy (F)? D ↵  
Specify source LDU  
Enter the name of each disk in the LDU (Press NEW LINE when done)  
Disk unit name? DPJO ↵  
Device code? [24] ↵ (Stand-alone PCOPY only)  
Disk unit name? ↵  
LDU unique ID is '1'  
LDU name is 'ROOT'  
Copy to Disk (D), labeled Tape (T), or Floppy (F)? T ↵  
Tape unit name? MTCO ↵  
Device code? [22] ↵ (Stand-alone PCOPY only)  
Specify Volume ID? PCOP01 ↵  
Tape unit name? ↵  
Expiration date (default is 2 17 86) 0 ↵  
Should PCOPY label the tapes [Y]? N ↵  
Copy to Tape from Disk. Please confirm (N/Y)? Y ↵  
Confirmed.  
What buffer size do you want in Kbytes (1, 2, 4, 8) [8] 2 ↵  
Generation number? [0003] ↵  
... (Time passes as PCOPY writes to tape) ...  
Tape unit name?  
Remove the first tape; insert the next tape.  
MTCO ↵  
Device code? [22] ↵  
Specify volume ID? PCOP02 ↵ (Second tape volume ID)  
... (PCOPY writes to second tape) ...  
PCOPY to tape complete. Do you want to verify the tape(s)? [N] ↵  
Done!

## PCOPY Dialog, Tape to Disk

Mount all the labeled tapes that you can and put them on line. Mounting multiple tapes will reduce the number of tape changes you must make.

As described earlier, in "PCOPY Requirements", the destination LDU must have been formatted with the Disk Formatter — with system tables in specific places. If not, you may need to run the Formatter to move move one or more tables. PCOPY will tell you what to move.

If your system LDU has AOS/VS files on it, try to start PCOPY from disk (BOOT n ↵), and so on for stand-alone; XEQ PCOPY ↵ for stand-among). Stand-among PCOPY can restore only a nonmaster LDU.

If your system LDU doesn't have AOS/VS files on it (for example, you're rebuilding it), you must start PCOPY from the PCOPY tape you made earlier. Do it as described early in this chapter, under "Starting PCOPY from Tape." Then return here and proceed as follows.

*AOS/VS Disk Copier REV n*

*Enter today's date (mm dd yy)?*

1. This *date* question is asked only by stand-alone PCOPY; stand-alone PCOPY gets today's date from the system calendar. If asked, type today's date, with numbers separated by one space; for example,

2 15 86 ↵

*Will this be a disk to disk PCOPY [N]?*

2. Press ↵ to select the default answer, No, shown in square brackets.

*Is source a logical Disk(D), labeled Tape (T), or Floppy (F)?*

3. Type T ↵.

*Tape unit name?*

4. Type the name of the tape unit that holds the *first* tape; e.g., MTC0 ↵.

MTC0 ↵

*Device code ? [22]*

This is asked by stand-alone PCOPY only. For a tape unit on the default device code, press ↵. For a tape unit on any other device code, type the device code and ↵.

*Specify volume ID?*

5. Type the volume ID that's on the tape. This should be visible on the paper label. (If you can't determine the volume ID, you can make one up; then, when PCOPY reads the label, the error message will tell you the actual volume ID.) But remember that, to restore the LDU, the tapes must be copied to the LDU in the same order that they were copied *from* the LDU. When PCOPY copies an LDU to tape, it keeps the LDU ID as the fileset identifier — this lets it avoid restoring the wrong material to an LDU.

For example, if the volume ID were PCOP01, you'd type PCOP01 ↵.

*Tape unit name?*

6. PCOPY repeats the *Tape unit name?...volume ID?* questions until you respond ↵ to *Tape unit name?*.

If you have several tape units, you can specify their unit names and the volume IDs in sequence; PCOPY will then copy to them in sequence — allowing you to leave the console for a while. For example, you might type the sequence MTB0 ↵, PCOP01 ↵, MTB1 ↵, PCOP02 ↵, and MTB2 ↵, PCOP03 ↵. Then PCOPY would copy to all tapes needed. If more tapes were needed to restore the LDU, it would ask *Tape unit name?* again. Then, you'd remove the tapes, mount the second set of tapes, and type MTB0 ↵, PCOP04 ↵, MTB1 ↵, PCOP05 ↵, and MTB2 ↵, PCOP06 ↵.

When you've specified each unit and volume mounted, press ↵ in response to *Tape unit name?*.

*Specify destination LDU*

*Enter the name of each disk in the LDU (Press NEW LINE when done)*

*Disk unit name?*

7. Type the unit name of the first disk in the LDU; e.g., DPF0 ↵.

*Device code [default] ?*

8. This is skipped by stand-alone PCOPY. Unless you know that this disk is connected to a nondefault device code, press **↓** for the default. Otherwise, type the device code of the unit's controller.

*Disk unit name?*

9. PCOPY repeats *Disk unit* questions until you respond **↓** to *Disk unit name?*. Be sure to specify all disks in the LDU, if a multiple-disk LDU was originally created with the Disk Formatter.

When you've specified each disk in the LDU, press **↓** at *Disk unit name?*. PCOPY displays the LDU unique ID and name, then asks for confirmation.

*LDU unique ID is 'id'*

*LDU name is 'name'*

*Copy to Disk from Tape. Please confirm (N,Y)?*

10. If there are any files you want on the destination LDU, type **N ↓** and begin again. A PCOPY overwrites all files on the destination medium — and PCOPY asks this question to give you a chance to reconsider. To proceed, type

**Y ↓**

*Confirmed.*

PCOPY now starts copying the tape(s) to the LDU. A 2400-foot tape takes 7 to 10 minutes. An 800-foot tape on an MTC unit tape takes 5 to 6 minutes. If PCOPY hits an error, it will display one of the error messages explained in Table 10-2. (But if an LDU or tape unit is not ready, PCOPY will wait in silence until you make it ready.)

As PCOPY reaches the end of each tape, it will rewind the tape. Then, if it needs more tape volumes, it will return to *Tape unit name?*, as shown in step 3 above.

When PCOPY is done, it says

*Done!*

11. To restore another LDU, place its disks in their units (if applicable). Then type **CONTINUE ↓** (stand-alone) or **XEQ PCOPY ↓** (stand-alone) and return to step 1 in this section.

\*

### Example of Tape-to-Disk PCOPY Dialog

```
Pathname?      PCOPY ↓
AOS/VS Disk Copier REV n
Enter today's date (mm dd yy)?      2  15  86 ↓      (Stand-alone PCOPY only)
Will this be a disk to disk PCOPY [N]?      ↓
Is source a logical Disk (D), labeled Tape (T), or Floppy (F)?      T ↓
Tape unit name?      MTC0 ↓
Device code ? [22]      ↓
Specify volume ID?      PCOP01 ↓      (Type the tape volume ID)
Tape unit name?      ↓
Specify volume ID?      PCOP02 ↓      (Type tape volume ID)
Specify destination LDU
Enter the name of each disk in the LDU      (Press NEW LINE when done)
Disk unit name?      DPJ0 ↓
Device code [24] ?      ↓      (Stand-alone PCOPY only)
Disk unit name?      ↓
LDU unique ID is 'UDD1'
LDU name is 'UDD1'
Copy to Disk from Tape. Please confirm (N/Y)?      Y ↓
Confirmed.
```



... (Time passes as PCOPY copies to the LDU) ...

*Tape unit name?*

Dismount tape from unit 0; mount the next tape on unit 0.

MTC0 )

*Device code ? [22]* )

*Tape unit name?* )

... (Time passes as PCOPY copies to the LDU) ...

*Done!*

\*

## PCOPY Dialog, Disk to Diskette

Before starting, you need enough hardware-formatted diskettes to hold your LDU's files. These diskettes should also have been formatted with the Disk Formatter. Running a Formatter full format, with at least one pattern, on a diskette allows PCOPY to use a diskette that has bad blocks. If the Formatter hasn't run on a diskette, and PCOPY discovers a bad block on it, PCOPY will abort and you must restart the PCOPY operation from the beginning. When you run the Formatter on a diskette destined for PCOPY, answer **N** ) to the Formatter's *SYSTEM DISK* question.

For a full 39-megabyte Winchester disk, you need about 40 737,000-byte diskettes. You should write the number of each diskette on its paper label — for example, 1, 2, 3, 4, and so on. When you write on a label that's already attached to the diskette inner envelope, use a felt-tipped pen to avoid scoring the diskette surface. Numbering is essential; if you ever need to restore an LDU from these diskettes, PCOPY will require the diskettes in the original dump sequence.

When you're ready, start PCOPY as described earlier.

*AOS/VS Disk Copier REV n*

*Enter today's date (mm dd yy)?*

1. This *date* question is asked only by stand-alone PCOPY; stand-among PCOPY gets today's date from the system calendar. If asked, type today's date, with numbers separated by one space — for example,

11 19 85 )

*Will this be a disk to disk PCOPY [N]?*

2. Press ) for the default answer, No, shown in square brackets.

*Is source a logical Disk (D), labeled Tape (T), or Floppy(F)?*

3. Type D )

*Specify source LDU*

*Enter the name of each disk in the LDU (Press NEW LINE when done)*

*Disk unit name?*

4. Type the name of the first disk in the LDU. This is DPJ0 (system disk) or DPJ1 (for the second disk, if any). For example,

DPJ0 )

*Device code ? [24]*

5. This question is skipped by stand-among PCOPY. If asked, press ) for the default code.

*Disk unit name?*

6. PCOPY repeats the *Disk unit* questions until you answer *↓* to *Disk unit name?*.  
Nearly always, there's only one disk in the LDU. If so, press *↓* now. PCOPY then describes the LDU's ID and name, and asks for the destination medium:  
*Copy to Disk (D), labeled Tape (T) or Floppy (F)?*
7. Type *F ↓*  
*Floppy unit name? [DPJ11]*  
The primary diskette unit name is DPJ10; the secondary unit name is DPJ11. Type the correct name; for example,  
DPJ10 *↓*  
*Device code? [64]*
8. This is skipped by stand-alone PCOPY. If asked, press *↓* to choose the default.  
*Specify volume ID*
9. Type the name of the volume ID that you want on the first diskette. This volume ID will identify the entire diskette copy. It must be between one and six characters long. You might use the date — perhaps in form *yymmdd* — or any other name that will help identify the copy. For example, for November 5, 1985, you might specify the volume ID *851105 ↓*.  
The volume ID will be required to restore the LDU, so make sure it's written on the paper label of diskette number 1.  
*Copy to Floppy from Disk. Please confirm (N/Y)?*
10. PCOPY gives you this chance to confirm the write to diskette. To confirm, type  
*Y ↓*  
*Confirmed.*  
PCOPY now starts copying the LDU to diskette. Each diskette takes about 2 minutes. If PCOPY hits an error, it will display one of the error messages shown later, in Table 10-2. (But if the disk or diskette unit is not ready, PCOPY will wait in silence until you make it ready.)
11. After PCOPY has filled the diskette, it says  
*Mount next floppy, strike any key when ready.*  
Remove the diskette from its unit and write the diskette sequence number on the diskette envelope if you have not done so already (use a felt-tipped pen). Return the diskette to an outer envelope. Insert the next diskette in the unit.
12. Press any character key.  
PCOPY now copies from the LDU to the new diskette. When done, it displays the message shown in step 11. Repeat steps 11 and 12 until PCOPY says  
*Done!*  
Remove the last diskette from its unit, and store all diskettes safely, away from strong magnetic fields.  
To copy another LDU, type *CONTINUE ↓* (stand-alone PCOPY) or *XEQ PCOPY ↓* (stand-alone PCOPY). Make sure you have enough diskettes, and return to step 1 in this section.

## Example of Disk-to-Diskette PCOPY Dialog

Pathname? PCOPY ↵  
AOS/VS Disk Copier REV n  
Enter today's date (mm dd yy)? 11 5 84 ↵ (Stand-alone PCOPY only)  
Will this be a disk to disk PCOPY [N]? ↵  
Is source a logical Disk (D) labeled Tape (T), or Floppy(F)? D ↵  
Specify source LDU  
Enter the name of each disk in the LDU (Press NEW LINE when done)  
Disk unit name? DPJ0 ↵  
Device code? [24] ↵ (Skipped for stand-among PCOPY)  
Disk unit name? ↵  
LDU unique ID is '1'  
LDU name is 'ROOT'  
Copy to Disk (D), labeled Tape (T), or Floppy (F)? F ↵  
Floppy unit name? [DPJ1] DPJ10 ↵  
Device code? [64] ↵ (Skipped for stand-among PCOPY)  
Specify volume ID? 851105 ↵  
Copy to Floppy from Disk. Please confirm (N/Y)? Y ↵  
Confirmed.  
... (Time passes) ...  
Mount next floppy, press any key when ready.  
Mount next diskette and press key.  
... (Time passes — you insert diskettes) ...  
Done!

## PCOPY Dialog, Diskette to Disk

Before you start, get the set of diskettes that PCOPY copied to. The volume ID used for the dump should be visible on the first diskette's paper label, and the sequence number of each subsequent diskette should be visible on its paper label.

As described earlier, in "PCOPY Requirements", the destination LDU must have been formatted with the Disk Formatter — with system tables in specific places. If not, you may need to run the Formatter to move one or more tables. PCOPY will tell you what to move.

If your system LDU has AOS/VS files on it, try to start PCOPY from disk (BOOT 24 ↵, etc. for stand-alone; XEQ PCOPY ↵ for stand-among). Stand-among PCOPY can restore only a nonmaster LDU, unit @DPJ1.

If your system LDU doesn't have AOS/VS files on it (for example, you're restoring it), you must start PCOPY from the PCOPY diskette that you made earlier. Follow the steps described early in this chapter, under "Starting PCOPY from Diskette." Then return here and proceed as follows.

AOS/VS Disk Copier REV n  
Enter today's date (mm dd yy)?

1. This *date* question is asked only by stand-alone PCOPY; stand-among PCOPY gets today's date from the system calendar. If asked, type today's date, with numbers separated by one space — for example,

12 14 85 ↵

Will this be a disk to disk PCOPY [N]?

2. Press **↓** for the default answer, No, shown in square brackets.  
*Is source a logical Disk (D), labeled Tape (T), or Floppy (F)?*
3. Type **F ↓**  
*Floppy unit name [DPJ1]?*  
The primary diskette unit name is DPJ10; the secondary unit name is DPJ11. Type the correct name, usually  
DPJ10 ↓  
*Device code ? [64]*
4. This is skipped by stand-alone PCOPY. If asked, press **↓** to choose the default.  
*Specify volume ID?*
5. Type the volume ID that was specified for the diskette dump. This should be written on the paper label of the first diskette. (If you can't determine the volume ID, make one up; later, when PCOPY checks the diskette, it will display the real ID in an error message. Then type CTRL-C CTRL-A to restart PCOPY and type the actual volume ID. But remember that, to restore an LDU properly, the diskettes must be copied to the LDU in the same order that they were copied *from* the original LDU.)  
For example, if the label were 851105, you'd type 851105 ↓.  
*Specify destination LDU*  
*Enter the name of each disk in the LDU (Press NEW LINE when done)*  
*Disk unit name?*
5. Type the name of the first disk in the LDU. This is DPJ0 (system disk) or DPJ1 (for the second disk, if any). For example,  
DPJ0 ↓  
*Device code? [24]*
6. This is skipped by stand-alone PCOPY. If asked, press **↓** for the default:  
↓  
*Disk unit name?*
7. PCOPY repeats *Disk unit* questions until you answer **↓** to *Disk unit name?*. In nearly all cases, there will be only one disk in the LDU; if so, press **↓**.  
*Copy to Disk from Floppy. Please confirm (N/Y)?*
8. If there are any files you want on the destination LDU, type **N ↓**. PCOPY overwrites all material on the destination medium. PCOPY gives you this chance to confirm the write to disk. To confirm, type  
Y ↓  
*Confirmed.*  
PCOPY now checks the volume ID and sequence number. If these are correct, it starts copying the diskette to the LDU. If PCOPY hits an error, it will display one of the error messages shown Table 10-2. (But if the disk or diskette unit is not ready, PCOPY will wait in silence until you make it ready.)
9. After PCOPY has finished copying from the diskette, it says  
*Mount next floppy, press any key when ready.*  
Remove the diskette from its unit and replace it in the envelope. Insert the next diskette in the unit.

10. Press a key.

If the sequence number is correct, PCOPY now copies from the new diskette to the LDU. (If the sequence number is wrong, PCOPY will display an error message and prompt for the correct diskette. Try to find and mount the correct diskette. If you succeed, fine; if not, you will have to restart the PCOPY from the first diskette).

When PCOPY has finished copying from this diskette, it displays the *Mount next floppy* message shown in step 9. Repeat steps 9 and 10 until until PCOPY says

*Done!*

Remove the last diskette from its unit and store all diskettes safely.

11. To restore another LDU, type CONTINUE ↓ (stand-alone) or XEQ PCOPY ↓ (stand-among). Return to step 1 in this section.

\*

### Example of Diskette-to-Disk PCOPY Dialog

Pathname? PCOPY ↓  
AOS/VS Disk Copier REV n  
Enter today's date (mm dd yy)? 2 14 86 ↓ (Stand-alone PCOPY only)  
Will this be a disk to disk PCOPY [N] ? ↓  
Is source a logical Disk (D) labeled Tape (T), or Floppy(F)? F ↓  
Floppy unit name? [DP11] DPJ10 ↓  
Device code ? [64] ↓ (Stand-alone PCOPY only)  
Specify volume ID? 851105 ↓  
Specify destination LDU  
Enter the name of each disk in the LDU (Press NEW LINE when done)  
Disk unit name? DPJ0 ↓  
Device code? [24] ↓ (Stand-alone PCOPY only)  
Disk unit name? ↓  
LDU unique ID is '1'  
LDU name is 'ROOT'  
Copy to Disk from Floppy. Please confirm (N/Y)? Y ↓  
Confirmed.  
... (Time passes) ...  
Mount next floppy, press any key when ready.  
Mount next diskette; strike key.  
... (Time passes) ...  
Done!

\*

## PCOPY Error Messages

While running PCOPY, you might receive the messages explained in Table 10-2.

**Table 10-2. PCOPY Error Messages**

| Message                                                                                  | Meaning and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>None. Nothing happens or no response.</i>                                             | <p>A pertinent tape or disk unit may not be ready and on line; or a diskette may be misinserted. Check; if any is not ready, make it ready and PCOPY will continue.</p> <p>You typed the wrong device code. Type the break sequence (CMD and BREAK/ESC) and retype the BOOT command.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <i>Bad sequence number, incorrect format for PCOPY</i>                                   | You mounted the wrong tape, disk, or diskette; or mounted a tape or disk(ette) not written by PCOPY. Dismount or replace the tape or disk(ette) and replace it with the correct one.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>Bad tape - Tape error during recovery of tape error</i>                               | <p>PCOPY encountered an error and — while trying to fix it — encountered another error. If you are dumping to tape, mount another tape.</p> <p>If you are verifying or loading from tapes, PCOPY aborts. If you are verifying, try another tape (or unit) and restart the PCOPY. If you are loading, try another unit if possible, or clean the unit heads with an alcohol-soaked swab; then restart PCOPY.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>Bitmap disk has been altered. Restore bitmap disk to device code nn unit number n</i> | For a disk-to-disk PCOPY with all disks not on line, the first disk to be copied must remain in the same unit, on line, throughout the copy. Put the bitmap disk in this unit and restart; or specify the unit that holds the bitmap disk. Restore the bitmap disk to its original unit. You may need to restart; or try typing CONTINUE ).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Bitmap not aligned, should be at n</i>                                                | <p>The bitmap address on the destination LDU does not match the bitmap address on the source LDU.</p> <p>To retain the destination LDU's bitmap/overlay area/remap area addresses, run a Disk Formatter Partial format on the destination LDU, and note the bitmap, overlay, and remap area addresses. Then, again with a Formatter Partial format, try to move the <i>source</i> LDU areas to the same addresses as on the destination LDU. If this succeeds, try PCOPY again. If it doesn't succeed, try to find some other way to get the source LDU's files onto the destination LDU, then run a Full format on the source LDU and default the bitmap and overlay area addresses. Future PCOPYs with the source LDU will then work without this error.</p> <p>If you <i>cannot</i> get the source LDU's files onto the destination LDU without using PCOPY, use a Disk Formatter Partial format to move the destination LDU's bitmap, overlay area, and remap area to the same addresses as on the source LDU (this will probably bring the addresses back to an old revision default).</p> |
| <i>Bitmap not on this disk</i>                                                           | For a disk-to-disk copy with all disks not on line, the first disk to be copied must have the bitmap on it. This disk must be on line throughout the copy. Put the bitmap disk in this unit and restart; or specify the unit that holds the bitmap disk.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <i>Check for proper density</i>                                                          | PCOPY encountered an error that may indicate incorrect density; check the unit for correct density.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

(continues)

**Table 10-2. PCOPY Error Messages**

| Message                                                                                                         | Meaning and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Disk error, Unit = u,<br/>Retries = r,<br/>Status = s</i>                                                    | <p>An unrecoverable disk/diskette error occurred.</p> <p>If device code <i>n</i> indicates a hard disk, see if the disk is ready and write-enabled. If not, write-enable it and type CONTINUE ), and retry PCOPY. If the disk is write-enabled, check the error status <i>s</i> in the <i>Programmer's Reference Manual for Peripherals</i>, or disk hardware manual. It may be possible to run a Disk Formatter Partial format on the disk.</p> <p>If device code <i>n</i> indicates a diskette, and this is a dump, you must either get another diskette or run the Disk Formatter on the current one; then restart the PCOPY. We suggest running the Disk Formatter, with at least one pattern, on all diskettes you plan to use for backup; doing this creates a bad block table that allows PCOPY to avoid bad blocks and prevents this situation. If you are trying to load, and must load from this diskette, retry PCOPY from the beginning (in another unit, if you have one); there's a <i>chance</i> that the diskette was badly seated and a second attempt will work.</p> |
| <i>Disk is in use - FIXUP must be run on the LDU.</i>                                                           | The LDU has not been closed normally by AOS/VS and may have file system inconsistencies. Run FIXUP on it.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>Dynamic memory allocation/deallocation error</i>                                                             | <p>From stand-alone PCOPY. Stand-alone PCOPY tries to wire pages. This message means that it can't do so. The problem probably involves privileges: to wire pages a process must become resident, which means it needs the <i>Change type</i> privilege.</p> <p>Run PREDITOR, specify your username, edit the profile, and give yourself the <i>Change type</i> privilege. Then retry PCOPY.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <i>Error - message</i>                                                                                          | Find the message text in this table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>Fatal disk error</i>                                                                                         | See <i>Disk error</i> message.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <i>Fatal tape error</i>                                                                                         | See <i>Tape error</i> message.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <i>Fatal tape read error, retries = 15</i>                                                                      | PCOPY cannot read the tape, although it has retried 15 (octal) times. PCOPY aborts. If you must load the tape, try another unit, or clean the unit's read/write heads.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>File is open, can't exclusively open</i>                                                                     | PCOPY opens the LDU exclusively, and the LDU is already exclusively open. Perhaps you have already started to run PCOPY on this LDU.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>File set ID does not match first volume ID</i><br><br><i>File set ID = id</i><br><i>First volume ID = id</i> | <p>(On load only.) On the second or subsequent tape/diskette, the fileset ID does not match the set ID of the first volume.</p> <p>To continue the load, you must find the other volume(s) that followed the first volume in the PCOPY dump. Or, if you conclude that the preceding volume(s) were wrong, you can find <i>all</i> correct PCOPY dump tapes and restart the load from the first volume.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

(continued)

**Table 10-2. PCOPY Error Messages**

| Message                                                                                                                                                                                    | Meaning and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><i>File set ID does not match LDU unique ID</i></p> <p><i>File set ID = name</i><br/><i>LDU ID = ldu-name</i></p> <p><i>If you wish to continue</i><br/><i>Please confirm (Y/N)</i></p> | <p>(On a load only.) The file set ID on this tape/diskette doesn't match the LDU unique ID that was given the LDU via the Disk Formatter. The LDU does not have the same ID as the one was PCOPYed; there may be valuable files on it. Do not confirm unless you are sure you want the contents of the tape set written to this LDU. (You might confirm, for example, if you knew that the LDU unique ID had been changed — via a Disk Formatter Partial or Full Format — since the PCOPY backup occurred.)</p> <p>If you confirm with Y ↵, COPY ignores the ID that's on the LDU and writes the tape — including the LDU ID on the tape — to the LDU. PCOPY will repeat this message for each tape or diskette in the original dump. After having typed Y ↵ the first time, you must continue typing Y ↵.</p> <p>If — for the first tape or diskette — you type N ↵, PCOPY asks you to specify the tape or floppy unit name again. You may want to stop PCOPY and find a tape set that was copied from the LDU. From AOS/VS, you can discover the fileset ID in any tape label by typing X DISPLAY @unitname ↵; the fileset ID is the second name after the HDR1 label.</p> |
| <p><i>Inconsistent block count on EOF1 (EOV1) label</i></p>                                                                                                                                | <p>The number of blocks read from tape is not the same as the block count in the end-of-file (or end-of-volume) label. This may mean that the program couldn't read everything on the tape. The load is invalid.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <p><i>Incorrect disk format revision number</i></p>                                                                                                                                        | <p>The LDU you have mounted is of an old, incompatible revision. Run a Disk Formatter Partial format on the LDU. This may fail; if so, try to dump the material (if there is any you care about). Then run a Full format.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p><i>Incorrect volume ID</i><br/><i>Tape volume ID = id</i></p>                                                                                                                           | <p>(On load only.) The volume ID you specified does not match the ID on the tape/diskette mounted.</p> <p>PCOPY repeats its volume ID request. If you made a typing error, and the ID displayed by PCOPY is correct, type the actual ID as given by PCOPY. If the displayed ID seems wrong, try to find the fileset with the correct volume IDs.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <p><i>Incorrect volume sequence number</i><br/><i>Expecting reel # n</i><br/><i>Received reel # m</i></p>                                                                                  | <p>The volume is out of order. Put the proper volume on a unit and/or respecify as asked.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p><i>Invalid date</i></p>                                                                                                                                                                 | <p>You entered an invalid expiration date or today's date. Retry.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <p><i>Invalid or missing HDR1 label</i></p>                                                                                                                                                | <p>The HDR1 label (which holds the file set ID, expiration date, and other essentials) is wrong or missing. This means the tape or diskette was not labeled by PCOPY or the LABEL program. The tape or diskette is unusable as is.</p> <p>On a dump, PCOPY will ask about <i>Tape unit name</i> and give you a chance to have it start labeling tapes. Tell it to do so by answering Yes to the <i>Should PCOPY label the tape(s)?</i> question.</p> <p>On a load, try to find and mount the correct tape or diskette.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <p><i>Invalid or missing VOL1 label</i></p>                                                                                                                                                | <p>The VOL1 label (first label on the tape) is wrong or missing. See the preceding message.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

(continued)



**Table 10-2. PCOPY Error Messages**

| Message                                                                                       | Meaning and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>LDU size mismatch</i>                                                                      | <p>The destination LDU is not the same size as the source LDU. The two LDUs must include identical disks, aside from the IDs and names.</p> <p>If they <i>are</i> identical, run a Disk Formatter Partial format and make sure that the octal addresses (DISK NUMBER n, m through n) are consistent on the LDUs.</p> <p>If the source LDU has a diagnostic area (a Disk Formatter option for revision 6.00), you must run a full format and reserve an identical area on the destination LDU.</p>                                                                                                                                               |
| <i>Overlay areas not aligned, should be at n</i>                                              | The destination LDU's overlay area does not match the source LDU's overlay area. See <i>Bitmap not aligned</i> message above.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>Overlay area size mismatch</i>                                                             | The destination LDU's overlay area is not the same size as the source LDU's. This may mean that one of the LDUs is a system disk and the other isn't. Either both must be, or none must be a system disk. Run a Disk Formatter Partial format on the destination LDU to check the sizes.                                                                                                                                                                                                                                                                                                                                                        |
| <b>PHYSICAL UNIT FAILURE</b>                                                                  | For disk or diskette, see <i>Disk error</i> message.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>Remap areas not aligned, should be at n</i>                                                | The destination LDU's remap area address does not match the source LDU's remap area address. See <i>Bitmap not aligned</i> message above.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <i>Remap area size mismatch</i>                                                               | The destination LDU's remap area size differs from the source LDU's. See <i>Bitmap not aligned</i> message above.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <i>Respecify tape units starting at reel n<br/>Tape unit name?</i>                            | <p>This usually follows a labeled tape error message. Usually, you don't need to restart the dump or load operation from the beginning.</p> <p>On a dump, decide whether or not you want to retain the offending tape. To retain it, dismount it and find another (perhaps the correct tape in the sequence). Then, regardless of your decision, type the tape unit name. PCOPY will then give you a chance to have it label the tapes. Say Yes to the <i>Should PCOPY label the tape(s)</i> question; and PCOPY will do it and continue the dump.</p> <p>On a load operation, find the correct tape, and type the unit name and volume ID.</p> |
| <i>Tape error, Unit = u,<br/>Retries = r,<br/>Status = s</i>                                  | <p>An unrecoverable tape error has occurred. This can occur if the tape is not a labeled tape. It can also occur if the tape heads are dirty (try cleaning them with an alcohol-soaked cotton swab), or if the heads are out of alignment.</p> <p>Restart PCOPY if needed. If you are verifying tapes, replace the tape; you must redo the whole PCOPY from the beginning. If the error recurs, check the Peripherals manual, or appropriate tape manual. Try another unit if you have one.</p>                                                                                                                                                 |
| <i>Tape has not reached its expiration date<br/><br/>Do you want to override it (Y or N)?</i> | <p>(On dump only.) The expiration date given or defaulted when PCOPY last wrote to this tape set hasn't been reached. If you want to override and write to the tape set, type Y J. You will need to do this for each tape in the tape set.</p> <p>To preserve the tape set, type N J and mount an expired or other set.</p>                                                                                                                                                                                                                                                                                                                     |

**Table 10-2. PCOPY Error Messages**

| Message                                              | Meaning and Action                                                                                                                                                                                                       |
|------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Tape is write locked<br/>insert a ring and...</i> | Do what it says.                                                                                                                                                                                                         |
| <i>Tape write error, retries = 15</i>                | PCOPY cannot write to the tape, although it has retried 15 times. It cannot recover from the error. Mount another tape and continue. If the error recurs, check the error status in the Peripherals or tape unit manual. |
| <i>Too many physical units in LDU</i>                | You tried to specify more than eight physical disk units for the LDU. Retry, specifying the correct number of physical disks.                                                                                            |
| <i>Wrong number of PU's in<br/>destination LDU</i>   | The destination and source LDUs do not contain the same number of physical disks. Probably you mounted the wrong destination (or source) LDU.                                                                            |

(concluded)

## Backup Using MSCOPY (Modified Sector Copy)

MSCOPY offers an alternative to file-oriented backups (with DUMP) and entire LDU backups (with PCOPY). MSCOPY does a form of incremental backup in which only disk sectors (blocks) that have changed since the last full backup are copied. MSCOPY works only with disk units that can keep track of modified sectors: model 6236 (354 Mbyte) and model 6239 (592 Mbyte), DPJ-type units.

MSCOPY runs while AOS/VS is up, on nonmaster LDUs. It is most useful for sites that have very large files where relatively few changes occur (like large INFOS II or DG/DBMS database files). It takes a long time to back up such files with DUMP or PCOPY; it may be faster to back up only their changed sectors with MSCOPY.

MSCOPY can't copy an open LDU; thus it can't copy the system LDU. So, if you use MSCOPY to copy nonmaster LDU(s), you need DUMP (or PCOPY) for backup on the system LDU.

You might consider MSCOPY if

- you have a nonmaster LDU composed of model 6236 or 6239 disks that has one or more large database files, and the file(s) change relatively little between backups; and
- this LDU can be released from the system for thirty minutes or so each day; and
- you're willing to use DUMP or PCOPY to back up the master LDU (if needed).

## How MSCOPY Works

When MSCOPY does a full backup on an LDU, it creates a *backup history* file for that LDU. The history file records information (like date and filename) on the full backup and all incremental backups.

After the full backup, the LDU is reinitialized into the system and disk sectors are modified. When any sector is modified, its *modified sector* bit is set and stays set until the next full backup. Each incremental backup copies all modified sectors.

As time passes, the number of modified sectors grows; so does the size of the incremental backups. Eventually, the incremental backups grow large enough to make another full backup worthwhile.

When you do another full backup, MSCOPY renames the last history file and starts a new history file. After rewinding the last full backup tape, MSCOPY zeroes all modified sector bits on the LDU — indicating that all sectors are unmodified.

To restore an LDU, you need restore only the full backup and most recent incremental backup.

The backup history file allows MSCOPY to keep track of all tapes in a backup set. If you restore a set, MSCOPY will use the pertinent history file to ensure that you restore both the full backup and the last incremental backup. All backup history files are stored in directory :UTIL:MSCOPY\_HISTORY — away from the copied LDU. THE MSCOPY program creates this directory the first time you run it. Don't delete or move this directory.

MSCOPY offers the following options on its menu.

- |                  |                                                                                                                                                                                                                                                        |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 <i>NEW</i>     | For a new LDU, does a full backup and creates a new history file. You must use NEW the first time you run MSCOPY on an LDU. You must use FULL and NEXT thereafter.                                                                                     |
| 2 <i>FULL</i>    | Does a full backup from an existing LDU, renames the old history file, and creates a new history file. Use FULL when you want a full backup — say, every month or so.                                                                                  |
| 3 <i>NEXT</i>    | Does an incremental backup that includes all modified sectors. NEXT is the MSCOPY option you'll use most often. Part of the display tells you what percentage of the LDU has been copied; you can use this to decide when it's time for a full backup. |
| 4 <i>RESTORE</i> | Restores an LDU from a backup set.                                                                                                                                                                                                                     |
| 5 <i>HELP</i>    | Gives help on MSCOPY commands.                                                                                                                                                                                                                         |
| 6 <i>HISTORY</i> | Displays dates and other information in a history file — including the percentage of the LDU copied on each backup.                                                                                                                                    |
| 7 <i>BYE</i>     | Leaves the MSCOPY program.                                                                                                                                                                                                                             |

MSCOPY includes the following files: in directory :UTIL, MSCOPY.CLI and MSCOPY.PR (macro to execute program and program itself); in directory :HELP, CLI.TPC.MSCOPY; and in :UTIL:MSCOPY, MSCOPY.BTSFPLK (error message file). All files are shipped in the directories above on the AOS/VS system tape.

## MSCOPY Command Line and Switches

The MSCOPY command line is

MSCOPY *[switch]*

The switches are

- |            |                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| /1 =       | {<br><i>IGNORE</i><br><i>WARNING</i><br><i>ERROR</i><br><i>ABORT</i><br>} | This sets CLASS1 (serious) error handling to the level you specify. The default is ERROR. We suggest you retain the default (omit this switch). For more detail on these levels, see the CLI manual.                                                                                                                                                                                                                                                                                                                                       |
| /2 =       | {<br><i>IGNORE</i><br><i>WARNING</i><br><i>ERROR</i><br><i>ABORT</i><br>} | This sets CLASS2 (mild) error handling to the level you specify. The default is WARNING. We suggest you retain the default (omit this switch).                                                                                                                                                                                                                                                                                                                                                                                             |
| /DENSITY = | {<br>800<br>1600<br>6250<br>}                                             | For backup only. This switch sets the recording density, in bpi. It overrides the setting set by the panel DENSITY switch (if any). If you omit /DENSITY, the density of the panel switch is used. If the unit has no switch, the density at which the last tape was written is used. Generally, you'll want to use the highest density the unit provides. A density of 6250 bpi is available only on MTD units; 800 bpi is available only on MTB units. If you plan to use multiple tape units, specify a density available on all units. |

*/E=pathname* Copies MSCOPY error messages to the file named in pathname, creating the file if it doesn't exist. Error messages are also sent to the console and listing file, if any.

*/L=pathname* Copies MSCOPY dialog to the file named in pathname. If the file doesn't exist, MSCOPY creates it; if it does exist, MSCOPY appends to it. This switch is useful when you want hard copy of an MSCOPY session.

*/RETAIN=days* By default, if you omit this switch, MSCOPY sets the tape expiration date to 90 days after the current date. If anyone tries to do an MSCOPY backup to an unexpired tape, MSCOPY will display

*Tape has not exceeded retention period.*

*MOUNTED new reel - try again*

*RELABEL tape and continue*

*Select action (MOUNTED or RELABEL) [MOUNTED]*

*>*

And you will need either to type **RELABEL** ) or find a volume without an unexpired label, mount it, and type **MOUNTED** ). MSCOPY will ask this question for *every unexpired volume* — which can be a nuisance for a full backup of 15 volumes or more.

For maximum flexibility, you might want to specify */RETAIN=0*, which marks the tape as already expired, allowing it to be reused immediately.

On the other hand, a nonzero retention period can be useful. It can help prevent backups you want to keep from being overwritten. To make good use of the retention period, you must decide how long you want to keep your tape sets, and you must acquire enough tape for all the backup sets needed. Also, you will need to be consistent: specify the same retention period in each backup.

If you decide on a retention period other than 90 days, specify it with */RETAIN=days*. You might want to edit the MSCOPY.CLI macro to specify your retention period. If 90 days is okay, omit this switch.

*/STATISTICS* Tells MSCOPY to display statistics: number of tape blocks and disk sectors read or written, bad block count, and so on. This switch is primarily useful for DG program developers.

*/VERIFY* For backup only. MSCOPY can verify the tapes that it wrote by comparing their data to the LDU data. If all tapes verify without errors, you can be nearly certain that they will restore properly later. (But, bad storage conditions can make tapes deteriorate *after* you verify them.) Verifying takes about as long as backing up.

When you verify, MSCOPY reads the tapes in the same order that it wrote them. So, for a multiple-tape backup, you will need to dismount the last tape(s) and mount the first tape(s). MSCOPY will then read the first tape label and prompt for other tapes as needed.

Usually, you can judge tape condition by the number of soft tape errors reported on the system console — and use this as a basis for replacing tapes. But if you *must* take every step to ensure that the backup can be restored, include this switch.

## If You Make a Mistake with MSCOPY

If you make a typing mistake, before pressing `]`, press the DEL key to erase characters one by one; or enter CTRL-U to erase the entire line.

If you've already pressed `]` after a wrong answer, MSCOPY will probably recognize your error and repeat the question. If so, type the correct answer. MSCOPY error messages are explained in Table 10-3.

If you decide to abort MSCOPY, type CTRL-C CTRL-B or press the BREAK/ESC key (ESC on some terminals) and type ABORT `]`. Then repeat the original MSCOPY command line.

If you abort MSCOPY during an incremental backup, full backup, or restore, the *operation will be invalid*. You must restart it from the beginning.

You can get help (a list of MSCOPY commands) by pressing the BREAK/ESC key or typing CTRL-C CTRL-A, then typing HELP `]`. To learn the dates of MSCOPY backups, choose HISTORY from the main menu.

## Running MSCOPY

You need Superuser privilege to access the history file and disk unit(s) that make up the LDU.

You must use an upper- and lowercase console, because MSCOPY dialog is upper- and lowercase.

Any time during a backup or restore operation, you can check progress with the STATUS command. Press the BREAK/ESC key (don't press CMD first); then type STATUS `]`. Press BREAK/ESC only while MSCOPY is doing I/O. If you press BREAK/ESC while MSCOPY is asking a question, it has the same effect as `]` (it tells MSCOPY to use the default answer).

By default, MSCOPY requires operator action after it uses each tape. On a backup, though, you can premount additional tapes after specifying the first tape. To do this, press the BREAK/ESC key, then type the premount command for each other tape unit, explained below. MSCOPY will then access the units in sequence, without operator interaction.

1. When you plan a full backup, make sure you have enough tapes and time. The number of tapes and minutes varies with the amount of space used on the LDU. A 2,400-foot tape, at 1,600 bpi, can hold about 38 Mbytes (74,000 disk blocks). It takes 10–12 minutes to fill if system load is light. A model 6236 disk unit can hold 354 Mbytes; a model 6239 disk can hold 592 Mbytes.

When an LDU is initialized, you can type SPACE ldu-name `]` to tell how many disk blocks are used (the CUR figure).

On a full (and new) backup, after MSCOPY has copied the LDU to tape and rewinds the last tape, it requires up to 20 minutes per disk (depending on how full the disk is) to zero all the modified bits on the LDU.

When you use MSCOPY to copy or restore an LDU, all disk units must be turned on and ready. The LDU can't be initialized (release it before starting MSCOPY if it is initialized). Generally, MSCOPY will run faster if system load is light.

2. Start MSCOPY by typing

`) MSCOPY ]`

*MSCOPY Revision n*

- 1 NEW - Perform a full backup, and create a new backup set.
- 2 FULL - Perform a full backup, and supersede the previous backup set.
- 3 NEXT - Perform an incremental backup, and add to the current backup set.
- 4 RESTORE - Restore an LDU from a backup set.
- 5 HISTORY - Display a backup set's history.
- 6 HELP - Display help file.
- 7 BYE - Leave MSCOPY.

*Please select action [ ]*

>

3. Select the action you want. You can type either the number (1-7) or action (**NEW**). Choice 1 **NEW** is required for backup if you've never run MSCOPY on the LDU. Choice 2 **FULL** does a full backup and starts a new backup set. Choice 3 **NEXT** does an incremental backup, based on modified sectors.

Choice 4 **RESTORE** starts restoring, based on a backup set's full and last incremental backup. Usually, you'll want to restore the most recent backup set, although you *can* restore any backup set. Choice 5 **HISTORY** displays the dates and labeled tape filenames of all backups in any backup set.

Choice 6 **HELP** explains MSCOPY commands; and 7 **BYE** exits to the CLI.

For example, for **FULL**, you'd type

2 ↵

4. With any choice but 6 **HELP** or 7 **BYE**, MSCOPY needs the LDU name:

*Enter name of object Logical Disk Unit (LDU) []*

>

Type the name of the LDU you want to back up, restore, or check the backup history of. This must be the LDU name as assigned by the Disk Formatter. For example

> DATABASE ↵ (Type LDU name next to the > prompt)

5. The following question is asked if you chose 1 **NEW** or 4 **RESTORE**.

*Enter names (separated by spaces) of all disk units in LDU [default]*

>

For the new backup set, you must identify disk units. MSCOPY runs only on DPJ-type disks, models 6236 and 6239. Type the unit names of all disks in the LDU. Omit a leading @. For example, if the LDU includes the second and third units on the first controller:

> DPJ1 DPJ2 ↵ (Type unit names next to the > prompt.)

When you restore, the default value — displayed in square brackets — shows disk unit(s) in the original LDU. To restore to the same unit(s) that were backed up, press ↵ for the default. Normally, you'll want to do this, so you will press ↵.

On the other hand, to restore to *different* disk unit(s), type the desired disk unit name(s). You might want this if one of the original units were down, and you had an identical disk (formatted the same way) in a different unit. For example, assume you have three units: DPJ0, DPJ1, and DPJ2. You need the LDU that normally runs in DPJ1, but unit DPJ1 is down. You can get along without DPJ2. You have backup sets for all units.

If the disk in DPJ2 is formatted to be identical to DPJ1, you can tell MSCOPY to restore the DPJ2 backup to DPJ1 — by specifying DPJ2 ↵ to this question. Later, when DPJ1 is fixed, you would probably restore the DPJ1 backup again — this time to DPJ1 — and restore the DPJ2 backup to DPJ2.

6. The following question is asked only on 4 **RESTORE** or 5 **HISTORY**.

*Enter name of backup history file [MS\_HISTORY.ldu-name]*

>

Nearly always, when you want to restore an LDU, you want the most recent backup. This is also true for a history file. Information on the most recent backup is kept in file MS\_HISTORY.ldu-name. So, to restore the most recent backup, or check the most recent history file, press ↵.

If you want to restore or check a backup history file that *isn't* the most recent, type the name of history file for the desired backup set.

Old backup history filenames have the form `MS_HISTORY.ldu-name.yymmdd` (yy, mm, and dd are the year, month and day when the file was renamed and a new history file was created). For example, file

`MS_HISTORY.DATABASE.850901` contains information on the backup set for the LDU named DATABASE — started with a full backup on September 1, 1985.

Any backup set you restore will overwrite any material on the LDU. It's a good idea to make sure you have all the tapes of a backup set available before starting a restoration.

Next, for HISTORY, MSCOPY displays the history file and redisplay the menu. You can proceed with backup or restore operations, or you can leave MSCOPY (BYE ).

7. For any backup or restoration, MSCOPY asks you to mount tape. The backup message is

*Tape set filename is x.nnn.yymmdd.hhmm*

*Mount reel 1, ready tape unit, and enter tape unit name [MTB0]*

The restoration message is

*Mount reel 1 of tape file x.nnn.yymmdd.hhmm, ready tape unit,  
and enter tape unit name [MTB0]*

>

The filename begins with a check character based on the time of day. This is followed by a number that shows the sequence in the backup set, the date (yy,mm,dd), and the time (hhmm).

E.000.850325.1723      (This tape filename indicates a full backup — the sequence is 000. The year is 85, month March, day 25, time 5:23 p.m. (1723 on 24-hour clock).)

D.001.850327.1744      (This filename indicates a first incremental backup — the sequence is 001. The year is 85, month March, day 27, time 5:44 p.m.)

J.013.850415.1803      (This filename belongs to a 13th incremental backup — sequence is 013. The year is 85, month April, day 15, time 6:03 p.m.)

On a backup, the tape set filename should be written somewhere on a paper label on the first backup tape. The name is a useful identifier for the tape set and its sequence in the backup set. Having it visible will be handy if you need to restore an LDU.

If you're restoring, MSCOPY expects you to mount the tape set with the filename displayed.

Make sure the tape you want written to (for backup) or read (to restore) is mounted, and that its unit is ready. Then type the unit name, without leading @; or, for MTB0, press J for the default.

8. MSCOPY now checks the tape unit to make sure it's ready. Then it begins the backup or restoration. Each 2,400-foot tape, at 1,600 bpi, takes 10–12 minutes to write or read. If MSCOPY encounters an error condition, it displays one of the error messages explained in Table 10-3.
9. On a backup, you can premount other tapes — for MSCOPY to fill without operator intervention.

If you want to premount, do it now, while MSCOPY is writing to the tape. (If you don't want to premount other tapes, or if restoring, skip to step 10.)

You can premount up to as many units as you have. MSCOPY will then use all the reels it needs, and, if it needs more volumes, prompt for them.

To premount, mount all additional tapes on all unit(s) desired. If the unit(s) have density switches, switch to the higher density. Make the unit(s) ready. For backup, the order of tapes isn't critical.

After mounting the tapes, press the BREAK/ESC key. Then, next to the \*> prompt, type **PREMOUNT** *tape-unitname* ↵. MSCOPY will check tape and unit, verify the premount (or display a *NOT premounted* error message), and repeat the prompt. Type as many premount commands as you want; then press ↵ to leave command mode.

A sample backup tape sequence with two tape units, MTB0 and MTB1, looks like this:

... (Mount tapes on units) ...

*Tape set filename is C.000.850720.1750*

*Mount reel 1, ready tape unit, and enter tape unit name [MTB0]*

> ↵ (Press ↵ to select default unit for the first reel.)

>

ESC (Press BREAK/ESC key.)

\*> **PREMOUNT** MTB1 ↵

*Unit MTB1 premounted* (MSCOPY verifies the premount)

\*> ↵ (↵ terminates premount mode)

>

... (MSCOPY writes to tape on unit 0, then — with *Unit premounted message* — to tape on unit 1) ...

*Tape set filename is C.000.850720.1750*

*Mount reel 3, ready tape unit, and enter tape unit name [MTB0]*

>

... (Dismount the newly written tapes; mount two more reels) ...

> ↵ (Again, select default unit name for the first reel)

>

ESC (Press BREAK/ESC key)

\*> **PREMOUNT** MTB1 ↵

*Unit MTB1 premounted* (MSCOPY verifies)

\*> ↵

>

... (MSCOPY writes to tape on unit 0, then to tape on unit 1) ...

... (This two-reel sequence repeats until the full backup is done) ...

Premounting tapes is desirable because it lets MSCOPY handle multiple tapes without human intervention — allowing you to leave the console for periods longer than 12 minutes.

10. MSCOPY will spin tape until it has backed up or restored the entire LDU. When MSCOPY finishes the current reel(s), it asks

*Tape set filename is x.nnn.yymmdd.hhmm*

*Mount reel n, ready tape unit, and enter tape unit name [MTB0]*

for backup. For restore, the message is

*Mount reel n of tape file x.nnn.yymmdd.hhmm, ready tape unit,  
and enter tape unit name [MTB0]*

Dismount the mounted reel(s), mount the next reel(s), type the tape unit name (or press ↵ for MTB0). Then return to step 8 for the tape I/O.

On a new or full backup, after MSCOPY writes to the last tape, it zeroes the modified sector bits on the LDU. This takes up to 20 minutes per disk, depending on how full the disk is.



11. At the end of a new or full backup, MSCOPY says

*New history file MS\_HISTORY.ldu-name created*

and for a full backup it adds:

*Previous history file is MS\_HISTORY.ldu-name.yymmdd*

The backup history filename is based on the LDU name. The current backup history file (relating to the most recent full backup) is MS\_HISTORY.ldu-name.

For a new LDU, MSCOPY does a full backup and creates the backup history file. (It checks for the backup history file at the beginning, and won't let you do a new backup if the history file already exists.)

For a full backup of an "old" LDU, MSCOPY does a full backup and renames the old history file to MS\_HISTORY.ldu-name.yymmdd. (The yy is the year, mm is the month, and dd is the day of the previous full backup). Before renaming the old file, MSCOPY deletes any existing file of the same name. Then, MSCOPY creates the new backup history file.

This arrangement makes it easy to identify backup history files. A MS\_HISTORY filename that ends with characters like .850523 (for example, MS\_HISTORY.DATABASE.850523) is an old history file. An MS\_HISTORY file that ends in the LDU name is a current history file.

The naming arrangement means you can't do a new backup when a history file exists, and that you can't retain two incremental or full backup sets for the same day (a minor restriction) — unless you manually rename the first backup history file from the CLI before the second backup.

12. When MSCOPY is done, it returns to the CLI.

Dismount all tapes, making sure they have paper labels with the full dump date, incremental dump date, and sequence number. Store safely, without write-enable rings. Tape storage suggestions appear early in this chapter.

## **MSCOPY Backup Example**

An MSCOPY example showing a new backup, incremental backups, and a full backup example appears in Figure 10-7. An MSCOPY restoration appears later, in Figure 10-8.

### The New (Full) Backup

(June 20, 1985. Computer site decides to start using MSCOPY to copy an LDU named DATABASE that includes disk units DPJ1 and DPJ2. Tape units will be MTB0 and MTB1 — with MTB1 premounted.)

) MSCOPY ↓

- 1 NEW - Perform a full backup, and create a new backup set.
- 2 FULL - Perform a full backup, and supersede the previous backup set.
- 3 NEXT - Perform an incremental backup, and add to the current backup set.
- 4 RESTORE - Restore an LDU from a backup set.
- 5 HISTORY - Display a backup set's history.
- 6 HELP - Display help file.
- 7 BYE - Leave MSCOPY.

Please select action [ ]

> 1 ↓

Enter name of object Logical Disk Unit (LDU) [ ]

> DATABASE ↓

Enter names (separated by spaces) of all disk units in LDU [ ]

> DPJ1 DPJ2 ↓

Tape set filename is C.000.850620.1750

Mount reel 1, ready tape unit, and enter tape unit name [MTB0]

... (Person mounts one tape on unit MTB0, another on unit MTB1) ...

> ↓ (Person takes default unit, MTB0)

>

... (Tape I/O starts) ...

ESC (Person presses BREAK/ESC key to enter command mode)

\*> PREMOUNT MTB1 ↓ (Premount tape on unit MTB1)

Unit MTB1 premounted (MSCOPY verifies premount)

\*> ↓

>

... (Backup proceeds, first on MTB0, then on MTB1) ...

Tape set filename is C.000.850620.1750

Mount reel 3, ready tape unit, and enter tape unit name [MTB0]

... (Person dismounts tape on unit 1 and 2, mounts fresh ones) ...

> ↓ (Person selects unit MTB0)

ESC (Person presses BREAK/ESC key)

\*> PREMOUNT MTB1 ↓ (Premount tape on unit MTB1)

Unit MTB1 premounted

\*> ↓

>

... (Backup proceeds, first on MTB0, then on MTB1) ...

... (Backup ends, MSCOPY rewinds last tape used — delay occurs while it zeros the modified bits) ...

*New history file MS\_HISTORY.DATABASE created*

)

(Person stores the tapes safely.)

### **The First Incremental Backup**

(June 21 — the next workday. 7:00 p.m. arrives, time for the incremental backup. Only one tape unit will be used, since the site expects the incremental to fit on one reel.)

) MSCOPY ↓

- 1 *NEW* - Perform a full backup, and create a new backup set.
- 2 *FULL* - Perform a full backup, and supersede the previous backup set.
- 3 *NEXT* - Perform an incremental backup, and add to the current backup set.
- 4 *RESTORE* - Restore an LDU from a backup set.
- 5 *HISTORY* - Display a backup set's history.
- 6 *HELP* - Display help file.
- 7 *BYE* - Leave MSCOPY.

*Please select action []*

> 3 ↓

*Enter name of object Logical Disk Unit (LDU) []*

> DATABASE ↓

*Tape set filename is T.001.850621.1905*

*Mount reel 1, ready tape unit, and enter tape unit name [MTB0]*

... (Person mounts tape on unit 0) ...

> ↓ (Defaults the unit name)

... (Incremental backup proceeds) ...

)

(Person stores the tape safely.)

### **The nth Incremental Backup**

(July 19 — After several weeks of incremental backups, the number of modified sectors has grown. The site does another incremental.)

) MSCOPY ↓

- 1 *NEW* - Perform a full backup, and create a new backup set.
- 2 *FULL* - Perform a full backup, and supersede the previous backup set.
- 3 *NEXT* - Perform an incremental backup, and add to the current backup set.
- 4 *RESTORE* - Restore an LDU from a backup set.
- 5 *HISTORY* - Display a backup set's history.
- 6 *HELP* - Display help file.
- 7 *BYE* - Leave MSCOPY.

*Figure 10-7. MSCOPY New, Incremental, and Full Backup Example (continued)*

*Please select action []*  
 > 3 ↓  
*Enter name of object Logical Disk Unit (LDU) []*  
 > DATABASE ↓

*Tape set filename is G.019.850719.1859*  
*Mount reel 1, ready tape unit, and enter tape unit name [MTB0]*

... (Person mounts tape) ...

> ↓

... (Incremental backup proceeds) ...

*Tape set filename is G.019.850719.1859*  
*Mount reel 2, ready tape unit, and enter tape unit name [MTB0]*

... (Surprise. The incremental backup requires a second tape. The person dismounts the tape and mounts fresh one) ...

> ↓            (Defaults the tape unit name)

... (Incremental backup proceeds) ...

)

(Person stores the tapes safely.)

### **The Next Full Backup**

(July 20 — Since the last incremental backup required more than one tape, the site decides on a full backup. As for the previous full backup, it will use a second tape, premounted on unit MTB1.)

) MSCOPY ↓

- 1 NEW - Perform a full backup, and create a new backup set.
- 2 FULL - Perform a full backup, and supersede the previous backup set.
- 3 NEXT - Perform an incremental backup, and add to the current backup set.
- 4 RESTORE - Restore an LDU from a backup set.
- 5 HISTORY - Display a backup set's history.
- 6 HELP - Display help file.
- 7 BYE - Leave MSCOPY.

*Please select action*  
 > 2 ↓  
*Enter name of object Logical Disk Unit (LDU) []*  
 > DATABASE ↓  
*Tape set filename is U.000.850720.1922*  
*Mount reel 1, ready tape unit, and enter tape unit name [MTB0]*

... (Person mounts one tape on unit MTB0, another on unit MTB1) ...

> ↓            (Person takes default, MTB0)

>

... (Tape I/O starts) ...

ESC            (Person presses BREAK/ESC key)

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*Figure 10-7. MSCOPY New, Incremental, and Full Backup Example (continued)*

```

*> PREMOUNT MTB1 ↓      (Premount tape on unit MTB1)
Unit MTB1 premounted      (MSCOPY verifies premount)
*> ↓
>

... (Backup proceeds, first on MTB0, then on MTB1) ...

Tape set filename is U.000.850720.1922
Mount reel 3, ready tape unit, and enter tape unit name [MTB0]

... (Person dismounts tapes on unit 0 and 1, mounts fresh ones) ...

> ↓      (Person defaults MTB0 unit name)

ESC      (Person presses BREAK/ESC key)

*> PREMOUNT MTB1 ↓      (Premount on unit MTB1)
Unit MTB1 premounted      (MSCOPY verifies)
*> ↓
>

... (Backup proceeds, first on MTB0, then on MTB1) ....
... (Repeat Mount reel n, tape mount, and premount as needed) ...

... (Backup ends, MSCOPY rewinds last tape used — delay occurs while it zeros the modified
bits) ...

Backup history file MS_HISTORY.DATABASE created
Previous history file renamed to MS_HISTORY.DATABASE.850620

)

(Person stores the full backup tapes safely.)

```

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Figure 10-7. MSCOPY New, Incremental, and Full Backup Example (concluded)

## Restoring an LDU with MSCOPY

When you restore with MSCOPY, you restore an entire LDU — no more, no less. To restore an LDU, follow these steps.

1. If the disk(s) has not been formatted, run a Full format on it via the Disk Formatter. Specify the same LDU ID and name as the original LDU had. You must specify (or default) the same addresses for the bitmap, overlay area (if any) and remap area that were given for the original LDU.
2. Get the desired set of backup tapes. Generally, you'll want the most recent set (described by backup history file `MS_HISTORY.ldu-name` in directory `:UTIL:MSCOPY`). But if you want a different backup set, you can check `MS_HISTORY+` files in directory `:UTIL:MSCOPY`. Files with a six-digit suffix are old files; the suffix indicates the full backup date (yymmdd).

When you restore, MSCOPY must read tapes in the correct order. It will allow you to change a tape if you mount the wrong one.

3. Start MSCOPY from a user console or the system console. Restore the full backup first. On a restoration, you must specify the tapes one by one; you can't premount.

Then restore the most recent (latest) incremental backup, unless you want to restore the LDU to a state before the most recent incremental backup. MSCOPY will consult the backup history file and warn you if the backup is not the most recent one. It will allow you to restore a backup that's *not* the most recent, if you insist.

4. If you want AOS/VS to run from the restored LDU, you must install a disk bootstrap on this LDU. (MSCOPY does not install this bootstrap.) Run the Installer as follows:

```
) SUPERUSER ON )
*) XEQ :UTIL:INSTL )
```

*AOS/VS Installer Rev n*

*Specify each disk in the LDU*

*Disk unit name? DPJn )* (Specify all units in restored LDU)

*— Disk bootstrap installed*

*Do you want to install a System Bootstrap [Y] ? N )*

*Do you want to install a System [Y] ? N )*

*Done*

```
*) SUPERUSER OFF )
```

Now, AOS/VS should run from the restored LDU.

5. Put the covers on all tapes and store tapes safely.
6. You're done! You've restored the entire LDU — with luck, losing only a little work (the changes made since the last backup occurred). The next MSCOPY backup can be a full or incremental backup.

## Restoration Example

(March 20, 1987. Computer site decides to restore the most recent backup set for its LDU named DATABASE. It includes units DPJ1 and DPJ2.

) MSCOPY )

- 1 NEW - Perform a full backup, and create a new backup set.
- 2 FULL - Perform a full backup, and supersede the previous backup set.
- 3 NEXT - Perform an incremental backup, and add to the current backup set.
- 4 RESTORE - Restore an LDU from a backup set.
- 5 HISTORY - Display a backup set's history.
- 6 HELP - Display help file.
- 7 BYE - Leave MSCOPY.

Please select action []

> 4 )

Enter name of object Logical Disk Unit (LDU) []

> DATABASE )

Enter name of backup history file [MS\_HISTORY.DATABASE] )

Enter names (separated by spaces) of all disk units in LDU [DPJ1 DPJ2] )

Mount reel 1 of tape file V.000.870302.1913, ready tape unit,  
and enter tape unit name [MTB0]

... (Person mounts first tape on unit, say MTB0. Mounts as many other tapes as possible — to save physical mounts later. Presses ) ...

)

... (Restoration starts, system runs tape) ...

Mount reel 2 of tape file V.000.870302.1913, ready tape unit,  
and enter tape unit name [MTB0]

... (Person makes sure second tape is on MTB1) ...

> MTB1 )

... (Restoration proceeds) ...

Mount reel 3 of tape file V.000.870302.1913, ready tape unit,  
and enter tape unit name [MTB0]

... (Person dismounts tapes on unit 1 and 2, mounts third and fourth backup tape)...

> ) (Defaults unit name)

... (Restoration proceeds) ...

Mount reel 4 of tape file V.000.870302.1913, ready tape unit,  
and enter tape unit name [MTB0]

... (Person makes sure fourth tape is on MTB1) ....

> MTB1 )

... (Restoration proceeds) ...

... (Person dismounts tapes, mounts next ones, repeats mount/premount sequence for all full backup tapes) ...

*Mount reel 1 of tape file Q.006.870319.1908, ready tape unit,  
and enter tape unit name [MTB0]*

... (MSCOPY has prompted for the first tape in the last incremental set. You can override this by mounting an earlier incremental from the set and telling MSCOPY to continue after the error message. But here, the person mounts the volume MSCOPY asks for on MTB0, and mounts the second volume on MTB1) ...

> ↵ (Presses ↵ to default unit.)

... (Restoration proceeds) ...

*Mount reel 2 of tape file Q.006.870319.1908, ready tape unit,  
and enter tape unit name [MTB0]*

> MTB1 ↵ (Desired tape is on unit MTB1)

... (Restoration proceeds) ...

) (Back to the CLI)

(Person stores the full and incremental backup tapes, then initializes and checks the LDU.)

DG-27047T

*Figure 10-8. MSCOPY Restoration Example (concluded)*

## MSCOPY Error Messages

While running MSCOPY, you might receive the messages explained in Table 10-3.

**Table 10-3. MSCOPY Error Messages**

| Message                                               | Meaning and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Bitmap not aligned</i>                             | <p>On restore. The bitmap address on the destination LDU doesn't match the bitmap address of the LDU that was backed up. This means that the LDU was changed (bitmap moved, renamed, or even reconfigured) since the backup occurred).</p> <p>You cannot restore this backup to the LDU as is. Check your backup sets for a more recent backup to restore; and use that one if possible.</p> <p>If you <i>must</i> restore this backup set, you need to run a Disk Formatter format on it, and make the following things identical to the LDU that was dumped: <i>diagnostic area</i> (if any — none if the LDU has none); <i>bitmap address</i>; <i>overlay area size and address</i> (if a system disk); and <i>remap area size and address</i>. Also, you might make the LDU unique ID and name the same. You might as well use a Full format.</p> <p>If you noted the original LDU specs for the bitmap, etc., enter the same value given before: use default or octal value. If you didn't note them, default them and hope for the best. After the Formatter finishes, try MSCOPY again.</p> |
| <i>Cannot create temp file for new backup history</i> | <p>On new or full backup. MSCOPY can't create a needed temporary file based on the name you typed. You may have typed an illegal LDU name, or you may not have write access to the directory. Try to discover and correct the problem; retry.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

(continues)



**Table 10-3. MSCOPY Error Messages**

| Message                                                                                                                                                                                                                                       | Meaning and Action                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><i>Cannot find HDRn label<br/>user volume<br/>VOL1 tape</i></p> <p><i>·<br/>·<br/>·</i></p> <p><i>MOUNTED different reel --<br/>try again.<br/>CONTINUE with risk!</i></p> <p><i>Select action (MOUNTED or<br/>CONTINUE) [MOUNTED]</i></p> | <p>On restore. The tape label is defective — perhaps it was not written by MSCOPY. MSCOPY can't read the tape.</p> <p>Do not continue. Dismount the tape, find the correct volume (or, if this is the first tape, find a valid backup set), mount the volume, and press <b>J</b> to select the MOUNTED action.</p>                                                                                              |
| <p><i>Cannot find EOx1 label</i></p>                                                                                                                                                                                                          | <p>On restore. The end of volume or end of file label is missing. If this is the last reel, the restoration may be okay — but probably the LDU has not been correctly restored. Restore from an earlier backup set.</p>                                                                                                                                                                                         |
| <p><i>Cannot write {data }<br/>                  {label }<br/>record due to write error.</i></p> <p><i>Use a different tape.</i></p> <p><i>Mount reel n of tape file<br/>x.nnn.yymm.dd...and enter<br/>tape unit name [MTB0]</i></p>          | <p>On a backup. MSCOPY tried to rewrite to the tape 14 times without success.</p> <p>The tape is defective. Dismount it, discard it, and mount another tape. Then type the unit name and press <b>J</b> (or, for unit MTB0, simple press <b>J</b>). The backup continues.</p>                                                                                                                                   |
| <p><i>Clearing all Modified Sector<br/>Bits</i></p>                                                                                                                                                                                           | <p>After completing the tape part of a new or full backup, MSCOPY clears (zeros) all modified sector bits to prepare for incremental backups. Clearing the bits takes up to 20 minutes for each 354-Mbyte disk in the LDU. The time needed relates to the amount of space used on the disk). After clearing bits on all disks in the LDU, MSCOPY will create the backup history file and return to the CLI.</p> |
| <p><i>Command line error occurred</i></p>                                                                                                                                                                                                     | <p>In the MSCOPY command, you made a mistake, like specifying a nonexistent switch. A companion message gives specific information.</p>                                                                                                                                                                                                                                                                         |
| <p><i>Command requires a unit<br/>number as an argument</i></p>                                                                                                                                                                               | <p>In your PREMOUNT command, specify a free tape unit name (<i>not</i> a unit that MSCOPY is already using or expects to use).</p>                                                                                                                                                                                                                                                                              |
| <p><b>CONTROLLER MICROCODE<br/>NEEDS TO BE UPDATED</b></p>                                                                                                                                                                                    | <p>The microcode for your controller is obsolete. See this message in Chapter 17.</p>                                                                                                                                                                                                                                                                                                                           |
| <p><i>Could not open Error file<br/>Listing</i></p>                                                                                                                                                                                           | <p>MSCOPY can't open the error or listing file you specified. Perhaps you gave an illegal pathname or there's an ACL problem. Leave MSCOPY and retry, respecifying the path-name.</p>                                                                                                                                                                                                                           |
| <p><b>DEVICE ALREADY IN USE ...</b></p>                                                                                                                                                                                                       | <p>If the device is a tape unit (MTx), either MSCOPY or another process has opened it. See if MSCOPY or another process is using the tape.</p> <p>If the device is an LDU (DPJn), this means the LDU you're trying to back up or restore is initialized. Release it (<b>RELEASE ldu-name J</b>) from the directory where it was initialized. Then try again.</p>                                                |

(continued)

**Table 10-3. MSCOPY Error Messages**

| Message                                                                                                                                                                                                                    | Meaning and Action                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><i>DIRECTORY ACCESS DENIED</i></p> <p>possibly followed by explanation</p> <p>71, "Cannot create new temp file for backup history"</p> <p>72, "Cannot read history file"</p> <p>73, "Cannot write new history file"</p> | <p>You don't have Superuser privilege. To run MSCOPY (to read and write files in the root directory and in PER), you must have Superuser privilege.</p>                                                                                                           |
| <p><i>Disk unit does not support Modified Sector I/O.</i></p>                                                                                                                                                              | <p>The controller on your disk unit doesn't keep track of modified sectors; you cannot use MSCOPY with this disk. Use DUMP or PCOPY.</p>                                                                                                                          |
| <p><i>Disk unit OFFLINE</i></p>                                                                                                                                                                                            | <p>Turn the disk on and wait for the READY light.</p>                                                                                                                                                                                                             |
| <p><i>Dump segment is out of sequence</i></p>                                                                                                                                                                              | <p>On restore. You mounted the wrong tape set. The tape set you tried to restore belongs to this backup set; it's just in the wrong order. For example, you tried to restore an incremental before the full backup. Get the correct backup reel(s) and retry.</p> |
| <p><i>Empty response</i></p>                                                                                                                                                                                               | <p>You replied <i>l</i> to a question that doesn't offer a default. Type an answer and <i>l</i>.</p>                                                                                                                                                              |
| <p><i>ERROR: message</i></p>                                                                                                                                                                                               | <p>Find the text of the message in this table.</p>                                                                                                                                                                                                                |
| <p>...(Lead message)...</p> <p><i>Errors encountered in tape label</i></p> <p>...(Additional message) ...</p>                                                                                                              | <p>Find the lead message in this table.</p>                                                                                                                                                                                                                       |
| <p><i>FILE ACCESS DENIED</i></p>                                                                                                                                                                                           | <p>See message <i>DIRECTORY ACCESS DENIED</i>.</p>                                                                                                                                                                                                                |
| <p><i>FILE DOES NOT EXIST, file</i></p> <p>... (additional message) ...</p>                                                                                                                                                | <p>This system error message means that MSCOPY can't find a file (filename <i>file</i>) that it needs. Perhaps you mistyped an LDU or other filename.</p> <p>If you need more information to continue, find the additional message in this table.</p>             |
| <p><i>FILE IS EXCLUSIVELY OPEN, CAN'T OPEN, FILE file</i></p>                                                                                                                                                              | <p>This probably means the tape unit has been opened by another program. Check and correct.</p>                                                                                                                                                                   |
| <p><i>FILE IS OPEN, CAN'T EXCLUSIVELY OPEN</i></p>                                                                                                                                                                         | <p>See previous message.</p>                                                                                                                                                                                                                                      |
| <p><i>Fixup must be run on this LDU</i></p>                                                                                                                                                                                | <p>The LDU was not closed normally by AOS/VS and may have file system inconsistencies.</p>                                                                                                                                                                        |
| <p><i>Full backup date/time mismatch</i></p>                                                                                                                                                                               | <p>On restore. The creation date on this tape doesn't match the one MSCOPY recorded for this backup. Don't continue. Find the correct tape set — or use an earlier set — to restore from.</p>                                                                     |
| <p><i>History file already exists</i></p>                                                                                                                                                                                  | <p>On your new backup, MSCOPY found that a history file already exists. You can do either a full or incremental backup, but cannot do a new backup.</p>                                                                                                           |

(continued)

**Table 10-3. MSCOPY Error Messages**

| Message                                           | Meaning and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>History file not present</i>                   | <p>MSCOPY can't find the history file for the LDU.</p> <p>On a backup, MSCOPY suggests you use the <i>NEW</i> choice, or correct the problem. If the history file may have been moved or deleted, think about putting it back. History files — always in directory :UTIL:MSCOPY_HISTORY — have the form MS_HISTORY.ldu-name (for the current backup set) and MS_HISTORY.ldu-name.yymmdd for previous backup sets (yyymmdd are the year, month, and day of the backup set's full backup). You cannot do a full or incremental (next) backup without a history file. If you can't find the history file, you must do a new backup.</p> <p>Another possibility, for either a backup or restoration, is that you mistyped the LDU name. If so, retype it.</p> <p>On a restoration, when it can't find the history file, MSCOPY asks you to <i>Enter sequence number from filename of most recent backup tape</i>. MSCOPY needs this to tell you which incremental tape set to load. The sequence number is the second group (follows check character) in the tape set filename. For example, in name G.011.850912.1745, the sequence number is 11. On a restoration, we suggest you make every effort to return the correct history file to the root directory before restoring the LDU. Without a history file, there's no way to ensure that the full backup you restore is the latest one.</p> |
| <i>ILLEGAL FILENAME CHARACTER, name</i>           | System error message. You specified an illegal filename character (like ~ or *) in an LDU name or history filename. Retry.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>Inconsistent DIB information</i>               | The disk information block (DIB) on the LDU is invalid. Possibly the disk has not been formatted with a Disk Formatter Full format. Check with a Disk Formatter Partial format; then, after running a Full format, try MSCOPY again.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <i>Incorrect tape fileset ID</i>                  | On restore. The tape label is wrong — perhaps it wasn't written by MSCOPY. Don't continue.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>Incorrect tape label fileset ID</i>            | Try to find the correct tape set, or use an earlier, intact fileset. Then retry.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>Incorrect tape label sequence number</i>       | On restore. The reel does not belong to this tape set (or backup set). Do not continue. Find and mount the correct tape (or restart with an earlier, intact backup set).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <i>Invalid block size specified in EOF2 label</i> | <p>On restore. The block size is the buffer size (record size). The record size is wrong in the end of file label; but this reel has been restored anyway. One or more records may be missing characters; or perhaps this field of the label has a tape flaw.</p> <p>If there are other error messages, check them in this table. If this is the only error message, perhaps this field of the label has a tape flaw.</p> <p>Check the LDU; if it's okay, this may mean the short record spec was a flaw, which you can ignore. If the LDU is not okay, restore from another (earlier) backup.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

(continued)

**Table 10-3. MSCOPY Error Messages**

| Message                                                                                    | Meaning and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Invalid block size specified in HDR2 label</i>                                          | On restore. The block size is the buffer size (record size). The record size is wrong; the backup will not restore properly.<br><br>The problem might be that you're restoring on a different type of unit (MTD versus MTB) than the backup was written on. But probably, the reel is from the wrong backup. Don't continue. Try another, earlier, backup.                                                                                                                                                                                                                |
| <i>Invalid record {length<br/>type<br/>specified in HDR2 label</i>                         | On restore. See <i>Invalid block size</i> specified in HDR2 label above.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <i>Invalid record {length<br/>type<br/>specified in EOF2 label</i>                         | On restore. See <i>Invalid block size</i> specified in EOF2 label above.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <i>LDU Size mismatch<br/>Type</i>                                                          | On restore. The LDU that was backed up was not the same size as, or included different disks than, the one you're trying to restore to. The two LDUs must include identical disks, aside from the LDU IDs and names.<br><br>If you <i>must</i> restore this backup, you'll need to run a Full format on the LDU. See <i>Bitmap not aligned</i> for the procedure.                                                                                                                                                                                                         |
| <i>Mount reel n of tape file<br/>x.nnn.yymmdd.hhmm and enter<br/>tape unit name [MTB0]</i> | On restore. MSCOPY is ready to load the tape volume. Mount it on a unit (if not already mounted). Type the unit name and ↵ (or press ↵ for unit MTB0).                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>Name block ...<br/>ACL block ...<br/>Sysboot ....<br/>...(Other messages)...</i>        | On restore. The LDU that was backed up differs from the one you're trying to restore to. See <i>Bitmap not aligned</i> message for more information.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <i>New history file<br/>MS_HISTORY.ldu-name<br/>created</i>                                | On new or full backup, information message. MSCOPY has finished the new or full backup and created the history file. Next it will clear modified sector bits (15–20 minutes per disk in the LDU).<br><br>On a full backup, MSCOPY also displays<br><br><i>Previous history file is renamed<br/>MS_HISTORY.ldu-name.yymmdd</i><br><br>If you need to restore this LDU, MSCOPY will use the latest history file to do it (or, you can specify an earlier history file — <i>yymmdd</i> indicate the year, month, and day of the full backup in any old backup history file.) |
| <i>Opening error message file :<br/>...<br/>MSCOPY.ERMES file not<br/>present</i>          | File MSCOPY.BTSFPLK is automatically loaded into :UTIL. It must be there for MSCOPY to explain text messages. If it's not there, reload from the AOS/VS system tape.                                                                                                                                                                                                                                                                                                                                                                                                      |
| <i>Overlay area {not aligned<br/>size match }</i>                                          | On restore. The LDU that was backed up is not the same as the one you're trying to restore. Perhaps the old one was a system disk, and the new one isn't. In any case, if you <i>must</i> restore this backup, the overlay areas must be the same size, and start at the same address; you need to run the Disk Formatter. See <i>Bitmap not aligned</i> message for more information.                                                                                                                                                                                    |

(continued)

**Table 10-3. MSCOPY Error Messages**

| Message                                                                                                                                                                         | Meaning and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>PHYSICAL WRITE LOCK,<br/>FILE @MTxn<br/>Insert write ring and<br/>respond with &lt;new-line&gt;</i>                                                                          | The tape on unit n is write protected. Check the paper label on the tape reel. If — after checking — you still want to write to the tape, insert a write-enable ring and press <b>].</b>                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>PREMOUNT command is only<br/>valid during dump</i>                                                                                                                           | While restoring a backup, you must specify tape reels one at a time; MSCOPY does not allow premounts during restorations. Wait for this reel to be restored, then specify another.                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <i>READ ACCESS DENIED</i>                                                                                                                                                       | See message <i>FILE ACCESS DENIED</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Remap Area</i> $\left\{ \begin{array}{l} \text{not aligned} \\ \text{size mismatch} \end{array} \right\}$                                                                    | On restore. The LDU that was backed up is not the same as the one you're trying to restore. Perhaps the old one was a system disk, and the new one isn't. In any case, if you must restore this backup, the remap area on the disk(s) <i>must</i> be the same size, and start at the same address, as the original(s). You need to run the Disk Formatter. See <i>Bitmap not aligned</i> message for more information.                                                                                                                                                                                      |
| <i>Tape filename date/time error</i>                                                                                                                                            | On restore. The tape set filename (form x.nnn.yymmdd.hhmm) does not match the one MSCOPY recorded for this backup. Don't continue. Find the correct tape set — or restore from an earlier set.                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>Tape has exceeded retention date<br/>MOUNTED different tape —<br/>try again<br/>CONTINUE with risk!<br/><br/>Select action (MOUNTED or<br/>CONTINUE) [MOUNTED]</i>           | On restore. This means that the retention date specified or defaulted, when the backup was done, has expired. (The retention period is 90 days unless specified otherwise with the /RETAIN= switch.)<br><br>It's likely that there is a more current tape set around — and, generally, you should find it and use it instead: find it, dismount the original tape and mount the first tape, and press <b>].</b> But if you <i>know</i> that you want to restore from this tape set, type <b>CONTINUE ]</b> .                                                                                                |
| <i>Tape has not exceeded retention<br/>period<br/><br/>MOUNTED new reel - try again<br/>RELABEL tape and continue<br/><br/>Select action (MOUNTED or<br/>RELABEL) [MOUNTED]</i> | On backup. The retention period set when MSCOPY wrote to the tape has not passed (default is 90 days from dump date, you can change it with the /RETAIN switch).<br><br>You may not really want to write to this tape set. If you do want to write to it, type <b>RELABEL ]</b> . You'll need to do this for each volume in the set.<br><br>To save the tape set, dismount the first volume, find and mount the first volume of an expired or other set, and press <b>].</b>                                                                                                                                |
| <i>Tape is not a backup of specified<br/>LDU<br/>...<br/>Select action (MOUNTED or<br/>CONTINUE) [MOUNTED]</i>                                                                  | On restore. The backup you're trying to restore was done from an LDU that had a different name.<br><br>Do not continue unless you're sure you want the backup set written to this LDU. You might continue, for example, if you knew that the LDU unique ID had been changed — via a Disk Formatter Partial or Full format since the MSCOPY backup occurred.<br><br>If you continue, MSCOPY ignores the ID on the LDU and writes the tape set — including the LDU ID on the tape — to the LDU. MSCOPY will repeat this message for each tape in the backup. For each reel, you must type <b>CONTINUE ]</b> . |

(continued)

**Table 10-3. MSCOPY Error Messages**

| Message                                                                                                                                                                        | Meaning and Action                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Tape label system id error</i>                                                                                                                                              | On restore. The operating system ID (AOS/VS and its revision number) on the tape conflicts with those of the current system.<br><br>If there are no other label errors, you might want to continue. If there are other errors, assume the reel is not from the backup you want. Don't continue; find and restore the most recent valid backup.                                                                                                                 |
| <i>Tape label block count does not match blocks read</i><br>...<br><i>Select action (MOUNTED or CONTINUE) [MOUNTED]</i>                                                        | On restore. The number of blocks actually read from the tape does not match the number recorded in the end of volume label. The restore is not complete and may be invalid.<br><br>If there are other errors, this is probably the wrong reel. Do not continue; find and mount a valid backup set. If this is the only error, and you really need to restore this backup set, you might tell MSCOPY to continue (it will prompt for the next tape, and so on). |
| <i>Tape label is not ANSI level 3</i>                                                                                                                                          | On restore. This means that probably the tape wasn't written by MSCOPY.<br><br>If there are other errors, don't continue. Find and restore the last valid backup. If there are no other label errors, and you know that you <i>must</i> restore this backup, you might want to continue.                                                                                                                                                                       |
| <i>Tape label version error</i>                                                                                                                                                | On restore. See <i>Tape label is not ANSI level 3</i> above.                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>Tape LDU configuration does not match current LDU</i>                                                                                                                       | On restore. The backup set was created by MSCOPY, but from an LDU with a different bitmap address, remap area address, or even number of disks. You cannot restore the backup set to this LDU.<br><br>If you <i>must</i> restore this backup set, you must run a Disk Formatter Full format on the disk(s) and create an LDU identical to the original. Details appear under <i>Bitmap not aligned</i> , above. Then try MSCOPY again.                         |
| <i>Tape reel is out of sequence</i><br><br><i>MOUNTED different reel — try again</i><br><i>CONTINUE with risk!</i><br><br><i>Select action (MOUNTED or CONTINUE) [MOUNTED]</i> | On restore. The tape reel belongs to the backup, but was mounted out of sequence. For example, after restoring volume 1, you specified a unit that has reel 3 (not 2) mounted. Find the correct tape from the set, mount it (if not mounted), and press ↵.                                                                                                                                                                                                     |
| <i>Tape set filename is x.nnn.yymmdd.hhmm</i><br><i>Mount reel n, ready tape unit, and enter tape unit name [MTB0]</i>                                                         | On backup. MSCOPY is ready to dump to the next tape volume. Mount a write-enabled reel on a unit (if not already mounted). Type the unit name and ↵ (or press ↵ for unit MTB0).                                                                                                                                                                                                                                                                                |
| <i>Tape unit is in use</i>                                                                                                                                                     | See <i>DEVICE ALREADY IN USE</i> above.                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <i>Tape unit OFFLINE</i>                                                                                                                                                       | Put the unit on line; then continue.                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>Tape was not created by ... MSCOPY</i>                                                                                                                                      | Do not continue. Remove the tape, find and mount the last valid backup, and press ↵.                                                                                                                                                                                                                                                                                                                                                                           |

(continued)

**Table 10-3. MSCOPY Error Messages**

| Message                                                      | Meaning and Action                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Unit MTBx NOT premounted</i>                              | On backup, after PREMOUNT command, MSCOPY rejected the premount. The cause may be an unexpired tape, tape not write enabled, or unit off line. Correct the problem and retry the premount.                                                                                                                                                                        |
| <i>Unit MTBx premounted</i>                                  | On backup, after PREMOUNT command, MSCOPY has verified the premount and will use the unit for I/O.                                                                                                                                                                                                                                                                |
| <i>Units in tape LDU do not match units in current LDU</i>   | The LDU name recorded in the backup set differs from the name that was backed up. If this is the only error message, you may be able to restore the LDU; see <i>Tape is not a backup...</i> message for more information.<br><br>If this message is accompanied by a <i>Tape LDU configuration...</i> message, read the <i>Tape LDU configuration...</i> message. |
| <i>Using tape unit MTxn f or reel n of x.nnn.yymmdd.hhmm</i> | On backup, MSCOPY has started writing to unit MTxn — which you premounted — after filling the tape on the previous unit.                                                                                                                                                                                                                                          |
| <i>Verification complete</i>                                 | On backup, MSCOPY has completed the tape verification. Dismount and store all tapes.                                                                                                                                                                                                                                                                              |
| <i>WARNING: message</i>                                      | Find the text of the message in this table.                                                                                                                                                                                                                                                                                                                       |
| <i>Verification not completed</i>                            | On backup, MSCOPY encountered an error (described in a companion message) that prevented it from verifying the backup. Depending on the other error message(s), you should restart the backup.                                                                                                                                                                    |

(concluded)

## What Next?

In this chapter, you've read about AOS/VS commands and utilities to back up and restore your vital disk-based material: DUMP, PCOPY, and MSCOPY.

Some tools to handle unusual system conditions — serious problems — include the SCP log and DTOS CPU diagnostics, described in the next chapter.

Other tools include the Disk Formatter, described in Chapter 13. Or, you might want to read about system management considerations, in Chapters 15 and 16.

End of Chapter

# Chapter 11

## Unusual System Conditions

Read this chapter

- when — for any reason — you want to run CPU diagnostics;
- if software-based abnormal shutdowns recur and you want to submit a Software Trouble Report to DG;
- when you want to read the SCP's error log and understand its entries (the log is maintained on all computers except the MV/2000 DC and 4000-series and 7000-series computers).

An unusual system condition is a situation in which you are having recurrent problems (or suspect problems) with your system hardware or software. But running diagnostics isn't restricted to problem situations. Some sites do it regularly, while their systems are running perfectly, to identify possible potential problems.

This chapter explains some tools to help you identify the source of actual and potential problems. The major sections proceed

- Hard, Soft, and Software Errors
- Running SCP-DTOS FRU Tests and Other Diagnostics
- Software Problems — How to Submit a Software Trouble Report
- Reading the SCP Error Log (ERRLOG)
- The CPUID

### Hard, Soft, and Software Errors

A hard error is an uncorrectable hardware error; if one occurs in the main processor, it halts the main processor. Examples of hard errors are multibit ERCC memory errors and disk I/O errors that persist after 14 retries. A soft error is a correctable hardware error; it doesn't halt the main processor. Examples of soft errors are a single-bit ERCC error and a disk I/O error that went away after one retry. A *software* error is an AOS/VS operating system or other software flaw. (A *microcode* error usually appears as an obscure software error message, like *Insufficient memory to run FIXUP*.)

Any of these errors produces an error message on the system console. If the error causes an AOS/VS panic (*FATAL AOS/VS ERROR*), panic values describe conditions when AOS/VS detected the error. The panic values are described in file AOSVS.PANICS.SR — interpreting the values is explained in Chapter 6.

Aside from panic and other system console messages, AOS/VS has the system error log (:ERROR\_LOG) and CONTEST test package to help identify current — and latent — errors. Also, the AOS/VS Release Notice has a “Notes and Warnings” section that often contains useful information. All serious error messages and their meanings are explained in Chapter 17.

To diagnose CPU problems, there are SCP-DTOS FRU tests and MV/System exerciser tests supplied with your CPU, and there is the SCP log.



Most important, there are human resources, including your DG support organization, and DG itself, accessible by a Software Trouble Report. Usually, your DG support organization will recommend one or more steps — like running FRU tests — to help identify a problem area. Details of some of these steps are described in this chapter.

## Running SCP-DTOS FRU Tests and Other Diagnostics

A group of CPU diagnostic tests called FRU (Field Replaceable Units) tests was supplied with most MV/Family computer.

These FRUs check the printed circuit boards in the CPU and identify units that need to be replaced. FRUs are easy to run; you can run them yourself. You might want to run FRUs when you suspect hardware problems in the CPU; or you might do it periodically as a matter of routine. If one or more FRUs fail, you can call your DG support organization with the specific information needed to fix your machine.

The FRUs run as an auto sequence of programs. Each program tests one or more boards. If a failure occurs, the current program reports it and describes the boards that may be faulty.

On some machines, the SCP-DTOS system that runs the FRUs will overwrite the SCP operating system in SCP memory. The SCP-OS and MV/Family microcode must be reloaded after the FRUs run. However, this takes only a minute or so.

The console CTRL-S/CTRL-Q sequence doesn't work with SCP-DTOS. However, when a FRU program detects an error, it displays only a screenful of information at a time, and waits for you to press the space bar before proceeding. So — even if your system console is a CRT — you can record all messages. You can also leave the system console, knowing that an error message will wait until you return.

The entire sequence of 20 or so FRU programs takes between 30 and 40 minutes (but only about three minutes on a 4000-series system). The command that runs the sequence is **ACCEPT** ).

Before you start, make sure that AOS/VS is shut down and that all disk units are off or write disabled. (Getting your disks off line is always a sound step before running diagnostics, unless the diagnostics are meant to test the disks.) Then, proceed to the pertinent section below.

### Starting FRU Tests on MV/10000-Series Computers

On an MV/10000 SX or MV/10000 system, get the most recent MV/10000 system tape you received from DG. Mount the tape on unit 0 on the first tape controller. Then follow these steps.

Press the CPU LOCK switch to the OFF position.

Press the CPU SYSTEM switch to RESET.

*BOOT WHAT DEVICE? (CHANNEL AND DEVICE CODE)*

break (Type the break sequence: CMD and BREAK keys, BRK key, or BREAK key, depending on console type.)

! 22T (Next to octal debugger ! prompt, type 22T or 62T if the tape is mounted on an MTD unit. But for a tape unit on the second IOC, type the channel number before the device code; e.g., 122T.)

*HIDTOS REV n ...* (Program displays its banner, then TESTOK and the \* prompt.)  
*TESTOK*

\* ACCEPT ) (Type ACCEPT ) next to the \* prompt.  
Proceed to "While the FRUs Run".)

### Starting FRU Tests on MV/8000 IIs and MV/8000 Cs

On an MV/8000 II or MV/8000 C system, get the most recent MV/n system tape you received from DG. Mount the tape on unit 0 on the first controller. Then follow these steps.

Press the CPU LOCK switch to the OFF position.

Press the CPU POWER switch to ON (if already on, OFF, then ON).

*BOOT DEVICE?* 22 ) (Or type 62 ) if tape is on an MTD unit.)

*TESTOK*

\* ACCEPT ) (Type ACCEPT ) next to the \* prompt.)

Proceed to "While the FRUs Run".

### Starting FRU Tests on MV/8000s

On an MV/8000, type the command XEQ DTOS ) to the SCP CLI; and type ACCEPT ). For example,

*SCP-CLI>* RESET )

*SCP-CLI>* XEQ DTOS )

\* ACCEPT ) (If the ) key doesn't work, try the CR key instead.)

Proceed to "While the FRUs Run".

### Starting FRU Tests on MV/6000s

On an MV/6000 system, get the most recent MV/6000 system tape you received from DG. Mount the tape on unit 0 on the first controller. Then follow these steps.

Press the CPU LOCK switch to the unlock position.

Press the CPU RESET switch to RESET.

*BOOT DEVICE?* 22 ) (Or 62 if tape is on an MTD unit.)

*TESTOK*

\* ACCEPT ) (Type ACCEPT ) next to \* prompt.)

### Starting FRU Tests on MV/4000s

On an MV/4000 system, get the most recent MV/4000 system tape you received from DG. Mount it on tape unit 0 on the first controller. Then follow these steps.

Press the CPU LOCK switch to OFF.

Press the SYSTEM switch to RST.

@ 22L (Or type 62L if tape is on an MTD unit.)

*TESTOK*

\*ACCEPT ) (Type ACCEPT ) next to \* prompt.)

## Starting FRUs on MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series Systems

With an MV/4000 DC, MV/4000 SC, or Data General DS/4000-series system, get the most recent SYSTEM MEDIA diskette or tape you received from DG. On the paper label, the second line includes the words SYSTEM MEDIA. Insert the diskette or tape in unit 0. Then follow these steps.

Turn power on and off. Press the front panel RESET switch.

@ 64L (For tape, type 22L instead of 64L)

TESTOK

\* ACCEPT ) (Type ACCEPT ) next to \* prompt.)

To verify the IOC controller emulator file — different from the main CPU — you must turn power off, then find the “IOC EMULATOR” diskette, and execute steps 3, 4, and 5 in Chapter 2. Choose option 2, VERIFY, in step 5.

### While the FRUs Run

During the FRU session, you'll see a series of messages of the form:

LOAD:

*programname REV n*

*programname ENTERED*

END OF PASS 1

This sequence will repeat for each test. Some tests are short; others take several minutes. If a test shows an error, you'll see a message of the form:

\*\*\*\*\*

PROGRAM DESCRIPTION *program PART n OF n*

PROGRAM NAME / REVISION NO. *programname n*

ERROR IN PASS NUMBER *n*

SUBTEST DESCRIPTION: *subtestname*

FAILING FRU

FIRST CHOICE: *circuit-board-name*

SECOND CHOICE: *circuit-board-name*

THIRD CHOICE: *circuit-board-name*

ERROR NUMBER: *n* SUBTEST NUMBER *n*

THIS IS ITERATION *n* OUT OF A TOTAL OF *n*

\*\*\*\*\*

*carry-and-accumulators*

ENTER SPACE TO CONTINUE

If you get such an error message, assume that one or more of the boards mentioned in the FAILING FRU message is bad. With a CRT, note the error information, especially the PROGRAM NAME, PROGRAM and SUBTEST description, and FAILING FRU choices. Then press the space bar and the FRU will give more information, like the SBUS address and data it found.

When all tests have run, the \* prompt will reappear:

\*

If there were error messages, you should tell your DG support organization about them before trying to resume normal system operation.

## Resuming Normal Operations

On an MV/8000 system that has an SCP diskette, type EXIT ↵ to have microcode and the SCP-OS reloaded and return to the SCP-CLI. Then you can put your disks back on line, reboot AOS/VS (RESET, BOOT 27 ↵, etc.), or do whatever is appropriate. You're done with the FRUs.

On any other machine put your system LDU on line. Press CPU power off. Then press the LOCK switch (if any) to the ON or LOCK position. Press power on; and SYSBOOT will lead you through the microcode load and back to AOS/VS. If this doesn't work, do a cold start as described in Chapter 6.

## SCP-DTOS Commands

The operating system that runs FRUs (SCP-DTOS) has its own set of commands. Whenever you see the message *TESTOK* and the \* prompt, this system is running, and you can type any of the following commands.

|               |                                                                                                                                |
|---------------|--------------------------------------------------------------------------------------------------------------------------------|
| ACCEPT        | Loads each of the FRU programs and runs it once. An example is above.                                                          |
| DIR           | Lists the filenames of all the FRU and MV/Family system exerciser programs. You can LOAD any of these by filename.             |
| EXIT          | On MV/8000 systems that have an SCP diskette, this command reloads the SCP-OS and microcode from the diskette.                 |
| HELP          | Gives help on SCP commands.                                                                                                    |
| LOAD filename | Loads the file specified into SCP memory. If the file is a FRU test, the LOAD command runs it a predetermined number of times. |

## Other Diagnostics

The time may come when you want to run diagnostics on peripherals, like disks, tape units, or line printers. For example, you might want to run them on a disk if FIXUP or the Disk Formatter could not process the disk and aborted.

An MV system exerciser program comes on each MV/Family system tape; and you can run this if you wish, although it is meant primarily to test healthy hardware.

DG offers a diagnostic system, MV/ADES (Advanced Diagnostic Executive System), that includes test, exerciser, formatter, and alignment programs. MV/ADES is available as a separate product. It can be installed on your system LDU. Before you run MV/ADES on a peripheral, consult your DG support organization for more information.

If you do have ADES diagnostics installed and you want to run them, bring your system down. When you bring it up again, interrupt the Operating System Load Menu. Then, from the Technical Maintenance Menu, choose option 5.

### *Technical Maintenance Menu*

...

*5 Run diagnostics*

...

*Enter choice [1]: 5 ↵*

SYSBOOT prompts

*Are you sure you want to run diagnostics? [N]:*

If you have co-resident ADES on your disk and you want to run it, type Y ↵. Otherwise, press ↵.

## Software Problems — Submitting a Software Trouble Report (STR)

If you are having serious system problems, and your organization is *outside* the continental United States, you should generally consult your local DG systems engineer about them.

If your site is inside the continental US, and you have a contract with the Atlanta support center, call the support center for help. If you don't have a contract with the support center, you will probably need to submit a Software Trouble Report (STR) on your own. The *Software Trouble Report Guide*, 012-1407, explains this. But, for your convenience, we'll review the steps involved.

Wherever you are, it's important to discover whether the problem is software or hardware. The system error log (:ERROR\_LOG), FRU tests, and the CONTEST program can help in this area. You should be sure that you are running current versions of the AOS/VS and SCP operating systems, with current microcode, and that all patches and hardware fixes have been applied to your system. You may also be interested in the *AOS/VS Monthly Newsletter*; DG publishes STR responses in this newsletter.

The best way (often the *only* way) to identify a software bug is to reproduce the environment in which the bug appeared. To do this, DG requires a copy of the software *and* information on your environment. If you don't provide these, DG may not be able to help you. It's very frustrating to receive STRs that say simply "EXEC HANG" or "SYSTEM TRAPPED", and it may be impossible to provide useful answers to such STRs. So, it's in your interest to provide all background information that you can.

*Before* you decide to submit an STR, be sure that all current patches have been installed. This includes peripheral manager, Agent, CLI, VSGEN, and other patches. If you patch VSGEN or any associated library, run VSGEN again to generate a new system; then apply AOS/VS patches to this system. In many cases, patching will clear up an error situation — allowing your applications to continue normally, and eliminating the need to submit an STR. Patches are easy to apply with the autopatch facility (Chapter 4).

### Gathering STR Information

Ultimately, if you decide that you want to submit an STR, set up for the STR by running AOS/VS and other software that you normally use. Then, if the error condition occurs, execute the following steps.

1. If AOS/VS has panicked (displayed *FATAL AOS/VS ERROR*), record the panic code and values (or, with a hardcopy console, use the listing). Go to step 11.
2. Note all processes that are/were running, including both DG and user application. Describe types and priorities if you can.
3. If a user process (son of EXEC) is malfunctioning or is deadlocked, note its process ID (pid). Then create a break file and dump it to tape or diskette via the following steps.

) SUPERPROCESS ON )

+ ) BREAKFILE / FILE = pathname pid ) (pathname gives the break file name. If the process is executing in a ring other than 7, you will also need to specify the ring. Type HELP/V BREAKFILE ) for more information.)

+ ) TERMINATE / B pid ) (Terminate process. If the process won't terminate, you will need to force a shut-down. Go to step 8.)

Mount tape or diskette on an available unit; e.g. MTB0.

COPY @MTB0 pathname )

(For diskette, get to the pathname directory; then insert a diskette and type DUMP/V @DPJ10 filename ). If the file won't fit, use labeled diskettes (@LFD:valid:filename) as described in Chapter 10.)

Go to step 20.

4. If a process not under EXEC (a son of the master CLI) is malfunctioning or deadlocked, follow these steps. If the process is a CEO process, try to shut down CEO (type SUPERPROCESS ON ), CEO.SYSTEM STOP ). If the process is a XODIAC or INFOS II process, try to shut these processes down as you would for a normal shutdown. Now, follow the steps shown under step 3.
5. If the error condition is a process trap, follow these steps. When a process traps, it automatically creates a break file, with .BRK suffix, in its working directory. Note the trap type (e.g., VALIDITY), the program counter, accumulators (ACs), and carry (C). For tape, use the CLI COPY command to copy the .BRK break file to tape; e.g., COPY @MTB0 pathname ); and go to step 20. For diskette, use the dump command; for example, DUMP/V @DPJ10 filename ). If the file won't fit, use labeled diskettes, as described in Chapter 10. Then go to step 20.
6. If more than one user process (but not every user process) is hung or malfunctioning, or if EXEC displayed an *INTERNAL INCONSISTENCY* message, then EXEC, the peripheral manager, or the system itself may be having problems. You will need to force a shutdown. Go to step 8.
7. If the entire system is hung, note whether the system console responds to commands or CTRL-C sequences. (This helps us determine whether the problem is in the peripheral manager or AOS/VS itself.) Also, note whether disk READY lights are blinking (the READY light blinks when the disk is busy). If tape I/O is in process, note whether the tape(s) are moving.

Then break the deadlock, get information, and force a shutdown as follows.

Unlock the computer (if locked). Type the break sequence (CMD and BREAK, BRK, or BREAK). The system console displays

SCP-CLI>

Get needed status information by typing the following sequence of commands *four times*.

SCP-CLI> HALT )

SCP-CLI> . ) (The . is the SCP status command)

AC0 AC1 AC2 ... MAP (Note this status information.)

n n n ... x

SCP-CLI> CONTINUE )

Type the break sequence.

After doing the HALT/CONTINUE sequence four times, go to step 9.

8. If possible, warn users to log off if they can (use the SEND command or BROADCAST macro). If CEO, XODIAC, or INFOS II processes are running, try to shut them down normally (but *don't* use the DOWN macro, since it terminates EXEC).

After you have as many processes as possible shut down, get to the SCP CLI: unlock the computer (if locked); then type the break sequence (CMD and BREAK keys, or BRK, or BREAK).

9. Start ESD via reset and start:

```
SCP-CLI> RESET ↵      (Use RESET, not HALT.)
SCP-CLI> START 50 ↵
```

*Do you want a memory dump (to submit a Software Trouble Report) (Y or N)? [Y]*

10. For reel-to-reel tape, get a scratch tape, 800 feet or more with write-enable ring in. Mount the tape on unit 0 on the first controller, if available. If the unit has a density switch, choose DENSITY HIGH.

For diskette, get several scratch diskettes (3-4 needed with 2 Mbytes of memory). These must be hardware formatted but need not be formatted with the Disk Formatter. Insert a diskette in unit DPJ10 (or DPJ1 if the diskette and disk share a controller).

The system console is displaying

*Do you want a memory dump (to submit a Software Trouble Report) (Y or N)? [Y]*

11. Type Y ↵.

The system console displays

*Dump to magnetic tape or diskette (T or D) ? [T]*

12. For tape, press ↵ or type T ↵. For diskette, type D ↵. Depending on the device, it then displays

Please      { mount tape.  
              insert diskette in unit. }      Then specify unitname. [default]

13. If you mounted the tape or diskette in the unit shown as default (for example, MTB0 or DPJ10), press ↵. If the tape or diskette is on a different unit, type the unitname and press ↵; for example, MTB1 ↵.

After you respond, the memory dump routine copies main memory and other things to tape or diskette. For diskette, it displays *DUMPING*, followed by periods to indicate the passage of time. If it needs another diskette, it will display

*Diskette is full.*

*Please insert next diskette in unit. Press NEW LINE when ready.*

- 13a. Insert another diskette and press ↵.

When done, the routine rewinds the tape (if using tape), and starts Emergency Shutdown (ESD). ESD runs as shown in the next section. The messages are

*Memory dump completed — running Emergency Shutdown (ESD)*

*File system restart*

*Now restarting device ...*

*... (Other ESD messages) ...*

*System shutdown*

SCP-CLI>

14. Dismount the tape or diskette and label it.

If ESD displays *Abnormal shutdown*, please restart ESD (type RESET ↵, START 50 ↵) and take another Memory Dump (steps 9 through 13). Then run FIXUP (step 15).

If ESD panics, please note the panic values, dismount the tape, mount another tape, and take another Memory Dump (this may help identify the problem and *will* help us improve ESD). Try ESD a second time. If ESD panics again, run FIXUP (step 15).

15. Run FIXUP. Be sure to specify 3 for VERBOSITY and the printer as the error log file. If FIXUP produces pertinent error messages, submit the listing. FIXUP is described in Chapter 6.
16. Check the SCP log (if any) for any recent event entries. (Use the LIST program and specify today's date and default the first time and the last time.)
17. On any machine except an MV/2000 DC or 7000-series or a 4000-series system, verify microcode by typing the following commands:

```

SCP-CLI> XEQ MCODE )      (Run microcode utility.)
SCP-MCODE> VSPAD )        (On MV/8000s that have an SCP
                           diskette, type VSPAD MV8000.)

?SPAD VERIFY ERROR
ADD SPAD REFERENCE        (It says DISK instead of REFERENCE
                           on some machines.)

. . .
. . .
. . .
SCP-MCODE> CLI )          (Return to the SCP CLI.)
SCP-CLI>

```

Note all addresses (ADD) where the REFERENCE value is nonzero (except for address 147, the CPUID). These are microcode verification errors. If there are no verification errors, please note this fact.

For MV/8000s, you can do additional verification from the MCODE utility by typing VERIFY MV8000 ) (or MV8000FP ). Type CLI ) to return to the SCP CLI.

Microcode verification errors are considered a *hardware* problem. Please do not submit an STR if there are verification errors (instead, consult your DG support organization).

18. Start up AOS/VS and proceed as follows.

For tape, with the memory dump tape mounted on unit 0, type

```

) SUPERUSER ON )
*) COPY @MTx0:1 sys.ST )    (x is B, C, D, or J depending on your unit. sys is
                           the name of your tailored system, without the
                           .PR suffix.)

```

For diskette, make sure a fresh diskette is in unit 0. Type

```

) SUPERUSER ON )
*) DUMP /V @DPJ10 sys.ST )   (sys is the name of your tailored system, without
                           the .PR suffix.)

```

The symbol table is a critically important part of the STR. Without it, we won't be able to analyze your problem.

19. If there is any other software (like a user program) involved, please add it to the tape or a different diskette. Please add all patch history files (:UTIL:+.PH and :PATCH:+.PH). And if you suspect that the problem may be in EXEC, please add any file with template :UTIL:EXEC+.MDM. For all material except the memory dump, please use the DUMP command. Dump all these additional files to tape file 2 (for tape) or a different diskette (for diskette). Also, please note what you have done on the tape reel or diskette label.
20. If you can, submit the following information about the system environment at the time of the error condition.
  - user devices that were attached to the system when the problem occurred;
  - hard, soft, or other pertinent error messages that appeared on the system console before and after the problem occurred;



- An error log report, if it includes any pertinent hard, soft, or other error information. You can get a report on all possible CPU errors via the REPORT /C switch; for example, X REPORT /C/L=@LPT :ERROR\_LOG ).

Please report any event or circumstance needed to simulate the conditions at your site. Label the tape and all listing materials, and submit them to your DG support organization. Thank you.

## Reading the SCP Error Log (ERRLOG)

ERRLOG is an SCP-OS utility program that records and displays CPU events, including hard and soft CPU errors. Some of these events are also recorded in AOS/VS' error log (ERROR\_LOG) — but if an error brings down AOS/VS, the event may not be recorded in ERROR\_LOG. There's some chance, though, that ERRLOG will record the error. ERRLOG exists only in a computer that has an SCP CPU (any computer except an MV/2000 DC, a 7000-class or a 4000-class integrated machine; for those machines, skip to "The CPUID").

Note that SCP error logging must be on for ERRLOG to record errors. By default, error logging is on. You can check by typing

```
SCP-CLI> FLAGS )
```

If flag ELOG is Y, then SCP logging is on. If flag ELOG is N, then logging is off. You can turn it on by typing

```
SCP-CLI> FLAGS ELOG Y )
```

Generally, you should leave SCP logging on all the time. It can help pinpoint the source of hardware problems.

Another FLAG, named SING (for single word), must be N for ERRLOG entries to be displayed. The default for SING is N; but if it is Y, you can set it to N by typing

```
SCP-CLI> FLAGS SING N )
```

## SCP ERRLOG Files

ERRLOG stores entries in two log "files". They are

- ERRLOG, for all hard (uncorrectable) CPU errors and key system information; and
- MEMLOG, for single-bit ERCC (Error Checking and Correction) errors. Single-bit ERCC errors are correctable, hence "soft". Multiple-bit ERCC errors are hard errors. AOS/VS tries to record soft ERCC errors in file :ERROR\_LOG, as described in Chapter 9 under REPORT Switches /HRCC and /NRCC.

On MV/8000 systems that have an SCP diskette, ERRLOG files are kept in SCP memory *and* recorded on the SCP's diskette. The log can store about 400 entries.

On machines that have an SCP but not an SCP diskette, the files are kept in SCP memory. Because SCP memory is volatile, the log files exist while CPU power stays on. The log can store about 60 entries.

On any system with an SCP CPU, when space in an error log "file" is exhausted, new entries overwrite the oldest entries (except that MEMLOG entries containing high ERCC counts are retained if possible). The SCP cannot record events that occur while you are checking the ERRLOG file or running CPU diagnostics.

## Running ERRLOG

You can run ERRLOG at any time from the SCP CLI. Simply type XEQ ERRLOG ↓ to the SCP-CLI. For example

```
SCP-CLI> XEQ ERRLOG ↓
```

```
SCP-ERR> (ERRLOG prompt)
```

Try a HELP command.

```
SCP-ERR> HELP ↓
```

HELP FILE FOR ERROR LOG...

...

C(LI) RETURN TO THE SCP-CLI ...

H(ELP) PRINT HELP ...

I(NIT) INITIALIZE ERRLOG ...

L(IST) LIST SELECTED ERRLOG ENTRIES ...

TI(ME) DISPLAY ...

The ERRLOG command meanings are as follows.

| Command | What It Does                                      | Example                                                                                    |
|---------|---------------------------------------------------|--------------------------------------------------------------------------------------------|
| CLI     | Returns to the SCP-CLI.                           | SCP-ERR CLI ↓<br>SCP-CLI>                                                                  |
| HELP    | Displays help messages.                           | SCP-ERR> HELP ↓                                                                            |
| INIT    | Clears a log file of all current entries.         | SCP-ERR> INIT ↓<br>ENTER FILE: MEMLOG ↓<br>CLEAR MEMLOG? Y ↓                               |
| LIST    | Displays log entries.                             | See the example below.                                                                     |
| TIME    | Changes the SCP-OS (not the AOS/VS) system clock. | CHANGE TIME (Y OR N) Y ↓<br>ENTER DATE (MO DAY YR) 6 4 86 ↓<br>ENTER TIME (HR MIN) 13 05 ↓ |

## Using the LIST Command

The LIST command can display error log entries by type and time period; or it can display all entries. Types are three-digit octal codes, with the meaning shown in Table 11-1. Unless otherwise noted, AOS/VS or ESD also attempts to log all of these event types in the error log (under different codes, explained in Chapter 9).

**Table 11-1. SCP ERRLOG Entry Types**

| Entry Code (octal) | What It Means                                                                                                                                                                                                                                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 140                | ELOG flag is YES; the SCP is logging events.                                                                                                                                                                                                                                                                                              |
| 141                | ELOG flag is NO; the SCP is not logging events.                                                                                                                                                                                                                                                                                           |
| 142                | An unexpected main processor HALT was detected. ERRLOG records the program counter, program status register, four fixed-point accumulators and map status at the time of the HALT. These entries are further described in the example below. This entry is not logged when you type a HALT command.                                       |
| 143                | An SCP CLI BOOT command was executed; and the SCP loaded the main processor with a program. ERRLOG records the value of the switch register (SW), which specifies the device code used to boot. AOS/VS cannot record this in ERROR_LOG.                                                                                                   |
| 144                | Power was cut to the CPU and/or the expansion chassis.                                                                                                                                                                                                                                                                                    |
| 145                | Power was restored to the CPU and/or the expansion chassis.                                                                                                                                                                                                                                                                               |
| 146                | An airflow fault occurred. Normally, the SCP operating system will have displayed an appropriate error message on the system console (MV/8000 diskette log only).                                                                                                                                                                         |
| 147                | An overtemperature fault occurred. Normally, the SCP operating system will have displayed an appropriate error message on the system console when the fault occurred (MV/8000 systems only). AOS/VS does not try to record this in ERROR_LOG.                                                                                             |
| 150                | A transfer to battery backup occurred.                                                                                                                                                                                                                                                                                                    |
| 151                | A hard (multiple-bit) ERCC error occurred. ERRLOG records the syndrome bits, module, and plane of the error. AOS/VS cannot record this in ERROR_LOG; instead, AOS/VS panics with a descriptive message.                                                                                                                                   |
| 152                | A single-bit (correctable) ERCC error occurred (file MEMLOG).                                                                                                                                                                                                                                                                             |
| 153                | A microsequencer parity error occurred. The microsequencer detected bad parity on a read from the control store. ERRLOG records the main processor program counter and RA register (this register contains the address of the microinstruction to be executed or the control store address to be loaded; it is displayed in hexadecimal). |
| 154                | The system cache detected one of several kinds of parity or address error. ERRLOG's LIST command will identify the error.                                                                                                                                                                                                                 |
| 155                | The bank controller detected bad parity on data from the system cache. ERRLOG records additional information.                                                                                                                                                                                                                             |
| 156                | The IOC (I/O controller) detected a parity error on a read from the system cache.                                                                                                                                                                                                                                                         |
| 157                | An S bus timeout occurred. ERRLOG records information on the pertinent operation and elements involved.                                                                                                                                                                                                                                   |
| 160                | The SCP detected bad parity on data read from the S bus. ERRLOG records information on the operation and elements involved.                                                                                                                                                                                                               |
| 161                | Unused.                                                                                                                                                                                                                                                                                                                                   |
| 162                | The error log is inoperative; perhaps the diskette is not properly inserted (MV/8000 diskette log only).                                                                                                                                                                                                                                  |

(continues)

**Table 11-1. SCP ERRLOG Entry Types**

| Entry Code (octal) | What It Means                                                                                                                                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 163                | An infinite protection fault occurred. The main processor received a protection fault while it was processing a protection fault. ERRLOG records the same information as with event 142. AOS/VS cannot log this in ERROR_LOG.                                                                                                                           |
| 164                | An infinite page fault occurred. On any reference to a page that is not in main processor memory, a page fault occurs, and the processor tries to read in the page. If a page fault occurs while the processor is handling a page fault, this error occurs. ERRLOG records the same information as with event 142. AOS/VS cannot log this in ERROR_LOG. |
| 165                | Someone enabled the instruction cache with the SCP DEGRADE command. This can occur only after someone has previously disabled the instruction cache with a DEGRADE command.                                                                                                                                                                             |
| 166                | Someone disabled the instruction cache with a DEGRADE command.                                                                                                                                                                                                                                                                                          |
| 167                | Reserved.                                                                                                                                                                                                                                                                                                                                               |
| 170                | Reserved.                                                                                                                                                                                                                                                                                                                                               |
| 171                | Someone issued a system RESET, either via the SCP-CLI or CPU panel switches. AOS/VS cannot log this in ERROR_LOG.                                                                                                                                                                                                                                       |
| 172                | Someone enabled the ATU accelerator with the SCP DEGRADE command. This can occur only after someone has previously disabled the accelerator with a DEGRADE command.                                                                                                                                                                                     |
| 173                | Someone disabled the ATU accelerator with a DEGRADE command.                                                                                                                                                                                                                                                                                            |
| 174                | An illegal PIO (programmed I/O) command occurred. The main processor sent a command to the SCP that the SCP doesn't recognize.                                                                                                                                                                                                                          |
| 175                | An XEQ DTOS command was executed (MV/8000 diskette log only).                                                                                                                                                                                                                                                                                           |
| 176                | A nonnominal DTOS return occurred (MV/8000 diskette log only).                                                                                                                                                                                                                                                                                          |
| 177                | Someone entered a HALT command (MV/8000 diskette log only).                                                                                                                                                                                                                                                                                             |
| 200                | Someone entered a CONTINUE command (MV/8000 diskette log only).                                                                                                                                                                                                                                                                                         |
| 201                | Someone entered an SCP command (MV/8000 diskette log only).                                                                                                                                                                                                                                                                                             |
| 202                | Someone entered an SCP INIT command. This is <i>not</i> the same as the ERRLOG INIT command. AOS/VS cannot log this event in ERROR_LOG.                                                                                                                                                                                                                 |
| 203                | The Bank Controller normally notes soft ERCC errors. This entry means that the controller has stopped noting such errors. It often indicates a large number of ERCC errors. Notify your DG field engineer or support organization.                                                                                                                      |

(concluded)

## LIST Command Dialog

When you enter a LIST command, ERRLOG asks for an event type. The types are

- ALL            Displays all errors. This is the default.
- LOG            Displays ERRLOG (not MEMLOG) errors.
- MEMLOG       Displays MEMLOG (single-bit ERCC) errors.
- n              Displays events of type n, shown in Table 11-1.

After you specify the types you want, ERRLOG asks for a date period, then a time period. You can specify these or default them. If you default them, ERRLOG assumes that you want all entries since the log was started or last initialized.

If there is no ERRLOG entry of the type you specify, the console will say *NO ENTRIES*.

If you specify TYPE 152, MEMLOG, it will ask for a memory module number. You can specify all modules by pressing ).

The LIST display is columnar, with event date, time, mode, and text explanation. The *mode* describes the state of the main and SCP processors when the event occurred. The modes and their meanings are

| Mode | Meaning                                                                                                                   |
|------|---------------------------------------------------------------------------------------------------------------------------|
| 0    | AOS/VS had control of the system console when the event occurred.                                                         |
| 1    | The SCP had control of the system console, <i>and</i> the MV/Family CPU was running (not halted) when the event occurred. |
| 2    | The SCP had control of the system console, and the MV/Family CPU was <i>halted</i> when the event occurred.               |

For example, the following dialog displays all entries:

```
SCP-ERR> LIST )
LIST PROGRAM
INPUT TYPE(S)
TYPE:  )

INPUT DATE (MM DD YY)
FIRST DATE:  )
LAST DATE:  )

INPUT TIME (HH MM)
FIRST TIME:  )
LAST TIME:  )

... (LIST program displays all entries) ...
SCP-ERR>
```

All displayed values except date and time are in octal, unless the FLAG RADIX has been changed to 16.

## Controlling Displays

As with any program, you can freeze display via CTRL-S and unfreeze it via CTRL-Q. In ERRLOG, you can abort a display via CTRL-O; the SCP-ERR> prompt will then return.

Whenever the SCP-ERR> prompt is showing, you can return to the SCP CLI by typing CLI ). You will do this when you are done with ERRLOG; you might also do it to check the value of SCP FLAGS. As usual, if any program is running in the main processor, you can return to it from the SCP CLI by typing TTY ).

## SCP ERRLOG Maintenance

On MV/8000 machines with an SCP diskette, the diskette log may fill up rapidly, as entries are made for each shutdown, startup, and other events. Even though new entries overwrite old ones, it's good practice to clear the log files periodically with the ERRLOG INIT command. The person who installed your hardware may recommend an interval for doing this; if not, you might do it every time preventive maintenance (vacuuming, etc.) is done on your system. Note any error conditions in the log before clearing the log. The dialog for clearing the log files is

```
SCP-ERR> INIT ↓
INITIALIZING
ENTER FILE: ERRLOG ↓
CLEAR ERRLOG? Y ↓
SCP-ERR> INIT ↓
ENTER FILE: MEMLOG ↓
CLEAR MEMLOG? Y ↓
SCP-ERR>
```

You can clear both files at once by typing ALL ↓ when the SCP prompts *ENTER FILE*:

On machines without an SCP diskette, you need not clear the log. But, you may want to check the log periodically and note errors before they are overwritten. Also, if power is cut to the CPU, all SCP log entries will be lost.

On any system, you should note any SCP error messages that appear on the system console. These may help identify the error.

## SCP ERRLOG Example

*SYSTEM SHUTDOWN*

*CPU HALTED*

```
SCP-CLI> XEQ ERRLOG ↓
```

```
SCP-ERR> LIST ↓
```

*LIST PROGRAM*

*INPUT TYPE(S)*

*TYPE: 171 ↓* (Check for RESETs.)

*TYPE: ↓*

*INPUT DATE (MM DD YY)*

*FIRST DATE: 12 8 86 ↓* (Check for a single day.)

*LAST DATE: 12 8 86 ↓*

*INPUT TIME (HH MM)*

*FIRST TIME: ↓* (Default first time is 00:00.)

*LAST TIME: ↓* (Default last time is 23:59.)

*12/08/86 16:53 2 SYSTEM RESET*

*12/08/86 18:03 2 SYSTEM RESET*

```
SCP-ERR>
```

This display indicates that the system operator reset the main processor twice on December 8, 1986 — at 4:53 and 6:03 p.m. The mode during each reset was, appropriately, 2. To continue

```
SCP-ERR> LIST ↓
```

*LIST PROGRAM*

*INPUT TYPE(S)*

*TYPE: A ↓* (All events.)

*INPUT DATE (MM DD YY)*

*FIRST DATE: ↓* (Default is beginning of log period.)

*LAST DATE: ↓* (Default is today.)

INPUT TIME (HH MM)

FIRST TIME: )

(Default is 00:00.)

LAST TIME: )

(Default is right now.)

```
11/28/86  14:53      2  MV/8000 LOADED
                        SW = 100027

11/28/86  15:20      0  MV/8000 HALT DETECTED
                        AC0 = 000000000000
                        AC1 = 00000000310
                        AC2 = 00000024056
                        AC3 = 00000204306
                        PC = 00000206513
                        PSR = 1
                        MAP = PHYS

11/28/86  15:21      2  SYSTEM RESET
```

#### SOFT ERCC ERRORS

NO ENTRIES MODULE = 0

NO ENTRIES MODULE = 1

NO ENTRIES MODULE = 2

NO ENTRIES MODULE = 3

SCP-ERR> CLI )

SCP-CLI> RESET )

SCP-CLI> BOOT 27 )

#### Operating System Load Menu

Enter choice [1]:

The meaning of terms used in a LIST report is as follows.

- *SW* is the switch register, which contains the device code used to boot; bit 0 is always 1 for a data channel device.
- *ACn* is a main processor fixed-point accumulator.
- *PC* is the value of the program counter.
- *PSR* is the value of the Program Status Register. It should be 0 if the machine halted normally.
- *MAP* gives the memory allocation and protection unit status, which should be *PHYS* on normal shutdown. *PHYS* means that the main processor has disabled both the Address Translation Unit (ATU) and the MAP. Other possible values of MAP are: *MAP A* (means that the main CPU was using MAP A, the user map); *MAP B* (means that the CPU was using MAP B, the operating system's map); or *ATU*, which means that the MAP was disabled and the Address Translation Unit was enabled.

## The CPUID

The CPUID (CPU identifier) is a number in scratchpad memory. It was inserted by DG to identify the CPU. The CPUID is very important, for the following reasons:

- The SYSBOOT bootstrap program uses it to decide which microcode file should be loaded (on all but MV/8000s);
- It describes the current microcode revision number;
- It specifies the amount of memory available in the machine.

## MV/20000-Series and MV/10000-Series Machines

On an MV/20000 Model 2, MV/20000 Model 1, MV/20000 Model C, MV/10000, and MV/10000 SX, the CPUID is stored as three separate entities: model number, microcode revision, and number of 32 Kbyte memory modules *in decimal*. AOS/VS requires the CPUID to display at least 64 modules (1 Mbyte). If you see a CPUID error message, use the SCP EXAMINE command to check location CPUID. An MV/10000 example is

```
SCP-CLI> EXAMINE CPUID ;
```

```
MODULE NUMBER: 8780
```

```
MICROCODE REV. 03 00
```

```
NUMBER OF NCPID MEMORY MODULES 256 CR
```

(256 32 Kbyte modules is 8 Mbytes. This is okay, so press the CR key to close and return to the SCP CLI.)

```
SCP-CLI>
```

## Machines Other Than MV/10000

On computers other than MV/10000s, the CPUID is a 32-bit value. The leftmost 16 bits contain a model number in octal. Bits 16–23 describe the revision number of microcode. Each new revision of microcode that you load updates bits 16–23. On some machines, the model number and microcode revision are write-protected from SCP commands; you cannot change them with SCP commands. On an MV/4000, MV/4000 DC, MV/4000 SC, and Data General DS/4000-series machine, these numbers are *not* protected, so be careful not to change them.

The rightmost two digits (6 bits) in the CPUID describe the number of 256 Kbyte memory modules in the main processor. The digits start with 0 (00, 01, 02, 03, and so on), so 03 means 4 modules. These digits can be examined and — perhaps — inadvertently changed.

*AOS/VS will not run* and will display a CPUID error message, if the CPUID specifies less than 4 memory modules (i.e., if the digits are less than 03). If you get this error message, use the SCP EXAMINE command on location CPUID. If the CPUID specifies too few memory modules, change it to reflect the memory you have. If the CPUID is okay, don't change it. Finally, close the CPUID location by pressing the CR key on the system console. For example, on an MV/6000:

```
SCP-CLI> EXAMINE CPUID ;
```

```
CPUID 04437001003 CR
```

(03 is 4 modules, which is 1 Mbyte; this is okay, so press the CR key to close and return to the SCP CLI.)

```
SCP-CLI>
```

## Changing the CPUID

To change the CPUID on MV/20000-systems and MV/10000-systems, type the new two- or three-digit value (in decimal) next to the displayed value and press CR. To change the CPUID on other machines, type the desired octal value next to the displayed value and press CR.

Then, verify the new CPUID by typing EXAMINE CPUID ; as above. You can check the CPUID from AOS/VS with the CLI command CPUID ;.

## What Next?

This chapter has explained some AOS/VS and diagnostic tools to help you pinpoint serious system problems — or simply check out your system.

You may want to read about the Disk Formatter program, described in the following chapter, or system management issues, covered in Chapters 15 and 16.

End of Chapter





# Chapter 12

## The Disk Formatter

Read this chapter

- when you want some background on AOS/VS logical disk units and how to use them;
- when you want to format one or more new (blank) disks, or reformat old ones;
- when you want to check for new bad blocks (noted as hard errors by AOS/VS or disk errors by FIXUP) on an LDU;
- when you want to rename a logical disk unit or change its access control list.

The Disk Formatter is an AOS/VS utility program that formats one or more physical disks into one or more logical disk units (LDUs). If you brought up your own first system (Chapter 2 or 3), you already have some experience with the Disk Formatter. This chapter explains the rest, in the following sections:

- About the Disk Formatter
- About LDUs
- If You Make a Mistake
- Starting the Stand-Alone Disk Formatter
- Starting the Stand-Among Disk Formatter
- The Full Format
- The Partial Format
- Disk Formatter Error Messages

### About the Disk Formatter

There are two versions of the Disk Formatter — a stand-alone version that runs only when AOS/VS is *not* running; and a stand-among version, that runs under AOS/VS. Each version offers two formats, Full and Partial.

The practical differences between the *versions* are that you must use the stand-alone version for disk(s) in the current LDU, or to format disks on controllers that are not supported by the current AOS/VS system. You can use the stand-among version for any LDU that is *not* the master.

There's a big difference between the Full and Partial *formats*. The Full format ignores all AOS/VS file structure and writes a new bitmap on the LDU, effectively destroying all AOS/VS files on it; it can also write patterns to check the disk surface for flaws. The Partial format retains the old bitmap and uses read-only surface analysis. So — if there are AOS/VS files that you want on the disk — you should use the Partial format of the pertinent Formatter.

Neither version of the Disk Formatter lays down a hardware format on a disk. Certified DG disks are shipped formatted; but if you ever need to reformat a disk, consult your DG support organization or engineer for details.

## About LDUs

This section explains some things about LDUs, and how you use them.

### Single- and Multiple-Disk LDUs

You can create a single- or multiple-disk LDU with a Disk Formatter Full format. A multiple-disk LDU can include up to eight disks. The disks can be different models, unless one of them is a model 6214 602-megabyte disk. An LDU built with a 602-megabyte disk cannot include other disk models. For any LDU, all disks involved must be ready before you can access the LDU.

The disk unit(s) in which you *format* an LDU are irrelevant to the LDU. For example, with removable packs, you can format an LDU in unit DPF0 and run it in unit DPF11; or you can format a two-disk LDU in DPF12 and DPF23 and run it in DPF1 and DPF2. This is why — during startup — you are asked to specify each additional disk in the LDU and its device code. It's also why, when you initialize an LDU from the CLI, you do it by disk unit name. Operations are simpler if each disk in an LDU has a “home” unit, but this is not required. Startup is easier if you have a system LDU in unit 0 — but even this is not mandatory for a tailored AOS/VS system.

Single-disk LDUs are easier to use because they involve only one disk unit. Also, FIXUP and PCOPY disk-to-disk operations are simpler with single-disk LDUs.

Nearly always, your primary *system* LDU will be a single-disk LDU. With a single-disk system LDU, someone need only type one disk unit name when bringing up AOS/VS. After AOS/VS is up, other LDUs can be grafted onto the system LDU with CLI INITIALIZE commands. You can put these commands in the macro UP.CLI. These LDUs can be released with CLI RELEASE commands; and you can put the RELEASE command(s) in the DOWN.CLI macro.

There's one good reason to make your system LDU a multiple-disk LDU. It is that you expect a file to span more than one disk when you own only two disk units.

The real advantage of a multiple-disk LDU is that it allows a contiguous file to span more than one physical disk. Some DG data management products — like INFOS II and DG/DBMS — may need such huge contiguous files. If your site will use such a file, you will need to build a multiple-disk LDU for it. Ideally, you'd run this LDU in *addition* to a single-disk system LDU.

Also, you may want to designate an LDU for the AOS/VS SWAP and PAGE directories, or one LDU for each of these directories. If so, each must be a single-disk LDU — named BOTH (for both directories), SWAP (for the swap directory), or PAGE (for the page directory). If you decide to have a separate LDU for either SWAP or PAGE, don't store user or system files there: the system deletes files not in a specified format from SWAP and PAGE each time the system is initialized.

An example of a system with a single-disk system LDU and multiple-disk other LDUs named BOTH and DATABASES is shown in Figure 12-1.

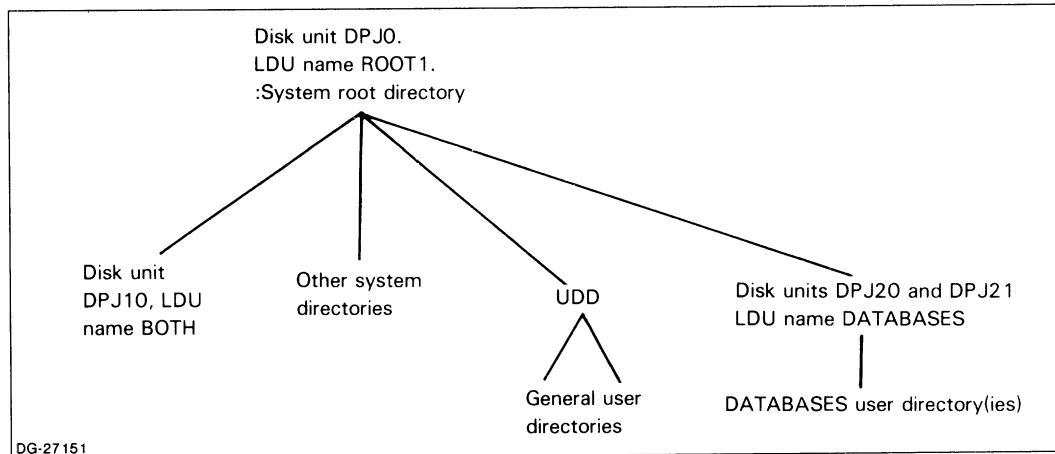


Figure 12-1. A Multiple-LDU AOS/VS System

To set up the system in Figure 12-1, you would do the following things:

- Use the Disk Formatter to create LDUs named BOTH and DATABASES.
- Bring up AOS/VS. From the CLI, initialize the disk units that hold the LDU (INITIALIZE @DPJ20 @DPJ21 ). AOS/VS then sees the LDU as directory DATABASES.
- For each username you want on DATABASES, use the CLI MOVE command to move the user directory to DATABASES. For example, for user Jack:

```
*) DIR :UDD )
*) MOVE/V DATABASES JACK:# )
... (CLI verifies directories and files moved) ...
```

- Delete the user directory in :UDD. For example,

```
*) DELETE/V JACK:# )
```

- Create a link named username in :UDD to :DATABASES:username. For example,

```
*) CREATE/LINK JACK DATABASES:JACK )
```

Thereafter, while DATABASES was initialized, any user whose directory had been moved to DATABASES would have the whole LDU available for database operations. The user directory pathname would be :DATABASES:username, but otherwise the user would be treated exactly as if he or she were in :UDD.

At startup, after AOS/VS was brought up from DPJ0, the UP.CLI macro could use the following commands to initialize the LDU:

```
DIR :
INITIALIZE/S @DPJ20 @DPJ21
WRITE/L=LDU.NAME [!STRING]
```

The DOWN.CLI macro would need only the following commands to release DATABASES:

```
RELEASE :[LDU.NAME]
DELETE :LDU.NAME
```

This technique works for any nonmaster LDU. For example, assume that you have a lot of users and want to put some of them on their own LDU — perhaps named UDD1. You'd use the Disk Formatter to create UDD1, initialize it from the CLI, DIR into :UDD, move each directory you wanted over to UDD1, delete each of these directories from :UDD, and create links in :UDD to :UDD1:username. Then you'd put the appropriate INITIALIZE and RELEASE commands in the UP and DOWN macros.

No CLI commands are needed to initialize an LDU named BOTH, or SWAP, or PAGE. Such LDU(s) are initialized automatically if specified to VSGEN; or you can give the disk unit name(s) during bootstrapping if you override default specs. While AOS/VS runs (in the system in Figure 12-1), it would have a whole disk for swapping and paging I/O.

If — at any point — you want to change the physical disk configuration in an LDU, you must run a Formatter Full format on all physical disks involved. Dump all files from each LDU involved; run a Full format on the LDU; then load the files onto the new LDU.

## LDU Access Control Lists (ACLs)

When you run the Formatter on an LDU, you can specify an access control list (ACL) or take the default, which creates a null ACL. For the master LDU, AOS/VS ignores the ACL, so that it can execute programs (like the CLI) for users. (If — at VSGEN — access control was not enabled for this system, then this system ignores *all* ACLs when it runs. But generating and running a system without access control is useful only when you want all users to have access to all files.)

For each nonmaster LDU, the ACL you specify (or default) with the Disk becomes effective when the LDU is initialized from the CLI. If the LDU has the default (null) ACL, some kind of access must be specified before anyone but a superuser can access the LDU. You can do this with the CLI command ACL any time after the LDU is initialized. The easiest way to do it is in the UP macro; for example

```
DIR :
INITIALIZE/S @DPJ10
WRITE Initialized :DPJ10 as [!STRING]. ACL is OP WARE,,, + E
ACL [!STRING] OP,WARE +,E
WRITE/L=LDU.NAME [!STRING]
```

When you assign a multiple-user ACL, proceed from specific usernames to general usernames (templates). For example, the ACL

```
+,RE OP,WARE $+,
```

gives all users (which includes OP) read and execute access — and *only* read and execute access. The W and A privileges for OP are ignored. The ACL also tries to establish null access to usernames beginning with \$, but this is overridden by the +,RE. The ACL defeats itself. But rearrange the username groups as follows:

```
OP,WARE $+,, +,RE
```

This ACL gives OP the privileges WARE, gives usernames beginning with \$ no access (null), and gives all remaining users read and execute privileges. This is what people want from ACLs. When you define more than one username group in an ACL, place specific username(s) first and the most general username template last.

The ACL assigned in an ACL command is effective only while the LDU is initialized. The Formatter-specified ACL returns when the LDU is released. So, if you know what ACL you want, you might want to assign it via a Formatter Full or Partial run. This would eliminate the need for an ACL command in the UP.CLI macro. If you needed to change the ACL at runtime, you could do it at will, as shown above.

## Formatting a Shared (Dual-Ported) LDU

Certain disk models can be connected to two MV/Family computers at once. (Each computer must, in addition, have a system disk of its own.) The main advantage of a shared LDU is fast recovery if one system fails — a big advantage for important database files.

On each computer, the system disk must be formatted and a system built — just as if the computers were not connected (doing this is described in Chapters 3, 4, and 5). You can format the shared LDU from either system, and, via the Disk Formatter, give it a unique ID and meaningful logical disk name. Give the LDU a restrictive ACL (for example, null). This will help prevent unauthorized people from initializing the LDU.

After the LDU has been formatted, you will need to protect its unit name entries in :PER. (If this isn't done, a user might read or write to the LDU as a physical device; for example, via `DUMP/V @DPJ1 MYFILE .`.) The UP macro can protect a unit entry, with Superuser on, via a command like `ACL @DPJn +, .`

When one system wants to use the LDU, it can turn Superuser on, initialize the LDU, and change the Formatter-assigned ACL as needed. Then, users and programs can access it like any LDU, by directory name. After initialization, the LDU is part of the file system, and access controls remain in force.

An LDU cannot be initialized if it's already initialized — this prevents the second system from initializing the shared LDU while the first system is using it. After a system has released the shared LDU, it can be initialized by *either* system. Be careful, however, and prevent both systems from trying to access the LDU at the same time.

More information on using shared LDUs appears in Chapter 15.

## Formatting a Mirrored LDU

Model 6236- and 6239-class disks permit logical disk mirroring. In logical disk mirroring, the operating system maintains two logically identical images of an LDU. Disk mirroring provides high data availability, but means giving up disk space. It may also have a performance cost. For more about logical disk mirroring, see Chapter 15.

When you format a mirrored LDU, the Disk Formatter requires that the disks be the same size and on the same controller. You must also make the following the same for both images: LDU name, bad block table entries, remap area size and address, and diagnostic area. You must, however, make the LDU unique IDs different.

Tell the Disk Formatter that the disks you are formatting are to be mirror images by separating them with the ! associator. When the Disk Formatter prompts

*Specify each disk in the LDU (press NEW LINE when done)*  
*Disk unit name?*

answer using the format

unitname!unitname. . .

For example, if your disks are DPJ1 and DPJ2, you'd answer

DPJ1!DPJ2 .

## The Bitmap/Overlay Areas and System Performance

The *bitmap* is an area on each LDU that describes which blocks are free and which are used for data storage. The overlay area contains the overlays of the currently running AOS/VS system. There is a bitmap on every LDU; there is an overlay area only on an LDU that includes a system disk.

AOS/VS must access the bitmap every time it creates or deletes a file. It must access the overlay area whenever it needs nonresident code to perform an operation. So the location of these two areas on the LDU can affect system performance.

The default bitmap and overlay area addresses are often chosen when an LDU is created. The default bitmap address is 3/8 the distance across the first disk in the LDU; and the default overlay area address follows the bitmap. These are good general-purpose addresses for a single-disk LDU: they are close to the center, which gives fast access if the LDU is nearly full of files. And they are closer to the beginning, which gives relatively fast access if the LDU has few files.

For a multiple-disk LDU that will hold (or does hold) very large contiguous files (for example, INFOS II or DG/DBMS database files), you *might* want to select nondefault addresses. In such a case, specify 0 (start of LDU) for the bitmap, and specify the bitmap size (given by the Formatter) as the overlay area address. Contiguous file space will then stretch from nearly the beginning of the LDU to the end.

Generally, though, you should take the Formatter defaults on bitmap and overlay area addresses.

## If You Make a Mistake

If you type a response to the Disk Formatter and want to change it before pressing `]`, press the DEL key as needed, or press `CTRL-U` to erase the line. If you are beyond the line containing the mistake and you want to abort, do this in one of two ways.

- If the Disk Formatter is asking a question, you can restart it at the beginning by typing `CTRL-C CTRL-A` (or abort the stand-alone Formatter by typing `CTRL-C CTRL-B`). The Disk Formatter does not alter the disk until surface analysis begins (Full format) or until you change a value (Partial format).
- If the Disk Formatter is running surface analysis, `CTRL-C CTRL-A` won't work. If you *must* abort the stand-alone Formatter, type the break sequence (`CMD` and `BREAK`, or `BRK`, or `BREAK`, depending on your system console). To abort the stand-alone Formatter, type `CTRL-C CTRL-B`.

If you abort the Disk Formatter, restart it from the beginning.

For any Formatter error message, see Table 12-4, near the end of the chapter.

## Starting the Stand-Alone Disk Formatter

If you want to run the Disk Formatter on the master LDU, you must use the stand-alone version. This is file `DMFTR` in the root directory. (If you *cannot* boot from disk, you must use an AOS/VS system tape or diskette, as shown below. But if you're rebuilding the master LDU from scratch, read Chapter 2 or 3 instead of this one.)

First, go to the system console — the stand-alone Formatter runs only from this console.

If CPU microcode is not loaded, cold start the computer as described in Chapter 6.

Make sure each disk you want to format is in its unit, and that all units are write-enabled (if they can be write-disabled) and ready.

To boot the Disk Formatter from the master LDU, type

```
SCP-CLI> RESET ]
SCP-CLI> BOOT 27 ]      (Or BOOT 24 or BOOT 33)
```

*Operating System Load Menu*

```
Enter choice [1]: 2 ]    (Choose option 2)
```

*Technical Maintenance Menu*

```
Enter choice [1]: 6 ]    (Choose option 6)
```

```
Pathname? :DFMTR ]
```

```
AOS/VS Disk Formatter Rev n
```

To start the Formatter from tape or diskette, get an AOS/VS system tape or AOS/VS system diskette number 1. Mount it on unit 0, and type

### **Tape**

```
SCP-CLI> RESET ↵  
SCP-CLI> BOOT 22 ↵
```

*Tape file number? 2 ↵ (File 2)*

*AOS/VS Disk Formatter Rev n*

### **Diskette**

```
SCP-CLI> RESET ↵  
SCP-CLI> BOOT 64 ↵
```

#### *Operating System Load Menu*

*Enter choice [1]: 2 ↵ (Choose option 2)*

#### *Technical Maintenance Menu*

*Enter choice [1]: 6 ↵ (Choose option 6)*

*Pathname? :DFMTR ↵*

*AOS/VS Disk Formatter Rev n*

You must run a Full format

- if the Disk Formatter has never run on the physical disk(s); or
- if you want to change an LDU's physical disk configuration; for example, make two existing LDUs into one, or vice versa; or
- if you want to add, remove, or change the size of the diagnostic area.

In nearly all other cases, you will want a Partial format. Skip to the pertinent section: "Full Format" or "Partial Format."

## **Starting the Stand-Among Disk Formatter**

You can run the stand-among Disk Formatter on any disk that is not part of the master LDU. It's not as fast as the stand-alone Formatter, but it does allow AOS/VS to remain up while you run it. You can run it from the system console or any user console enabled by EXEC.

The stand-among Disk Formatter is in directory :UTIL (loaded there during the starter system initial load). Its filename is DFMTR.PR.

First, make sure each disk you want to format is in its unit, and that each unit is write-enabled and ready.

With directory :UTIL in your searchlist, type

```
) XEQ DFMTR ↵
```

*AOS/VS Disk Formatter Rev n*

*Full format destroys ...*

You must run a Full format

- if the Disk Formatter has never run on the physical disk(s); or
- if you want to change an LDU's physical disk configuration; for example, make two existing LDUs into one, or vice versa; or
- if you want to add, remove, or change the size of the diagnostic area.

In nearly all other cases, you will want a Partial format. Go to the pertinent section: "Full Format" or "Partial Format."



## The Full Format

The Disk Formatter announces itself. Then it asks whether you want a Full or Partial format.

*AOS/VS Disk Formatter Rev n*

*Full format destroys any AOS/VS file structure, Partial retains it.*

*Full (F) or Partial (P or NEW LINE)?*

A Full format writes a new bitmap to the LDU, effectively destroying all files by overwriting pointers to them. It also can run surface analysis patterns to check disk surfaces for bad blocks — this overwrites the files themselves. So, before you proceed with a Full command, if there is material on the LDU that you want to try to dump, abort the Formatter. For the stand-alone Formatter, use the break sequence; for the stand-among Formatter, press CTRL-C CTRL-B. From the AOS/VS CLI, dump the files from the LDU. Then restart the Formatter as shown above.

To specify a Full format, type

F )

*Full Format*

*Specify each disk in the LDU (press NEW LINE when done)*

*Disk unit name?*

Type the unit name that holds the disk you want formatted as the first (or only) disk in the LDU. Table 12-1 shows the disk unit names and device codes of all disks supported by AOS/VS, by model number, in ascending order. For example,

DPJ1 )

For a mirrored LDU, type the LDU names separated by a !. For example

DPJ2!DPJ3 )

The stand-among Formatter knows — via AOS/VS — the device code of the disk unit. So it skips the next question and asks for another *Disk unit name?*. (If the disk controller was not generated into the current AOS/VS system, you *must* run the stand-alone Disk Formatter.)

*Device code [default] ?*

Type the device code of the disk unit you just specified. If the disk unit you specified is on the default device code for its controller, you can press ) in response to the *Device code?* query.

**Table 12-1. All AOS/VS Disk Unit Names and Device Codes**

| <b>Disk Model Number, Description, and Capacity</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Default Device Code of Controller</b> | <b>Disk Number on Controller</b>                   | <b>Disk Unit Name</b>                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4514. This is a minidiskette, 5-1/4 inches, capacity 368,000 bytes. It is used in DESKTOP GENERATION and other systems.                                                                                                                                                                                                                                                                                                                                                                                              | 20                                       | first<br>second                                    | DPM0<br>DPM1                                                                                                                                                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 60                                       | first<br>second                                    | DPM10<br>DPM11                                                                                                                                                   |
| 6030. This is a diskette, single or dual slot. Capacity per diskette is 0.3 Mbyte.                                                                                                                                                                                                                                                                                                                                                                                                                                   | 33                                       | 0 on dial<br>1 on dial<br>2 on dial<br>3 on dial   | DPD0<br>DPD1<br>DPD2<br>DPD3                                                                                                                                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 73                                       | 0 on dial<br>1 on dial<br>2 on dial<br>3 on dial   | DPD10<br>DPD11<br>DPD12<br>DPD13                                                                                                                                 |
| 6045 **. This is a moving-head unit with two disks: one removable, one nonremovable. Unit capacity is 10 Mbytes. It also supports diskettes.                                                                                                                                                                                                                                                                                                                                                                         | 33                                       | 0 on dial<br>1 on dial<br>2 on dial<br>3 on dial   | Removable: DPD0; nonremovable: DPD4<br>Removable: DPD1; nonremovable: DPD5<br>Removable: DPD2; nonremovable: DPD6<br>Removable: DPD3; nonremovable: DPD7         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 73                                       | 0 on dial<br>1 on dial<br>2 on dial<br>3 on dial   | Removable: DPD10; nonremovable: DPD14<br>Removable: DPD11; nonremovable: DPD15<br>Removable: DPD12; nonremovable: DPD16<br>Removable: DPD13; nonremovable: DPD17 |
| 6060, 6061, 6067, and 6122; 6160 and 6161; 6214.<br><br>All are moving-head disks. The 6060, 6061, 6067, and 6122 are freestanding and use a removable pack; a controller can run four units. The 6160, 6161, and 6214 are sealed with nonremovable disks; a controller can run two units.<br><br>A 6060 holds 96 Mbytes; a 6061 holds 190 Mbytes, 6067 holds 50 Mbytes, and a 6122 holds 277 Mbytes. A 6160 holds 73 Mbytes and a 6161 holds 147 Mbytes.<br><br>A 6214 is a freestanding unit and holds 602 Mbytes. | 27                                       | first (0)<br>second (1)<br>third (2)<br>fourth (3) | DPF0<br>DPF1<br>DPF2<br>DPF3                                                                                                                                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 67                                       | first (0)<br>second (1)<br>third (2)<br>fourth (3) | DPF10<br>DPF11<br>DPF12<br>DPF13                                                                                                                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | *                                        | first (0)<br>second (1)<br>third (2)<br>fourth (3) | DPF20<br>DPF21<br>DPF22<br>DPF23                                                                                                                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | *                                        | first (0)<br>second (1)<br>third (2)<br>fourth (3) | DPF30<br>DPF31<br>DPF32<br>DPF33                                                                                                                                 |

(continues)

\* There is no default device code for the third, fourth, or subsequent disk controllers. These device codes are chosen at installation.

\*\* A model 6045 controller can run both 6045 disk units and 6030 diskette units. To format diskettes on the first 6045 controller, dial 1, 2, or 3 on the diskette unit; this makes the diskette names DPD1, DPD2, or DPD3, respectively. To format diskettes on the second 6045 controller, dial 1, 2, or 3 on the diskette units; this makes the diskette names DPD11, DPD12, or DPD13, respectively.

**Table 12-1. All AOS/VS Disk Unit Names and Device Codes**

| Disk Model Number, Description, and Capacity                                                                                                                                        | Default Device Code of Controller | Disk Number on Controller                          | Disk Unit Name                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6063, 6064, 6066. Each is a fixed-head disk. The 6063 holds 1 Mbyte, the 6064 holds 2 Mbytes, the 6066 is two 6064 units and one controller.                                        | 26                                | first (0)<br>second (1)<br>third (2)<br>fourth (3) | DKB0<br>DKB1<br>DKB2<br>DKB3                                                                                                                                     |
|                                                                                                                                                                                     | 66                                | first (0)<br>second (1)<br>third (2)<br>fourth (3) | DKB10<br>DKB11<br>DKB12<br>DKB13                                                                                                                                 |
| 6067. See 6060 description.                                                                                                                                                         |                                   |                                                    |                                                                                                                                                                  |
| 6070. This is a moving-head unit with two disks: one removable, one nonremovable. Unit capacity is 20 Mbytes.                                                                       | 33                                | 0 on dial<br>1 on dial<br>2 on dial<br>3 on dial   | Removable: DPG0; nonremovable: DPG4<br>Removable: DPG1; nonremovable: DPG5<br>Removable: DPG2; nonremovable: DPG6<br>Removable: DPG3; nonremovable: DPG7         |
|                                                                                                                                                                                     | 73                                | 0 on dial<br>1 on dial<br>2 on dial<br>3 on dial   | Removable: DPG10; nonremovable: DPG14<br>Removable: DPG11; nonremovable: DPG15<br>Removable: DPG12; nonremovable: DPG16<br>Removable: DPG13; nonremovable: DPG17 |
| 6097. This is a diskette unit, single or dual slot. Diskette capacity is 1.26 Mbytes.                                                                                               | 33                                | first<br>second                                    | Left: DPI0; right: DPI1<br>Left: DPI2; right: DPI3                                                                                                               |
|                                                                                                                                                                                     | 73                                | first<br>second                                    | Left: DPI10; right: DPI11<br>Left: DPI12; right: DPI13                                                                                                           |
| 6098. This is a moving-head sealed disk with diskette. A toggle switch makes the disk unit 0 and diskette unit 1, and vice-versa. Capacity: Disk 12.3 Mbytes, diskette 1.26 Mbytes. | 33                                | only                                               | Disk DPI0 and diskette DPI1; or vice-versa.                                                                                                                      |
|                                                                                                                                                                                     | 73                                | only                                               | Disk DPI10 and diskette DPI11; or vice-versa.                                                                                                                    |
| 6099. This the same as model 6098, but without the diskette.                                                                                                                        | 33                                | only                                               | DPI0                                                                                                                                                             |
|                                                                                                                                                                                     | 73                                | only                                               | DPI10                                                                                                                                                            |
| 6100. This is the same as 6098, with twice the disk capacity; disk 24.6 Mbytes, diskette 1.26 Mbytes.                                                                               | 33                                | only                                               | Disk DPI0 and diskette DPI1; or vice-versa.                                                                                                                      |
|                                                                                                                                                                                     | 73                                | only                                               | Disk DPI10 and diskette DPI11; or vice-versa.                                                                                                                    |
| 6103. This is the same as the 6100, without the diskette; capacity is 24.6 Mbytes.                                                                                                  | 33                                | only                                               | DPI0                                                                                                                                                             |
|                                                                                                                                                                                     | 73                                | only                                               | DPI10                                                                                                                                                            |
| 6122. See 6060 description.                                                                                                                                                         |                                   |                                                    |                                                                                                                                                                  |
| 6160, 6161. See 6060 description.                                                                                                                                                   |                                   |                                                    |                                                                                                                                                                  |
| 6214. See 6060 description.                                                                                                                                                         |                                   |                                                    |                                                                                                                                                                  |

(continued)

**Table 12-1. All AOS/VS Disk Unit Names and Device Codes**

| Disk Model Number, Description, and Capacity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Default Device Code of Controller | Disk Number on Controller                          | Disk Unit Name                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------------|--------------------------------------------|
| 6227. A sealed, moving-head disk, capacity 15 Mbytes. There can be a 1.26-Mbyte diskette on the same controller. If so, a toggle switch under the front panel makes the disk unit 0 and diskette unit 1, and vice-versa.                                                                                                                                                                                                                                                                                                                      | 33                                | only                                               | Disk DPI0 (with diskette, DPI0 or DPI1)    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 73                                | only                                               | Disk DPI10 (with diskette, DPI10 or DPI11) |
| 6234. A sealed, moving-head disk, rack mounted. It holds 50 Mbytes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 33                                | only                                               | DPI0                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 73                                | only                                               | DPI10                                      |
| <p>6236 and 6237; 6239, 6240, and 6290. A rack-mounted, sealed, moving-head unit with power switch on the right. It has a LED display that shows the number and can show the current cylinder or disk fault code. A controller can run four units.</p> <p>A model 6236 unit holds 354 Mbytes; a model 6237 is three 6236 units in one cabinet, on one controller. A model 6239 unit holds 592 Mbytes; a model 6240 is three 6239 units in one cabinet, on one controller. Model 6290 is two 6239 units in one cabinet, on one controller.</p> | 24                                | first(0)<br>second (1)<br>third (2)<br>fourth (3)  | DPJ0<br>DPJ1<br>DPJ2<br>DPJ3               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 64                                | first (0)<br>second (1)<br>third (2)<br>fourth (3) | DPJ10<br>DPJ11<br>DPJ12<br>DPJ13           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | *                                 | first (0)<br>second (1)<br>third (2)<br>fourth (3) | DPJ20<br>DPJ21<br>DPJ22<br>DPJ23           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | *                                 | first (0)<br>second (1)<br>third (2)<br>fourth (3) | DPJ30<br>DPJ31<br>DPJ32<br>DPJ33           |
| 6309. This is a 737,000 byte, 5-1/4 inch, minidiskette unit. It is an add-on to the primary diskette on MV/4000SC and Data General DS/4000-series systems.                                                                                                                                                                                                                                                                                                                                                                                    | 64                                | second(1)                                          | DPJ11                                      |
| <p>6310, 6328, 6329. This is a 5-1/4 inch, sealed disk, an add-on to the primary disk on MV/4000DC, MV/4000SC, and Data General DS/4000-series systems.</p> <p>Model 6310 holds 39 Mbytes.<br/>Model 6328 holds 71 Mbytes.<br/>Model 6329 holds 120 Mbytes.</p>                                                                                                                                                                                                                                                                               | 24                                | second(1)                                          | DPJ1                                       |

(concluded)

- \* There is no default device code for the third, fourth, or subsequent disk controllers. These device codes are chosen at installation.

The Formatter repeats the question(s) *Disk unit name?* (and *Device code?* for stand-alone) so that you can specify more than one disk. A maximum of eight physical disks is allowed in an LDU. After you describe the last physical disk, press *]* in response to *Disk unit name?* For example,

*Disk unit name? ]*

| *Do you want to allocate a diagnostic area? [Y]*

This question lets you reserve an area on disk for later installation of DG's Advanced Diagnostic Executive System (ADES). ADES can run from a medium other than disk, but it runs much faster from disk. Also, diagnostics are easier to run remotely if ADES is on disk. To use ADES, you must purchase it and have it installed on the disk by a DG field engineer. ADES for MV/Family machines requires a minimum of 8,000 disk blocks — 4.1 Mbytes. This space is lost for AOS/VS file storage.

| ADES runs only from an AOS/VS system disk (like DPJ0, DPJ10, or DPF0). So, unless you will install AOS/VS and run it from the LDU you're formatting, answer No by typing N *]*. You should also say No if you have total disk storage of 50 Mbytes or less. If you say No, skip the next question.

| If you want to reserve an area for ADES, press *]*. Then, the Disk Formatter asks

*Enter the number of blocks (1750 to 35230) required. [23420]*

The displayed figures are octal. ADES needs at least 8,000 blocks (17500 octal). A good minimum figure is the default, 23420 (10,000) blocks. Decide on the number of disk blocks needed for the diagnostics you want installed; then either take the default (press *]*) or type the number (octal!). The Formatter will now assume that this disk is a system disk.

The Disk Formatter now displays each disk number with octal start and end logical block addresses. The Formatter deals only with octal numbers (except that it accepts 8 as the number of the last physical disk in the LDU). For example, it might display

*Disk number 1: 00000000000 through 00001325657*

*Disk number 2: 00001325660 through 00002653535*

And it asks for the LDU's unique ID.

*LDU unique I.D. (1 to 6 characters)? []*

AOS/VS uses the logical disk unique ID to determine which physical disks belong to this LDU.

For simplicity, you might want to use an ID that is as close as possible to the LDU name, which you'll specify next. The LDU name will be the filename of the LDU. For example, if you plan to name the LDU UDD1, you would type UDD1 *]*. If you plan to name it DATABASE, you'd use a six-character abbreviation; e.g., DATABA *]*.

Create an ID from one to six characters long, and type it in. Any filename character is legal: A through Z (uppercase and lowercase are treated the same), 0 through 9, period (.), dollar sign (\$), question mark (?), and underscore (\_). Each ID should be unique among LDUs.

| (If you are formatting a mirrored LDU, the Disk Formatter prompts for the LDU unique I.D. for image 1 and will later repeat the dialog for image 2. The LDU unique I.D.s *must* be different. Mirroring requires however, that the LDU name, bad block table entries, remap area size and address, and diagnostic area be the same.)

(If you are creating a destination LDU for the PCOPY program, you may choose to give it the same ID and name as the source LDU, or not. LDU names and IDs are irrelevant for disk-to-disk PCOPY. But PCOPY requires that a destination LDU's bitmap, overlay, and remap area addresses be the same as the source LDU's.)

Whatever ID you decide on, note it for future use.

After you type the ID, the Disk Formatter asks

*LDU name (1 to 31 characters)?*

For any nonmaster LDU, the name you type here will be the filename of the LDU. This name will be displayed when you initialize the LDU from the CLI, or boot it (if a system disk).

People and AOS/VS can use the LDU name just as any other directory pathname. An LDU's pathname is the directory it was initialized from. For example, an LDU named DATABASES, initialized from the root directory, would have the full pathname :DATABASES. If you need more background on this, read "Single- and Multiple-Disk LDUs," earlier in this chapter.

As mentioned before, you may want to designate one LDU for the system's SWAP and PAGE directories, or one for each directory. For both directories, use a logical disk name of BOTH. For the PAGE directory, use PAGE; or for the SWAP directory, use SWAP. Then — later in the Formatter dialog — assign a username of + and an access control list of E. Afterward, when you bring up AOS/VS, it will use this LDU for both SWAP and PAGE, or for the one you specified. An LDU you designate for both, or either, directory should be a DPJ- or DPF-type disk to be large enough; and it should — ideally — be on its own controller.

After deciding on the LDU name (1 to 31 filename characters), type it. The Disk Formatter asks

*Access Control List*

*Username or template (1 to 15 characters)?*

AOS/VS maintains an access control list (ACL) for each initialized LDU. The ACL lists usernames of users who can access the LDU and the type(s) of access each user has. To create the ACL, you specify usernames and the access privilege types you want these users to have.

Whatever ACL you specify is ignored if this LDU runs as the master LDU: all users have execute (E) access to the root directory.

If you don't know exactly which usernames and access types you want for this LDU, a good secure, general-purpose ACL is +,E. This gives all users execute access. For a null ACL, press ]. This will prevent anyone but a superuser from initializing or accessing the LDU.

Later, if needed, you can override the LDU ACL with the CLI command ACL after initializing the LDU; or you can change it with a Partial format.

The next section reviews templates and the ACL issue. If you don't want a review, skip the next section.

## Username Templates and Access Types

You can specify a username literally (e.g., ADAM for a user who will log on as ADAM), or you can specify one or more username templates. A username template allows a group of users with a variety of usernames to access the LDU. A username template uses one or more template characters to represent other filename characters. The template characters are hyphen (-), plus (+), and asterisk (\*).

- + represents any string of filename characters;
- represents any string of filename characters, except periods;
- \* represents any single character, except a period.

For example, the template

**\*FORTRAN**

matches username AFORTRAN, but not AMFORTRAN, nor .FORTRAN.

The template **-FORTRAN**

matches username BOBFORTRAN, but not BOBFORT, nor BOB.

The template **FORTRAN+**

matches username FORTRANA and FORTRAN.USER, but not .FORTRAN, nor AFORTRAN.

The template **-FORTRAN+**

uses two template characters and matches usernames **BOBFORTRAN.XX** and **FORTRAN**, but not **FORT.RAN**, nor **.FORTRAN**.

Each time you supply a username or template, the Disk Formatter asks about the access privileges. A user can have five types of access to a directory (which an LDU is); or a user can have no access. The access privilege types are O, W, A, R, or E. Table 12-2 explains their meanings.

**Table 12-2. Access Privilege Types**

| <b>Access</b> | <b>A User Who Has</b> | <b>Can</b>                                                  |
|---------------|-----------------------|-------------------------------------------------------------|
| O             | Owner access          | Initialize the LDU and change its ACL.                      |
| W             | Write access          | Insert and delete filenames in the LDU's primary directory. |
| A             | Append access         | Add new files to the LDU's primary directory.               |
| R             | Read access           | List the files in the LDU's primary directory.              |
| E             | Execute access        | Use the LDU's filename in a pathname.                       |

You can assign combinations of these privileges. For example, **RE** allows the specified user to use the LDU's name in a pathname (E) and list the files in its primary directory (R).

To initialize an LDU, a user needs the following privileges (unless he or she has Superuser on):

- Write access to the directory in which he or she wants to initialize the LDU;
- Execute access to the device entry (like **@DPJ10**) in directory **:PER** (often set by the **UP** macro);
- Owner access to the LDU (set with the Disk Formatter).

## **Specifying Usernames and Privileges**

The Disk Formatter is asking for an

*Access Control List*

*Username or template (1 to 15 characters)?*

The Formatter will ask for a username or template, then for access privileges, until you press **]** to the username question. It allows up to seven username-privilege groups. This allows you to set up quite a specific ACL. Or, you can press **]** to assign a null ACL, which denies access to all but superusers.

Decide on the usernames and access privileges you want for the LDU. For multiple user groups, remember to type the specific usernames first, and the most general usernames (templates) last, as covered earlier in the chapter. For the first username, you might type **OP ]**.

The Disk Formatter then asks about that user's access privileges:

*Access (O, W, A, R, E, or NEW LINE)?*

Describe the privileges you want for the user(s); for example, E ↵. Pressing ↵ by itself explicitly gives the user(s) no privileges; this is useful when you want to give the user(s) no access to an LDU.

For example, assume you want to give all usernames — except those beginning with \$ — Execute access to an LDU. Type \$+ ↵ (covers the \$ usernames), then ↵ (for no privileges). Then type + ↵ (covers the usernames not beginning with \$) and E ↵ (for Execute privilege).

After you describe access privileges, the Formatter repeats

*Username or template (1 to 15 characters)?*

If you have another username to specify, type it. Otherwise, press ↵.

*Access (O, W, A, R, E, or NEW LINE)?*

Describe the access privileges for user(s); for example, E ↵.

When you press ↵ in response to *Username ...*, the Formatter asks

*Surface analysis? [N]*

This begins a series of questions about surface analysis. During analysis, the Disk Formatter writes a test pattern to and reads it from each disk block. Then it compares the results. It records bad disk blocks in a bad block table that AOS/VS keeps partially in memory. When AOS/VS wants to access a block whose address is noted in this table, the table directs it to a good block in an area called *the remap area*. You can choose up to five test patterns.

*A bad block can bring down AOS/VS*, so it's critically important that all bad blocks be recorded. You should run all five test patterns on each new disk, and whenever you suspect that a disk may have developed one or more new bad blocks.

If you are formatting a mirrored LDU, the Disk Formatter prompt for *Surface analysis* is preceded by a prompt *For image 1* the first time through the dialog, and *For image 2* the second time through. If you *know* that either disk has been formatted recently, you can skip running patterns.

If you don't want any patterns run on this disk, type N ↵; the Formatter then skips to the *for disk #n* bad block sequence, below.

If you want one or more of the checkout patterns run, type Y ↵.

*Disk number?*

To have patterns run on all disks in the LDU, press ↵. (You *can* specify disk numbers individually, but omitting patterns on a disk isn't recommended.)

Now, the Formatter says

*You may run up to five (5) patterns. How many would you like to run?*

Choose the number you want and type it.

Table 12-3 shows the approximate time required for surface analysis on each type of disk supported by AOS/VS.

The Disk Formatter requires no interaction as it runs the patterns, so you can leave the system console as they run.



**Table 12-3. Surface Analysis Times for Disks**

| <b>Disk Model</b> | <b>Capacity<br/>(Megabytes)</b> | <b>Approximate Time Per Test<br/>Pattern</b>       |
|-------------------|---------------------------------|----------------------------------------------------|
| 6060              | 96                              | 13 minutes                                         |
| 6061              | 190                             | 17 minutes                                         |
| 6122              | 277                             | 26 minutes                                         |
| 6160              | 73                              | 11 minutes                                         |
| 6161              | 147                             | 22 minutes                                         |
| 6214              | 602                             | 52 minutes                                         |
| 6227              | 15                              | 10 minutes                                         |
| 6234              | 50                              | 8 minutes                                          |
| 6236, 6237        | 354 per unit                    | 24 minutes per unit                                |
| 6239, 6240, 6290  | 592 per unit                    | 50–60 minutes per unit                             |
| 6309              | 0.7                             | 2 minutes                                          |
| 6310              | 39                              | 8 minutes                                          |
| 6328              | 71                              | 14 minutes                                         |
| 6329              | 120                             | 24 minutes                                         |
| 6063, 6064, 6066  | 1 per disk unit                 | 3 minutes per disk unit                            |
| 6097 (diskette)   | 1.26                            | 2 minutes                                          |
| 6070              | 10 per disk                     | 14 minutes per disk                                |
| 6045              | 5 per disk                      | 8 minutes per disk                                 |
| 6096, 6099        | 12.5 (disk)<br>1.25 (diskette)  | 14 minutes for hard disk<br>2 minutes per diskette |
| 6100, 6103        | 25 (disk)<br>1.25 (diskette)    | 28 minutes for hard disk<br>2 minutes per diskette |
| 6030 (diskette)   | 0.3                             | 2 minutes                                          |

#### *Analyzing Disk #n*

The Disk Formatter now runs the pattern(s) on the current disk. As each pattern runs, the Formatter displays

#### *-- Running pattern n*

where *n* is the octal value of the pattern that's running.

As the Formatter finishes the pattern(s) on each disk, it updates the disk's bad block table. Each disk that isn't analyzed retains its existing bad block table. If an existing table is invalid, the Formatter prints a message and zeros the bad block table. The Formatter issues an error message and terminates if it finds more than 126 bad blocks on one physical disk. (It allows up to 1022 bad blocks on a model 6214 disk.) All error messages are explained in Table 12-5.

When the Disk Formatter completes the surface analysis on this disk, it says

*n bad disk blocks*

If there are bad blocks, it asks

*Display bad block statistics [N]*

You may want to see the bad block statistics. If so, type **Y** ; and the Formatter displays the address of each bad block. You might want to note these for future reference (on any but a 6214 disk). To skip the statistics, press **]** or type **N** ;.

Next, the Disk Formatter asks for any additional bad block numbers.

*Additional bad block number (press NEW LINE when done):*

Generally, on a Full format, you will have no additional bad blocks to enter; if this is true, press **]** and skip to the *Bitmap* ... questions. If you want to enter one or more bad blocks, type each block's address. You can do this by typing the logical block number (in octal). Or, for any disk except a DPJ-type disk, you can type the disk-number, cylinder, head, and sector numbers of each block in this format:

**disk-number:cylinder-number,head-number,sector-number**

(Omit the head number for a bad block in a fixed-head disk). Press **]** to signal the end of your bad block entries. Now the Disk Formatter asks if it should display the updated bad block statistics.

*Display bad block statistics? [N]*

Press **]** or answer **Y** ;. If you answer **Y** ;, the Formatter displays the updated bad block statistics. Then, if there is another disk in the LDU, the Formatter returns to run patterns (if specified) on it; then, it runs through the bad block statistics again.

When the Formatter has asked about bad block tables for all disks in the LDU, it displays the bitmap size and asks about the bitmap address:

*Bitmap size: n*

*Bitmap address? [default]*

The default address (displayed in brackets) is 3/8 of the distance across the first disk in the LDU. This is a good general-purpose choice; we recommend it. To select the default, press **]**.

There may be a reason to start the bitmap at the beginning of the LDU (described near the beginning of this chapter). If you know that you want the bitmap at the beginning of the LDU, type **0** ;.

If the bitmap you specify or default contains bad blocks, the Disk Formatter issues a warning and asks you to confirm the address. Do *not* confirm it. Instead, type **N** ;; then add 100 octal to the original bitmap address and try again. Keep doing this until the Formatter accepts your answer.

The Disk Formatter then writes the bitmap to the LDU. Then — unless you allocated a diagnostic area earlier — it asks

*System disk? [Y]*

If you will ever want to bootstrap a program (like AOS/VS or PCOPY) from this LDU, answer **]** or **Y** ;. This tells the Formatter to reserve space for a system bootstrap on the LDU.

LDUs aside from your master LDU need not be system disks. But, since space for an AOS/VS system represents a small portion of total disk space (on most hard disks), you can generally default the answer to yes. Of course, if you're formatting a diskette or if you know that you will never want to bootstrap from this LDU, answer no (**N** ;); the Formatter then skips the next two questions.

If you answer **]** (or **Y** ;), or if you allocated a diagnostic area earlier, the Formatter asks you to specify the

*Overlay area size? [default]*

The overlay area is reserved for AOS/VS overlays — parts of the system that AOS/VS may need to perform some system operation. The default size is about 400 (decimal) blocks.

Generally, you should default this question by pressing `Y`. But if this is a diskette, or if you know it will never have an AOS/VS system on it, type `O Y` and skip the next question. For any overlay area, it asks

*Overlay area address? [default]*

The default address is as close as possible to 3/8 of the distance across the first disk in the LDU. (It immediately follows the bitmap, if you defaulted the bitmap address.) If you defaulted the bitmap address, you should default the overlay area address. To do so, press `Y`.

If you put the bitmap area at the beginning of the LDU, then the overlay area should follow the bitmap. To do this, type the size that the Formatter gave for the bitmap (e.g., `251 Y` for a 354-megabyte LDU).

If the overlay area that you default or specify contains a bad block, the Disk Formatter will issue a warning and ask you to confirm your response. Don't confirm; performance will suffer if AOS/VS has to go all the way to the remap area to pick up an overlay. Instead, type `N Y`. Then add 100 octal to the original address and type this value. Repeat until the Formatter accepts your answer without a warning.

Finally, the Disk Formatter asks you to specify the size and starting address of remap areas for each physical disk in the LDU.

*Disk number n remap area size? [default]*

Generally, you should default this question by pressing `Y`. (But, for a diskette, save space by specifying a smaller area. Take the number of bad blocks, add 10 to it, and type this figure.) The Disk Formatter then asks for the

*Disk number n remap area address? [default]*

To take the default, press `Y`. If you take the default, the Disk Formatter uses the first free, 126-block area on this physical disk as the disk's remap area. Generally, you should take the default unless there are a lot of bad blocks.

For a large, multiple-disk LDU that will hold big contiguous files, you should put the first disk's remap area at the beginning of the first physical disk (default), and put the the last disk's area at the end of the last physical disk.

For every bad block AOS/VS needs to access, it must go to the remap area to find a substitute. If this disk has a lot of bad blocks, you may want to put the remap area in the middle of the disk. To do it on a single-disk LDU, specify the address right after the bitmap and overlay area (if this LDU is formatted as a system disk).

The Disk Formatter does not allow bad blocks in the remap area. If you specify or default an area containing bad blocks, the Formatter issues an error message and repeats the question. As above, add 100 octal to the default or your specified value and try again. Repeat until the Formatter accepts your answer.

This is the last question; the Disk Formatter now says

-- *LDU created*

*Done!*

From the stand-alone Formatter, you return to the AOS/VS CLI. To format another LDU, type `XEQ DFMTR` again and return to the beginning of this section. Or, you might want to install an AOS/VS system on it, as described in the next chapter.

In any case, if the disks in the LDU involve one or more new disk controllers, you will want to run `VSGEN` and create a tailored system to support the new controller(s). If your current tailored system supports the new LDU's controller(s), you might try out the new LDU from AOS/VS (using the CLI command `INITIALIZE`).

If you ever need to change the name, ACL, or bitmap, overlay, or remap areas on this LDU, or to identify new bad blocks in it, you can run a Disk Formatter Partial format on it, as described in the next section.

*Note* that whenever you build an LDU, be sure to write the LDU ID and name on a paper label, and stick it on the disk cover or unit. If the disk is part of a multiple-disk LDU, this label should also describe the other disks in order, and sequence number of this disk. For example, the label might say

```
LDU ID is: DATABA   LDU name is: DATABASE
This LDU includes three model 6239 disks.
This is disk number: 2
LDU created:  4 February 1986
```

Without the label, it's easy to lose track of disk IDs/names and sequence numbers — especially on removable disks.

Figure 12-2 shows a sample Disk Formatter Full dialog, for a two-disk LDU.

SCP-CLI> RESET ↓ (For stand-alone Disk Formatter, this is XEQ DFMTR ↓; and skip to  
AOS/VS Disk Formatter banner.)

SCP-CLI> BOOT 24 ↓ (or BOOT 27 ↓)

*Operating System Load Menu*

Enter choice [1]: 2 ↓ (Choose option 2)

*Technical Maintenance Menu*

Enter choice [1]: 6 ↓ (Choose option 6)

Pathname? :DFMTR ↓

AOS/VS Disk Formatter Rev n

Full format destroys any AOS/VS file structure, Partial retains it.

Full (F) or Partial (P or NEW LINE)? ↓

Full Format

Specify each disk in the LDU (press NEW LINE when done)

Disk unit name? DPJ10 ↓

Device code [64]? ↓

Disk unit name? DPJ11 ↓

Device code [64]? ↓

Disk unit name? ↓

Do you want to allocate a diagnostic area? [Y] N ↓

Disk number 1: 000000000000 through 00002506727

Disk number 2: 00002506730 through 00005215656

LDU unique I.D. (1 to 6 characters)? DATABA ↓

LDU name (1 to 31 characters)? DATABASE ↓

*Access Control List*

Username or template (1 to 15 characters)? + ↓

Access (O, W, A, R, E, or NEW LINE)? E ↓

Username or template (1 to 15 characters)? ↓

Surface analysis? [N] Y ↓

Disk number? ↓

You may run up to five (5) patterns. How many would you like to run? 3 ↓

Analyzing disk #1

— Running pattern nnnnnn

— Running pattern nnnnnn

— Running pattern nnnnnn

0 bad blocks

Additional bad block number (press NEW LINE when done): ↓

0 bad blocks

Figure 12-2. Full Disk Formatter Dialog for a Two-Disk LDU (continues)

```

Analyzing disk #2
— Running pattern nnnnnn
— Running pattern nnnnnn
— Running pattern nnnnnn
0 bad blocks
Additional bad block number (press NEW LINE when done ): ↵
0 bad blocks

Bitmap size: 522
Bitmap address [00000772361] ↵
System disk: [Y] ↵
Overlay area size? [000620] ↵
Overlay area address? [00000772632] ↵
Disk number 1 remap area size? [000176] ↵
Disk number 1 remap area address? [00000000174] ↵
Disk number 2 remap area size? [000176] ↵
Disk number 2 remap area address? [00002507126] ↵

— LDU created
Done!

SCP-CLI>          (For stand-alone Disk Formatter)

or

)                  (For stand-among Disk Formatter)

```

DG-27152

Figure 12-2. Full Disk Formatter Dialog for a Two-Disk LDU (concluded)

## The Partial Format

When you start up the Disk Formatter (by specifying pathname DFMTR ↵ for the stand-alone version, or by typing XEQ DFMTR ↵ for the stand-among version), it says

*AOS/VS Disk Formatter Rev n*

*Full format destroys any AOS/VS file structure, Partial retains it.*

*Full (F) or Partial (P or NEW LINE)?*

For a Partial format, type

P ↵

*Partial format*

*Specify each disk in the LDU (press NEW LINE when done)*

*Disk unit name?*

Enter the name of the disk unit that holds the first disk in the LDU. Table 12-1 (earlier) shows the disk unit names and device codes of all disks supported by AOS/VS. For example,

DPJ1 ↵

For a mirrored LDU, type the LDU names separated by a !. For example

DPJ2!DPJ3 ↵

The stand-among Formatter knows — via AOS/VS — the device code of the disk unit. So it skips the next question and asks for another *Disk unit name?*.

But the stand-alone Formatter asks

*Device code [default] ?*

Type the device code of the disk unit you just specified. If the unit is on the default device code for its controller, press ↵ in response to the *Device code?* query.

The Formatter repeats the question(s) *Disk unit name?* (and *Device code* if stand-alone) so that you can specify all physical disks that were fully formatted into the LDU. When you have identified them all, press ↵ in response to *Disk unit name?*

The Disk Formatter now displays each disk number with octal start and end logical block addresses. The Formatter deals only with octal numbers (except that it accepts 8 as the number of the last physical disk in the LDU). For example, it might display

*Disk number 1: 00000000000 through 00001325657*

*Disk number 2: 00001325660 through 00002653535*

If you are formatting an unsynchronized LDU, you can get one of the following two messages. You might get

*LDU image 'LDU ID' is the preferred image  
Do you want to continue ? [Y]*

or

*This LDU is not normally mirrored  
LDU image 'LDU ID' is the preferred image  
Do you want to continue ? [Y]*

Continue by typing Y ↵, or say No by typing N ↵.

The Formatter asks if you want to change the LDU's unique identification (ID).

*New LDU unique I.D. (1 to 6 characters)? [default]*

The *[default]* is the value assigned when this LDU was created via a Full format run. If you are satisfied with the default, press ↵; the Formatter then goes on to the next question.

The ID can be from 1 to 6 characters long; any filename character is legal. Each ID should be unique among all your LDUs. (If you want this LDU to serve as a destination LDU for the PCOPY program, it can — but need not — have the same ID and name as the source LDU. LDU names and IDs are irrelevant for disk-to-disk PCOPY. But PCOPY requires that a destination LDU's bitmap, overlay, and remap area addresses be the same as the source LDU's.)

For simplicity, you may want to use an ID that is as close as possible to the LDU name (if you plan to change the current name). After choosing an ID, type it and ↵.

(If you are formatting a mirrored LDU, the Disk Formatter prompts for the LDU unique I.D. for image 1 and will later repeat the dialog for image 2. The LDU unique I.D.s *must* be different.)

After you type or default the ID, the Disk Formatter asks whether you want a

*New LDU name (1 to 31 characters)? [default]*

As with the ID, if you are satisfied with the default, press ↵ and skip to the next question.

If you want to change the LDU name, remember that for any nonmaster LDU, the LDU name is its filename. This name will be displayed when you initialize the LDU from the CLI, or boot it (if a system LDU). People and AOS/VS can use the LDU name just as any other directory pathname. If you change the LDU name, any macros that use the old name must also be changed. If you need more background on this, see "Single- and Multiple-Disk LDUs," earlier in this chapter.

You may want to designate one LDU for the system's SWAP and PAGE directories, or an LDU for each directory. For both directories, use a logical disk name of BOTH. For the PAGE directory, use PAGE; or for the SWAP directory, use SWAP. Then — later in the Formatter dialog — assign a username of + and an access control list of E. Afterward, when you bring up AOS/VS, it will use this LDU for both SWAP and PAGE, or for the one you specified. An LDU you designate for both, or either, directory should be a DPJ- or DPF-type disk; and it should — ideally — be on its own controller.

After deciding on the LDU name (1 to 31 filename characters), type it.

Next, the Disk Formatter asks

*New Access Control List? [N]*

If you don't want to change the current LDU access control list (ACL), press *;*; the Formatter then skips to the *Read only surface analysis?* question.

To change the ACL, type *Y ;*. The Formatter will then ask for the username (or template), then the access privileges for that username. It allows up to seven username-privileges specifications. For multiple usernames, the order in which you specify the usernames may be important (described earlier, under "LDU Access Control Lists"). It will repeat the two questions until you press *;* in response to *Username ...*, or until you specify seven usernames. For example,

```
Y ;
Username or template (1 to 15 characters)? OP ;
Access (O, W, A, R, E, or NEW LINE)? OWARE ;
Username or template (1 to 15 characters)? SARAH ;
Access (O, W, A, R, E, NEW LINE)? ARE ;
Username or template (1 to 15 characters)? + ;
Access (O, W, A, R, E, or NEW LINE)? E ;
Username or template (1 to 15 characters)? ;
```

This gives OP all access to the LDU primary directory, gives user Sarah Append, Read, and Execute access, and gives all users Execute access. Username templates and access privilege types are explained earlier in this chapter.

If needed, you can override the LDU ACL given here with the CLI command ACL after you initialize the LDU. After you specify or default the access control list, the Disk Formatter asks

*Read only surface analysis? [N]*

Read only surface analysis involves reading each disk block twice and comparing the data read. This is not as thorough a test as the write/read sequence used in a Full format. To do it, the Formatter requires about as much time as to run a single test pattern on all disks in the LDU (times are shown in Table 12-3).

(If you are formatting a mirrored LDU, the Formatter asks whether you want to run a read only surface analysis for the first image. It repeats the question for the second image.)

If you press *;*, the Formatter goes to the *Display bad blocks ...* question. If you answer *Y ;*, the Formatter asks for the

*Disk number?*

You can press *;* to have analysis done on all disks; the Formatter then proceeds. Or, you can specify the number of each disk on which you want the analysis done; for example, *1 ;, 2 ;*, etc. If you specify numbers, press *;* in response to this question when you are done.

The Formatter now does the read analysis. If the data read is not the same for the two reads, or if it cannot read a block, it notes the block as bad.



The Formatter now describes the bad blocks for this disk:

*For disk #n  
n bad disk blocks*

If there are any bad blocks, it asks

*Display bad block statistics? [N]*

To see the details on old and new bad blocks, type Y ↵. To skip the details, press ↵; the Formatter then summarizes old and new bad blocks and skips to *Update bad block table*. A sample bad block display looks like this.

*Addr: 00000574537 Cyl: 000653 Head: 000010 Sect: 000017*

*Addr: 00000747566 Cyl: 001043 Head: 000014 Sect: 000006*

*\* Addr: 00000747570 Cyl: 001043 Head: 000014 Sect: 000006*

*\* New bad block which was not allocated*

*\*\* New bad block which was allocated (must run FIXUP!)*

*n old bad blocks*

*n new unallocated bad blocks*

*n new allocated bad blocks*

For DPJ-type disks, only the block number (*Addr*) is displayed.

If *n new allocated bad blocks* is not 0, one or more new bad blocks have developed in AOS/VS file(s); someone must run FIXUP on the LDU to restore its integrity.

But if the Formatter finds *many* new bad blocks (allocated or unallocated) during read-only analysis, this may mean disk hardware problems. In such cases, you might want to abort the Formatter with CTRL-C CTRL-B (stand-alone) or the break sequence (stand-alone); then consider running diagnostics on the disk unit with a different pack (if possible). After all, you don't want bad blocks noted on the disk if the disk is fine and the unit *heads* are out of alignment.

Next, the Disk Formatter asks if you want to

*Update bad block table? [N]*

Press ↵ if you don't have any new bad blocks to enter, or if you don't want the Disk Formatter to enter any bad blocks it found during the read-only analysis. If you press ↵, the Formatter skips to the *Bitmap...* questions.

Generally, if the Formatter found only a few new bad blocks, you should answer Y ↵. The Formatter then enters the new bad blocks it found; and it asks you to enter other bad blocks.

*Additional bad block number (press NEW LINE when done):*

Specify each bad block by typing its logical block number (in octal); or (except on DPJ-type disks) type the disk number, cylinder, head, and sector numbers of each block in this format:

*disk-number:cylinder-number,head-number,sector-number*

(Omit a head number for a bad block on a fixed-head disk.) Press ↵ to signal the end of your bad block entries.

Now the Disk Formatter asks if it should display the updated bad block statistics:

*Display bad block statistics? [N]*

Press ↵ or type Y ↵. If you answer Y ↵, the Formatter displays the updated bad block statistics. Then, if there is another disk in the LDU, it does the read-only analysis (if specified) and runs through the bad block sequence again.

When the Formatter has asked about bad block information for all disks in the LDU, it displays the LDU's bitmap size and asks about the bitmap address:

*Bitmap size: n*

*New bitmap address? [default]*

There is one bitmap for all physical disks in the LDU.

You can always take the default bitmap address, assigned when this LDU was fully formatted, by pressing .

By default — during the Full format that creates an LDU — the Formatter puts the bitmap 3/8 of the distance across the first disk in the LDU. This is a good general-purpose address.

There may be reason to move the bitmap to the beginning of the LDU — as described near the beginning of this chapter. However, if the LDU has been used with AOS/VS, the desired area probably has files in it; if so, the area won't be available for the bitmap. You can check by typing ; then, if the Formatter rejects your answer, you can retain the old address.

If you really want to have the bitmap at the beginning of the LDU, and this area is already allocated to files, the best course is to dump all files from the LDU, run a Full format and put the bitmap where you want, and reload the files. This will also reduce fragmentation on the LDU.

If the bitmap area you specify or default contains bad blocks, the Disk Formatter issues a warning and asks you to confirm the address. Do not confirm; type . If the area has AOS/VS files in it, the Formatter will say *Specified area already allocated*. For either error, add 100 octal to the address typed and try again. Keep doing this until the Formatter accepts your answer.

Depending on your answer, the Formatter leaves the bitmap in its original spot, or moves it to a new one.

If the LDU was formatted as a system disk, the Formatter skips the next question. Otherwise, it asks

*Allocate a system bootstrap area ? [N]*

This question allows you to set up the LDU as a system disk, from which you can start and run an AOS/VS system.

If you answer , the Disk Formatter will reserve a 126-block area for SYSBOOT. It will also ask about overlay area size and address. To be able to boot and run AOS/VS from this LDU, you must answer  to this question, and specify the correct overlay area size to the next question. (The size is 620 octal.) Then you must use the Installer to install a disk bootstrap, system bootstrap, and system on the LDU. Next, from AOS/VS, you must copy the CLI, Agent, PMGR, and microcode (.MCF) files to the LDU (CLI MOVE command). Thereafter, if this LDU includes a disk on unit 0, you will be able to start and run AOS/VS on it as if it were your original LDU.

If you don't want to be able to start and run AOS/VS from this LDU, press  and skip to the *Remap area* questions.

*New overlay area size [default]*

Generally, you should take the default by pressing . But if the default is 0, and you want to set up the LDU as a system disk, type the appropriate value, described three paragraphs back, and .

*New overlay area address [default]*

To take the default, given when the LDU was fully formatted, press . (But if you moved the bitmap in the previous step, move the overlay area to start immediately after the bitmap. To do this, add the bitmap size given by the Formatter to the bitmap address you typed — octal arithmetic — and type this number.)

As with the bitmap, if the overlay area you specify or default contains bad blocks, the Disk Formatter issues a warning and asks you to confirm the address; type `N`. If the area has AOS/VS files in it, the Formatter will say *Specified area already allocated*. For either error, add 100 octal to the original bitmap address and try again. Keep doing this until the Formatter accepts your answer.

Depending on your answer, the Formatter leaves the overlay area in its original spot, or moves it to the new one.

Finally, the Disk Formatter asks you about the remap areas on each disk in the LDU.

*New Disk number n remap area size? [default]*

Generally, you should default this question by pressing `Y`. But note the size if you would like to specify a nondefault address for the remap area. The Formatter then asks for the

*New Disk number n remap area address? [default]*

To take the default, given when the LDU was fully formatted, press `Y`. Generally, you should take the default unless there are a lot of bad blocks. If you press `N`, the Formatter then announces *Done* and stops.

If this disk has a lot of bad blocks, you might want to move the remap area to the middle of the disk. To do it, divide the total number of blocks on the disk by 2 (octal arithmetic), and type this number.

The Disk Formatter does not allow bad blocks in the remap area. If the area you specify (or default) contains a bad block, the Formatter issues an error message and repeats the question. It also issues an error message if there are AOS/VS files in this area. As above, add 100 octal to the default or to your specified value and try again. Repeat this until the Formatter accepts your answer.

This is the last question; the Disk Formatter now says

-- *Partial format complete*

*Done!*

From the stand-alone Formatter, you return to the SCP-CLI. If you want to format another LDU, type `CONTINUE` `Y` and return to the beginning of this section. Otherwise, you might want to bring up AOS/VS and try out your new LDU. Or, you might want to install an AOS/VS system on it, as described in the next chapter.

From the stand-among Formatter, you return to the AOS/VS CLI. To format another LDU, type `XEQ DFMTR` `Y` again and return to the beginning of this section. Otherwise, you might want to try your new LDU with the `INITIALIZE` command. Or, you might want to install an AOS/VS system on it, as described in the next chapter.

*Note* that whenever you change an LDU's name or unique ID, be sure to write the new ID and/or name on the paper label attached to the disk cover or unit. If the disk is part of a multiple-disk LDU, this label should also describe the other disks, and the LDU sequence number. Without the label, it's easy to lose track of disk IDs/names and sequence numbers.

Figure 12-3 shows a sample Disk Formatter Partial dialog, which changes the ID, name, and ACL, and bitmap address on the LDU in unit `DPF1`.

```

SCP-CLI> RESET ↓ (For stand-alone Disk Formatter, this is XEQ DFMTR; and skip to AOS/VS
                  DISK FORMATTER banner.)

SCP-CLI> BOOT 27 ↓ (Or BOOT 33)

      Operating System Load Menu

Enter choice [1]: 2 ↓ (Choose option 2)

      Technical Maintenance Menu

Enter choice [1]: 6 ↓ (Choose option 6)

Pathname? :DFMTR ↓

AOS/VS Disk Formatter Rev n
Full Format destroys any AOS/VS file structure, Partial retains it.
Full (F) or Partial (P or NEW LINE)? F ↓

      Partial Format

Specify each disk in the LDU (press NEW LINE when done)
Disk unit name? DPF1 ↓
Device code [27]? ↓
Disk unit name? ↓

Disk number 1: 000000000000 through 00002042416

New LDU unique I.D. (1 to 6 characters)? [VULCAN] UDD2 ↓
New LDU name (1 to 31 characters)? [VULCAN] UDD2 ↓

New Access Control List? [N] Y ↓
Username or template (1 to 15 characters)? $+ ↓
Access (O, W, A, R, E, or NEW LINE)? ↓
Username or template (1 to 15 characters)? + ↓
Access (O, W, A, R, E, or NEW LINE)? RE ↓
Username or template (1 to 15 characters)? ↓
Read only surface analysis? [N] Y ↓

Disk number? ↓
Analyzing disk #1

2 bad blocks
Display bad block statistics? [N] Y ↓

** Addr: 00000574537 Cyl: 000653 Head: 000010 Sect: 000017
* Addr: 00000747566 Cyl: 001043 Head: 000014 Sect: 000006

* New bad block which was not allocated.
** New bad block which was allocated (must run FIXUP!)

1 old bad blocks.
0 new unallocated bad blocks.
1 new allocated bad blocks.

Update bad block table? [N] ↓
Additional bad block number (press NEW LINE when done): ↓
2 Bad blocks

```

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Figure 12-3. Partial Disk Formatter Dialog for a Single-Disk LDU (continues)

```

Display bad block statistics? [N]  ↵
Bitmap size: 205
New bitmap address [00000000000] 1021200 ↵
New overlay area size? [000620]  ↵
New overlay area address? [00000000174] 1021600 ↵
Specified area already allocated
New overlay area address? [00000000174] 1022100 ↵
New Disk number 1 remap area size? [000176]  ↵
New Disk number 1 remap area address? [000174]  ↵
-- LDU created
A bad block was allocated, must run FIXUP
Done!

SCP-CLI>                (For stand-alone Disk Formatter)

or

)                (For stand-among Disk Formatter)

Run FIXUP on the LDU.

```

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*Figure 12-3. Partial Disk Formatter Dialog for a Single-Disk LDU (concluded)*

## Disk Formatter Error Messages

The error messages that you might receive from the Disk Formatter appear alphabetically in Table 12-4.

**Table 12-4. Disk Formatter Error Messages**

| Message                                                                | Meaning and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (nothing)                                                              | You may have specified a nonexistent disk unit. Wait a few seconds. If nothing happens, enter the break sequence (CMD and BREAK, or BRK, or BREAK keys); RESET ↵, BOOT n ↵, and try again.                                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>A bad block was allocated, must run FIXUP</i>                       | One or more of the disk blocks that belongs to an AOS/VS file is bad. The block is “part” of the file. The Disk Formatter has assigned the block to the bad block table, but you must run FIXUP on the disk to correct the file structure. This message occurs on a Partial format only.                                                                                                                                                                                                                                                                                                      |
| <i>A disk can only be mirrored with a disk of the same size</i>        | Each disk in an LDU image must have the same size as its mirror. You can also get this message if the sizes of the diagnostic areas differ.                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>A disk cannot be mirrored with itself</i>                           | You tried to mirror a disk with itself. Enter a valid mirror configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>BAD BLOCK IN INVISIBLE SPACE, CAN'T FORMAT DISK</b>                 | One of the first eight blocks on the disk is bad; the disk is unusable in its current state. The problem may be head alignment or a flawed disk. Diagnostics or other recovery action is needed. Call your DG support organization.                                                                                                                                                                                                                                                                                                                                                           |
| <i>Both LDU images have inconsistent data — Must run a Full format</i> | The Disk Formatter has detected that the information on the images is inconsistent. Perhaps you specified incorrect images.                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>Can't expand specified area</i>                                     | AOS/VS files occupy some (or all) of the area specified. See the message <i>Specified area already allocated</i> in this table for action.                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>Can't open disk, ERROR CODE n</i>                                   | The Disk Formatter can't open the disk for I/O. Code <i>n</i> is an AOS/VS error code, which the CLI will interpret for you if you type MESSAGE n ↵. If the code is 000063, it means device already in use; this means that you tried to run the Formatter on a disk that is part of the master LDU, or on a disk that was grafted onto the current LDU via the CLI command INITIALIZE. If the former, you must run the <i>stand-alone</i> Disk Formatter. If the latter, release the disk using its LDU name from the CLI, then restart the Disk Formatter.                                  |
| <i>Disk error Device d u Status= s</i>                                 | The Disk Formatter encountered a disk block that it cannot read or write. It returns to the <i>DISK UNIT NAME?</i> query for this disk. Make sure the disk is write-enabled (if this applies); then restart the Formatter. If the problem recurs, diagnostics may be needed; contact your DG support organization.<br><br>The <i>d</i> is the device code; the <i>u</i> is the unit number; and <i>s</i> is the hardware status code. You can check <i>s</i> in the Peripherals manual (Preface). In any case, record <i>s</i> for your DG support organization when you report this problem. |
| <i>Fatal disk error Device d u Status s</i>                            | The Disk Formatter encountered an unrecoverable error while trying to read or write a disk block. The problem may be hardware failure. Diagnostics may be needed. Follow the recovery action suggested for <i>Disk error...</i> , above.                                                                                                                                                                                                                                                                                                                                                      |

(continues)

**Table 12-4. Disk Formatter Error Messages**

| Message                                                  | Meaning and Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Inconsistent DIB info, must run Full format</i>       | <p>During a Full format, the Disk Formatter writes a Disk Information Block (DIB) to each physical disk in the LDU. The DIB contains the LDU unique ID, LDU name, sequence number, and name and sequence number of all disks in the LDU. This message (which appears on a Partial format only) can mean one of the following things.</p> <p>First, it may mean that the disk you just specified doesn't belong to the LDU at all. Check via the paper disk labels; then, mount the proper disk(s) or specify the proper unit numbers and retry.</p> <p>Second, it may mean that the <i>sequence</i> in which you specified the disk is wrong. For example, you typed the unit name of the disk formatted as the <i>second</i> disk first. Try changing the order in which you specify the disks.</p> <p>Third, it may mean that the revision and/or sequence numbers are invalid. This can mean that the DIB was damaged; if so, you will need to run a Full format on the disk(s).</p> |
| <i>Inconsistent LDU revision, must run a Full format</i> | <p>Disks in the specified LDU have different revision numbers. Only a Full format can correct this. If this error occurs during a Partial format, you need only run a Full format on the image being introduced.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>Inconsistent mirrored LDU</i>                         | <p>The LDU you specified has inconsistent information in the Disk Information Block (DIB). Respecify the LDU.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <i>Internal problems while merging bad block tables</i>  | <p>The Disk Formatter encountered a problem it could not deal with while merging bad block information for a mirror. Report the problem to Data General.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>INVALID BAD BLOCK TABLE</b>                           | <p>The bad block table is not valid. The table may have been overwritten. The Formatter zeros the current table. If the disk contains valuable files, see if AOS/VS can access it; if so, dump all its files. Then run a Disk Formatter Full format on the disk, specifying at least one pattern; and reload the files.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>INVALID DISK NUMBER</b>                               | <p>The LDU you're working with does not contain the specified disk number. Retry.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>LDU image 'LDU ID' is the preferred image</i>         | <p>The Disk Formatter has selected the more recent image as the preferred image. You only get this message when running the Disk Formatter on an unsynchronized image.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>Mirrored disks must reside on the same controller</i> | <p>Mirrored disks must reside on the same controller. Determine what your mirrored LDU configuration should be.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>No space for name or ACL block</i>                    | <p>The LDU lacks a free block for name or ACL information. This may be a hardware problem; the disk may need diagnostics.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>No space for System Bootstrap</i>                     | <p>The system bootstrap (SYSBOOT) requires 124 blocks in the first disk in the LDU. The Formatter can't find this space. If the disk is really full, dump and reformat it; then reload the files and try again.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Not enough contiguous space for specified area</i>    | <p>The contiguous disk space needed is not available. Add 100 octal to the area start address and retry. If this fails a few times, reboot AOS/VS, and type <b>F/PACKET</b> from its master directory. This shows logical disk addresses in entries 22 and 23 (octal). Files with lower logical addresses are earlier on the disk. Dump and delete some of them, run the Formatter again, then reload the files.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

(continued)

**Table 12-4. Disk Formatter Error Messages**

| Message                                                     | Meaning and Action                                                                                                                                                                                                                                                                |
|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Only DPJ-type disks can be mirrored</i>                  | You specified a disk for mirroring that is not a DPJ-type disk. You can only mirror DPJ-type disks.                                                                                                                                                                               |
| <i>Specified address is out of range</i>                    | The LDU does not contain the specified address. This error message may also indicate that a disk in the LDU lacks a remap area.<br><br>Try another address; check all disks in the LDU with a Formatter Partial run.                                                              |
| <i>Specified area is already allocated</i>                  | AOS/VS files, or one of the special areas (bitmap, etc.) occupy part or all of this area. Add 100 octal to the disk address shown for the item (bitmap address, etc.) and type this figure. Repeat this until the Formatter accepts your answer.                                  |
| <i>Specified area has a bad block in it, confirm</i>        | The area you specified (or defaulted) has a bad block in it. Do not confirm; type <b>N</b> . Add 100 octal to the specified (or default) area and try again. Repeat this until the Formatter accepts your answer.                                                                 |
| <i>The LDU unique I.D. must be different for each image</i> | You have attempted to mirror two images that have the same LDU Unique ID. Make the LDU Unique IDs different.                                                                                                                                                                      |
| <i>There is a bad block in the remap area</i>               | The remap area you specified (or defaulted) contains a bad block. Add 100 octal to the REMAP AREA ADDRESS specified or defaulted; then type this number as the remap address. If this doesn't work, try it again.                                                                 |
| <i>This LDU is not normally mirrored</i>                    | The Disk Formatter has found that this is either a new mirror or that it was a mirror but someone initialized it with the /NOMIRROR switch to the INITIALIZE command.                                                                                                             |
| <i>Too many bad blocks for a mirrored disk</i>              | The bad block tables on a mirrored disk must be equivalent. The Disk Formatter has found more than 126 bad blocks, too many to permit mirroring. You should have a DG representative hardware format DPJ (6236-class) disks to "remove" bad blocks.                               |
| <b>TOO MANY BAD DISK BLOCKS</b>                             | The Disk Formatter found more than 126 (1022 on a model 6214) bad blocks on this disk while performing surface analysis.<br><br>Retry from the beginning. If the message recurs during the second surface analysis, diagnostics may be needed. Call your DG support organization. |
| <b>TOO MANY PHYSICAL UNITS IN LDU</b>                       | There cannot be more than eight physical disks in an LDU. Retry. Do not specify more than eight physical disks per LDU.                                                                                                                                                           |

(concluded)

## What Next?

This chapter gave some background on creating and using LDUs, then it described the Full and Partial formats of the stand-alone and stand-among Disk Formatter.

If the LDU(s) that you built involve one or more new disk controllers, you will need to run VSGEN and generate an AOS/VS system that supports the controller(s). If not, you might want to install a system on the new LDU(s), described in the next chapter. Or, if you are ready, try running the new LDU(s) from AOS/VS — and perhaps put the CLI INITIALIZE commands for them in the UP.CLI macro.

## End of Chapter





# Chapter 13

## The Installer

Read this chapter

- when you want to understand what the Installer does;
- when you want to install an AOS/VS disk bootstrap, system bootstrap, or operating system on a logical disk unit (LDU).

The Installer is a utility program that installs a disk bootstrap, system bootstrap (SYSBOOT), and/or an AOS/VS operating system on an LDU. If you brought up your own first system (Chapter 2 or 3), you already have some experience with the Installer. This chapter tells the rest, in the following major sections:

- Some Background
- About the Installer
- If You Make a Mistake
- The Stand-Alone Installer
- The Stand-Among Installer
- Installer Error Messages

### Some Background

Three AOS/VS-based programs are needed to bring up an AOS/VS operating system from disk. The first, called the disk bootstrap, is on the first two blocks of an LDU. The second, the system bootstrap (SYSBOOT), follows in the hundred-odd block area reserved by the Disk Formatter. Finally, the AOS/VS system itself is somewhere on the disk, usually in directory :SYSGEN.

When you boot AOS/VS from an LDU (e.g., by typing `BOOT 27`), the following things happen:

- the hardware reads the disk bootstrap from the LDU into main processor memory;
- the disk bootstrap executes and reads SYSBOOT into memory;
- SYSBOOT executes, loads microcode if needed, and allows you to interrupt its execution;
- SYSBOOT's Technical Maintenance Menu permits changing the default operating system;
- SYSBOOT copies the disk-based part of the default or installed AOS/VS system to the overlay area reserved for it by the Disk Formatter;
- SYSBOOT loads AOS/VS into memory; and
- the AOS/VS system executes.

The Installer is the program that writes the disk and system bootstraps — and, optionally, an AOS/VS system — to the LDU. An AOS/VS system *need not* be installed.

When you install an AOS/VS system, the Installer copies it to the LDU as a disk file outside the file system. Then, it creates a pointer to the system name in “invisible” space at the beginning of the LDU. Because this pointer is invisible and the file is outside the file system, you cannot delete the installed system, nor can you find out its name since it has none.

You *must* install the AOS/VS starter system, as you did in Chapter 2 or Chapter 3, and *can* install any AOS/VS system.

You *can* install any AOS/VS system, but it's not really necessary. Installing a tailored AOS/VS system overwrites the starter system. This means that, if you want to go back to the starter system, you must reload it from the AOS/VS system tape or diskette. Beginning with AOS/VS Revision 7.00, it is just as convenient to make the tailored system the default system. SYSBOOT will start it automatically, and still permit you to run the starter system that is still installed. So there's no advantage to installing a tailored system.

(If you want to run the starter system instead of the tailored system, choose option 2, "Enter the Technical Maintenance Menu", on the Load Operating System Menu. Then, choose option 8, "View or change the default operating system filename", on the Technical Maintenance Menu, and specify **INSTALLED SYSTEM**. Finally, choose option 1, "Load and start the default operating system" to run the starter system.)

## About the Installer

The Installer can install a disk bootstrap, SYSBOOT, and/or AOS/VS system on any LDU formatted as a system disk.

There are two versions of the Installer: a stand-alone version that runs only when AOS/VS is not running; and a stand-among version that runs under AOS/VS.

The stand-alone Installer requires an AOS/VS system tape or diskettes, and works with any system LDU.

The stand-among Installer accepts disk file pathnames and doesn't use a system tape or diskettes; it works only with a *nonmaster* LDU that has not been initialized (CLI command INITIALIZE).

## If You Make a Mistake

If you type a response to the Installer and want to change it before pressing ↵, press the DEL key as needed or press CTRL-U to erase the line.

If you are beyond the line containing the mistake, you should proceed to the end, then rerun the Installer. It asks only a few questions and runs fast.

For any Installer error message, see Table 13-1, at the end of the chapter.

## The Stand-Alone Installer

The stand-alone Installer is in file INSTL in the master LDU's root directory. You can boot it directly from this LDU.

To use the Installer, perform the following steps.

1. Make sure all disks in the LDU are mounted, and that their units are ready and write-enabled (if this applies).
2. Mount an AOS/VS system tape or diskette on/in unit 0, on the first controller. This tape/diskette can be either your own tailored system or the DG-supplied AOS/VS starter system tape or diskette. (Making a tailored AOS/VS system tape or diskette is described near the end of Chapter 4.)
3. If AOS/VS is running, shut it down. Make sure the SCP-CLI is active on the system console. (You can run the stand-alone Installer only from the system console.)

4. Next to the SCP-CLI prompt, type RESET; then type the BOOT command followed by the device code of your master LDU.

For the first DPF-type controller (controller name DPF), the default device code is 27; for the second DPF-type controller (controller name DPF1), the default device code is 67. For the first model 6236 through 6240, 6290, 6310, 6328, or 6329 controller (controller name DPJ), the default device code is 24; for the second of these controllers (controller name DPJ1), the default device code is 64.

For the first fixed-head controller (DKB), the code is 26; and for the second fixed-head controller, it is 66. For all other types of disks, the default is 33 for the first controller, and 73 for the second controller. For a 737,000-byte diskette unit (DPJ10), the device code is 64; and for a 368,000-byte diskette unit (DPM0), the device code is 20.

For example,

```
SCP-CLI> RESET ↵  
SCP-CLI> BOOT 64 ↵
```

#### *Operating System Load Menu*

...

5. Enter choice [1]: 2 ↵ (Choose option 2)

#### *Technical Maintenance Menu*

...

6. Enter choice [1]: 6 ↵ (Choose option 6)

*Pathname?*

7. Type the filename of the Installer program (INSTL):

INSTL ↵

SYSBOOT now finds and starts the Installer. The Installer displays

*AOS/VS Installer Rev n*  
*Specify each disk in the LDU*  
*Disk unit name?*

8. Type the unit name that holds the first physical disk in the LDU. The unit names and device codes of all disks supported by AOS/VS appear in Table 12-1. For example, for the first DPF-type unit on the second controller, type

DPF10 ↵

- 8a. For a mirrored LDU, type the LDU names separated by a !. For example

DPJ2!DPJ3 ↵

*Device code [default]?*

9. If this unit's controller is on the default device code, press ↵ to choose the default answer. Otherwise, type the device code and press ↵.

Next, if the LDU was formatted to contain more than one physical disk, the Installer asks

*Disk unit name?*

- 9a. If you specified only one image of a mirror, the Installer will prompt

*Disk is normally mirrored*

*Do you wish to continue with an incomplete mirror ? [Y]*

Press *Y* if you wish to continue or type *N* if you do not.

- 9b. If you specified an unsynchronized mirror, the Installer will prompt

*Disk n is the preferred image*

*Do you wish to continue with the preferred image ? [Y]*

Press *Y* if you wish to continue or type *N* if you do not.

10. The Installer repeats *Disk unit name?* and *Device code?* questions until you have identified the units that hold all disks in the LDU, and their device codes.

Then, the Installer writes a disk bootstrap to the LDU and displays

*-- Disk bootstrap installed*

*Do you want to install a System Bootstrap [Y] ?*

11. Press *Y* if you want a copy of the system bootstrap (SYSBOOT) written to the LDU. Or type *N* if you do not. Installing the system bootstrap overwrites the existing bootstrap (if any), but does not affect the installed AOS/VS system (if any).

For tape, you should generally press *Y* — especially if there is a new revision of AOS/VS on this tape. For diskette, generally type *N*. If you don't want a new SYSBOOT installed, answer *N* and go to step 14.

If you press *Y*, the Installer asks

*Install from which unit [MTC0] ?*

12. To install from magnetic tape, press *Y* and go to step 13. To install from diskette, make sure that the diskette that holds SYSBOOT is mounted in a unit (replace the system diskette, if needed). Then type the unit name; for example, *DPJ10*. The Installer asks

*Device code?*

- 12a. If the diskette unit is on the default device code, press *Y*. Otherwise, type the device code and press *Y*.

The Installer now reads the diskette and tries to copy SYSBOOT to the LDU. On success, it displays *System Bootstrap*. Go to step 14.

13. If you answered *Y* above, the Installer asks

*Device code [22]*

- 13a. If the tape unit is on the default MTB/MTC device code (22), press *Y*. If it is on a different device code (e.g., 62), type the device code and *Y*.

*File number [4] ?*

- 13b. SYSBOOT is in file 4 of an AOS/VS system tape, so press *Y*.

The Installer now reads the tape or diskette and tries to copy SYSBOOT to the LDU. On success, it displays

*-- System Bootstrap installed*

14. *Do you want to install a System [Y] ?*

If you install an AOS/VS system, it will overwrite the system already installed on the LDU. The system you install depends on the system tape or diskette you're using. If it's your own tape or diskette, then it has your tailored AOS/VS system on it. If it's a DG-supplied AOS/VS tape or diskette, then it has the starter system on it.

15. Press *↓* or type *N ↓*, depending on whether or not you want the system on the tape or diskette installed on the LDU. If you type *N ↓*, you're done; the Installer displays *Done!*, and terminates.

If you press *↓*, the Installer asks

*Install from which unit [default] ?*

The Installer remembers the answer you gave in step 12. Press *↓* and, for tape, go to step 16. For diskette, continue with this step. The Installer asks

*Diskette unit name?*

*Device code?*

- 15a. Make sure that a diskette with the AOS/VS system you want to install is inserted in diskette unit 0. If the diskette unit is on the default device code, press *↓*. Otherwise, type the device code and press *↓*.

Go to step 17.

16. After you press *↓*, the Installer asks

*Device code [22]?*

- 16a. If the tape unit is on the default MTB/MTC device code (22), press *↓*. If it is on a different device code (e.g., 62), type the device code and *↓*.

*File number [5] ?*

- 16b. To install from tape (either a DG-supplied system tape or an AOS/VS tape you created using the SYSTAPE macro), press *↓*.

17. The Installer now reads the tape file or diskette and tries to install its contents on the LDU, placing a pointer in invisible space as described earlier. Then it displays

-- *System installed*  
*Done!*

To run the Installer again, type *CONTINUE ↓* and retrace the steps above. Otherwise, you might want to bootstrap the AOS/VS system on this LDU to see how it does. After you specify each disk in the LDU, press *↓* to start up the installed system.

Figure 13-1 shows a sample stand-alone Installer dialog from magnetic tape.

Have all disks ready and write-enabled.

SCP-CLI> RESET ↵  
SCP-CLI> BOOT 24 ↵

*Operating System Load Menu*

Enter choice [1]: 2 ↵ (Choose option 2)

*Technical Maintenance Menu*

Enter choice [1]: 6 ↵ (Choose option 6)

Pathname? INSTL ↵

AOS/VS Installer Rev n

Specify each disk in the LDU:

Disk unit name? DPJ10 ↵

Device code [64]? ↵

Disk unit name? DPJ11 ↵

Device code [64]? ↵

-- Disk bootstrap installed

Do you want to install a System Bootstrap [Y] ? ↵

Install from which unit [MTC0] ? ↵

Device code [22]? ↵

File number [4] ? ↵

-- System bootstrap installed

Do you want to install a System [Y] ? ↵

Install from which unit [MTC0] ? ↵

Device code [22]? ↵

File number [5] ? ↵

-- System installed

Done!

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*Figure 13-1. Installing Bootstraps and an AOS/VS System via the Stand-Alone Installer*

## The Stand-Among Installer

The stand-among Installer is in directory :UTIL, filename INSTL.PR. It works only with nonmaster LDUs that were formatted to include a system disk. It won't work on the master LDU or any LDU that has been initialized from the master.

Before running it, you should know the full pathname of the AOS/VS system you want to install. To run it, follow these steps.

Make sure that all disks in the LDU are mounted, and that their units are ready and write-enabled (if the latter applies).

Beside the AOS/VS CLI prompt, type

```
) DIR :UTIL )  
) XEQ INSTL.PR )
```

*AOS/VS Installer Rev n*

*Specify each disk in the LDU*

*Disk unit name?*

Type the unit name that holds the first physical disk in the LDU; for example, DPF10 ). The unit names of all disks supported by AOS/VS appear in Table 12-1, in the previous chapter.

For a mirrored LDU, type the LDU names separated by a !. For example

DPJ2!DPJ3 )

If the LDU was formatted to contain more than one physical disk, the Installer asks

*Disk unit name?*

The Installer repeats the *Disk unit name?* questions until you have identified the units that hold all disks in the LDU.

(If you specified only one image of a mirror, the Installer will prompt

*Disk is normally mirrored*

*Do you wish to continue with an incomplete mirror ? [Y]*

Press ) if you wish to continue or type N ) if you do not.

If you specified an unsynchronized mirror, the Installer will prompt

*Disk n is the preferred image*

*Do you wish to continue with the preferred image ? [Y]*

Press ) if you wish to continue or type N ) if you do not.)

Finally, the Installer writes a disk bootstrap to the LDU and displays

– *Disk bootstrap installed*

*Do you want to install a System Bootstrap [Y] ?*

Press Y ) if you want the system bootstrap (SYSBOOT) written to the LDU. Type N ) if you do not. Installing a system bootstrap overwrites the existing bootstrap (if any) but does not affect the installed AOS/VS system (if any).

Generally, it can't hurt to answer ). But if you don't want a new SYSBOOT written to the LDU, answer N ) and go to the *Do you want to install a System?* question.

If you press ), the Installer asks for SYSBOOT's pathname:

*Pathname?*

The SYSBOOT pathname, in root directory, is :SYSBOOT, so type :SYSBOOT ). The Installer now copies SYSBOOT to the LDU and displays

– *System Bootstrap installed*

*Do you want to install a System [Y] ?*



If you choose to install an AOS/VS system, it will overwrite the system (if any) that is installed on the LDU. You can install any existing AOS/VS system that you want.

Press *↓* if you want to have a system installed; type *N ↓* if you do not. If you answer *N ↓*, you're done; the Installer displays *Done!* and terminates.

If you answer *↓*, the Installer wants to know

*Pathname?*

Type the full pathname, with *.PR* suffix, of the AOS/VS system you want to install. For example, *:SYSGEN:NEWSYS.PR ↓*.

The Installer then copies the system to the LDU, placing a pointer in invisible space as described earlier. Then it terminates and control returns to the CLI.

*-- System installed*

*Done!*

)

To run the Installer again, type *XEQ INSTL ↓* and retrace the steps above. Otherwise, you might want to shut down the current AOS/VS system and bootstrap the installed AOS/VS system on this LDU to see how it does. After you specify each disk and device code in the LDU, press *↓* to bring up the installed system.

Figure 13-2 shows a sample stand-among Installer dialog.

```
Ready all disks in the LDU.

) DIR :UTIL ↓
) XEQ INSTL ↓

AOS/VS Installer Rev n
Specify each disk in LDU:

Disk unit name? DPF10 ↓
Disk unit name? DPF11 ↓

-- Disk bootstrap installed
Do you want to install a System Bootstrap [Y] ?

Pathname? :SYSBOOT ↓

-- System bootstrap installed
Do you want to install a System [Y] ?

Pathname? :SYSGEN:NEWSYS.PR ↓

-- System installed

Done!

)
```

DG-27154

*Figure 13-2. Installing Bootstraps and an AOS/VS System on an LDU, via the Stand-Among Installer*

## Installer Error Messages

While you are running the Installer, you may receive one of the error messages shown alphabetically in Table 13-1.

**Table 13-1. Installer Error Messages**

| Message                                                                | Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>ABORT message</i>                                                   | The Installer hit a fatal error and aborted. If the message allows you to correct the problem, do so and retry. Otherwise, try to find the message text in this table.                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Bad system file</i>                                                 | The tape or diskette file you specified is too big for its reserved area on the LDU. This probably means that you specified the wrong tape file, or used the wrong diskette.<br><br>If you get a <i>MUST RUN FIXUP</i> message, run FIXUP on the LDU. Rerun the Installer and type the correct file number for the system tape. The number is 4 for a system bootstrap, 5 for an AOS/VS system. Make sure the tape is a system tape, created by the SYSTAPE.CLI macro. For diskette, make sure the diskette contains the AOS/VS system in CLI COPY format. |
| <i>Both LDU images have inconsistent data — Must run a Full format</i> | The Installer has detected that the information on the images is inconsistent. Perhaps you specified incorrect images.                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Device already in use</i>                                           | The Installer can't open the disk(s) involved. This occurs if you try to run the stand-alone Installer on an LDU that a program has already opened (for example, the master LDU). Try the stand-alone Installer.                                                                                                                                                                                                                                                                                                                                           |
| <i>Disk 1 is the preferred image</i>                                   | The Installer has chosen the first image specified as the preferred image.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>Disk 2 is the preferred image</i>                                   | The Installer has chosen the second image specified as the preferred image.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>Disk and file system revision numbers don't match</i>               | The disk has an early revision number; or perhaps the Disk Information Block (DIB) has been damaged. Try a (current revision) Disk Formatter Partial format on the LDU, changing nothing. If this runs, bring up AOS/VS, try to dump all files from the LDU, run a Disk Formatter Full format on the LDU, and run the Installer again.                                                                                                                                                                                                                     |
| <i>Disk error, Device d u Status= s</i>                                | The Installer has encountered a disk block from which it cannot read or write; it aborts.<br><br>The <i>d</i> is the device code, <i>u</i> is the unit number, and <i>s</i> is the hardware status code, described in the Peripherals manual (see Preface).<br><br>Make sure the unit(s) are write-enabled, and retry. If problem persists, try a Disk Formatter Partial format (Chapter 12). The disk may need diagnostics; consult your DG support organization.                                                                                         |
| <i>Disk is normally mirrored</i>                                       | You have specified only one image of a mirrored LDU. You can continue, but the mirror will have to be synchronized at a future time.                                                                                                                                                                                                                                                                                                                                                                                                                       |

(continues)

**Table 13-1. Installer Error Messages**

| <b>Message</b>                                | <b>Meaning</b>                                                                                                                                                                                                                                                                       |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Disk space exhausted</i>                   | The Installer cannot find the disk space it needs to install a disk or system bootstrap.<br><br>The easiest way to handle this is to dump the LDU, run a Full format on it, try the Installer again, and reload the files.                                                           |
| <i>Disk was left in inconsistent state</i>    | The image(s) specified is not consistent due to an incomplete mirror synchronization. Specify a consistent image.                                                                                                                                                                    |
| <i>File does not exist</i>                    | The entry you typed does not identify an existing tape or disk file. Try retyping the device name, or respecify the tape file number, or type an existing file pathname.                                                                                                             |
| <i>Hard tape error</i>                        | The Installer has hit a hard error on the tape unit.<br><br>Retry. If the same message recurs at the same point, the tape is probably bad; try another system tape. If it recurs, you may need to run hardware diagnostics on the tape unit or contact your DG support organization. |
| <i>Inconsistent LDU</i>                       | One or more of the disks involved do not belong to the LDU. Mount the correct disk(s) and retry; or, specify the disks in a different order.                                                                                                                                         |
| <i>Inconsistent mirrored mirrored LDU</i>     | The LDU you specified has inconsistent information in the Disk Information Block (DIB). Respecify the LDU.                                                                                                                                                                           |
| <i>Invalid DIB info, must run Full format</i> | The disk has not been formatted via a Disk Formatter Full format. Run a Formatter Full format on the disk(s) involved.                                                                                                                                                               |
| <i>Invalid disk sequence number</i>           | The disk sequence number is not between 1 and 8. For action, see <i>Disk and file system</i> message, above.                                                                                                                                                                         |
| <i>Invalid mirror input</i>                   | You specified incorrect disk unit names. Start over and specify the right names.                                                                                                                                                                                                     |
| <i>Invalid mirrored LDU</i>                   | The Installer has found that the specified mirror is inconsistent. Perhaps you specified incorrect images.                                                                                                                                                                           |
| <i>LDU is not mirrored</i>                    | You specified a mirror, but the Installer has found that the LDU is not mirrored. Specify the image that you want the Installer to run on.                                                                                                                                           |
| <i>Mirror synchronization was in progress</i> | One of the images is inconsistent and cannot be used. The Installer must choose the other image as the preferred image.                                                                                                                                                              |
| <i>Must run FIXUP on this LDU</i>             | The LDU is unstable because a utility or AOS/VS has aborted. Run FIXUP on the LDU.                                                                                                                                                                                                   |
| <i>Soft tape error</i>                        | A soft (correctable) tape error occurred; proceed as usual.                                                                                                                                                                                                                          |
| <i>System Bootstrap area not allocated</i>    | The LDU was not formatted as a system disk. Run a Disk Formatter Partial format, say Y to <i>Allocate a system bootstrap area</i> , and change nothing else (described in Chapter 12).                                                                                               |
| <i>System Bootstrap too large</i>             | The file you specified is too large for the SYSBOOT area reserved by the Disk Formatter. See message <i>Bad system file</i> in this table for recovery action.                                                                                                                       |
| <i>This LDU is not normally mirrored</i>      | The Installer has detected that the disks specified are not images of each other. Specify the image that you want the Installer to run on.                                                                                                                                           |

(concluded)

## **What Next?**

This chapter explained how installed software brings AOS/VS up, and described using the Installer utility to place this software on an LDU.

Next, you might want to read about some cautions and hints to the operator in the next chapter, or about system management issues in Chapters 15 and 16.

End of Chapter



# Chapter 14

## Cautions and Hints to the System Operator

Read this chapter

- when you want to learn some simple things to avoid;
- when you have a problem with the system and don't know what to do.

This chapter attempts to tell the operator, as quickly and tersely as possible, what not to do, and what to do in confusing or serious error situations. Each section ends with a series of blank lines — designed for the operator, system manager, or anyone in authority to add his or her own cautions and hints. Neither section is exhaustive; it simply attempts to cite common situations.

The major sections are

- Cautions
- Hints

### Cautions

By observing the following list of cautions you will help preserve the integrity of your multiuser system.

- Don't leave the CPU, disk units, or system console unattended for long periods, unless you know that all people in the area are trustworthy and experienced users. Cutting power to the CPU or disks, or resetting the main processor, will usually bring AOS/VS down abnormally. Also, anyone with access to the system console can type the break sequence, run ESD, restart AOS/VS, and come up in the master CLI, with all its powers.
- Don't leave a standard CLI running on the system console. The master CLI and its son CLIs (except for LOCK\_CLI) have all process control and "super" privileges. Do not endanger system integrity by allowing users access to these privileges.
- If your system is connected to another site — via modem or network — consider remote user privileges carefully. A privileged profile, with network or modem access, gives a network or modem user access to all your files from outside your installation.
- If you're running a secure system, with detailed logging (SYSLOG with /DETAIL=FULL), remain aware of the log file and its space requirements. If the system runs out of space for file :SYSLOG with /DETAIL=FULL, it will panic. Follow procedures for generating and examining reports, and for dumping and deleting old log files.
- Don't cut power to CPU or disk units without shutting the AOS/VS system down; if the CPU has a LOCK switch, keep it in the LOCK position.
- Don't type main processor control commands like HALT or RESET to the SCP-CLI when AOS/VS is running.
- Always shut down the system normally unless an emergency forces an abnormal shutdown.
- Don't panic if you accidentally hit the break sequence and see the SCP-CLI running on the system console. Type TTY ↵ (or on MV/4000, CONTINUE ↵) to return control to AOS/VS.

- Use the following blank lines for your own notes or comments.

[illegible]

## Hints

This section describes topics alphabetically by subject.

**batch streams** — EXEC must be running, streams continued, printer started, and XLPT process running. If streams aren't running, check with `CX STATUS` and `?` (for the XLPT process).

**backup** — Follow routine, using labeled tapes, diskettes, PCOPY disk-to-disk, or MSCOPY. Macros to help are shipped with AOS/VS (explained in Chapter 10). All databases (CEO, INFOS II, etc.) and user files must be closed to be effectively backed up.

**bootstrapping** — Type `RESET`, `BOOT 24` or `BOOT 27`, wait for time-out, set date and time, if prompted and default everything else; and then type `UP`.

**break sequence** — The `BRK`, `CMD` and `BREAK`, or `BREAK` keys give the SCP-CLI control of the system console. To restore it to AOS/VS, type `TTY`.

**CLI (AOS/VS)** — A key to system control; use Help as needed. Read the CLI manual.

**clock, system** — This must be correct; `SYSLOG`, `ERROR_LOG`, and all date/time operations depend on it. Be sure to type the correct date and time when you bring up the system. If the date or time is wrong, correct it with the CLI command `DATE` or `TIME` — when EXEC is *not* running.

**console, system** — When the system console remains unattended for long periods, run `LOCK_CLI` (Chapter 9). When the SCP CLI or master AOS/VS CLI (PID 2) is running, anyone at the system console has access to the entire AOS/VS system. If the system console seems dead, type `CTRL-Q` to clear a possible `CTRL-S`; make sure it is on and on line; check fault lights (if any is on, turn console off and on again). If there is no response, see Chapter 6, "Deadlocks" or Chapter 17, message "None. Nothing..."

**CPU** — Maintain regular preventive maintenance (vacuuming, filters, and so on). If there are problems, run `DTOS FRUs` (Chapter 11). When AOS/VS is up, avoid the front panel switches, unless you must unlock to break an AOS/VS deadlock (break, then run `ESD`), or unless you want to cut CPU power. If you can, lock the CPU before turning power on; this will simplify startup.

**definitions** — See the Glossary.

**diagnostics** — FRU tests for CPUs are shipped with the SCP operating system, and you can run them as described in Chapter 10. Diagnostics for peripherals are usually run by a DG field engineer; you can consult your support organization for advice. When running any kind of diagnostic, keep all the devices except those being tested off line or write-disabled (to prevent inadvertant erasure of data). Use the system error log (`X REPORT :ERROR_LOG`) and the `CONTEST` program as diagnostic aids. Also use *AOS/VS FATAL ERROR* messages, which you can interpret via file `:UTIL:AOSVS.PANICS.SR`.

**disk packs** — Keep each in its unit or protective cover, in a dust-free place. Keep a paper tape label on each disk cover or unit, with unit name, device code, LDU name and ID, and name of other disks in the LDU (if this applies). Do not leave a disk pack in a precarious position, where vibration or accident could cause it to fall.

**disk units** — Never turn off unless AOS/VS has been shut down. Make sure they are write-enabled before bootstrapping AOS/VS. If you are running a non-AOS/VS program and want to make sure a disk won't be written to, then press the write-enable switch to disable or off. In an "open" shop, you may want to keep users away from the units. Maintain regular preventive maintenance (vacuuming, filters, and so on). After a *FATAL ERROR*, or *HARD ERROR*, if you suspect surface damage on a disk unit that uses removable packs, don't insert another pack in the unit to check. Also, don't put the suspect pack in another unit. (A pack with surface damage may damage the read/write heads of any unit that runs it.)



**diskette** — Do not open the diskette door while the diskette light is on. Wait a few seconds for the light to go off; then open the door. Handle diskettes carefully; do not write on a diskette label with a ball-point pen; and store diskettes vertically in a temperate, dust-free place, away from strong magnetic fields. If you aren't sure how to insert a minidiskette, see Chapter 2, Figure 2-1.

**errors, fatal, hard, or soft** — Messages are in Chapter 17. On a fatal AOS/VS error, note the panic values in the logbook; do a memory dump (if you want help from DG); then run ESD. If ESD runs, start AOS/VS. If ESD fails, rerun it (break if needed, `START 50`). If ESD fails again, run `FIXUP` on all initialized LDUs. Then reboot AOS/VS. On hard disk errors, make sure the unit is on-line and write-enabled; if so, and the status code indicates a bad sector (bad block), run a Disk Formatter Partial format with read-only analysis (Chapter 12) and tell the Formatter to update the bad block table; then run `FIXUP` and try again. If hard errors persist, consult your DG support organization and run without the disk until it is repaired. Soft errors on tape are a potential danger sign only; but if one occurs on a disk, shut it down and run a Formatter Partial format as described earlier in this paragraph.

**EXEC** — Use `CLI QDISPLAY`, `XHELP`, `CX STATUS` and `CX MOUNTSTATUS` commands as needed; use `CX PAUSE` to pause streams and printers, `CX HOLD` on a dubious request, `CX FLUSH` to terminate an active request. For `START` syntax, read `:UP.CLI` via the `CLI TYPE` command. Use `XEQ PED` and `? macro` as needed.

**fault light** — On the CPU front panel, a fault light usually means a problem with power supply; see appropriate part of Chapter 17. If a fault light glows on a disk unit at startup, turn disk power off and on again. If a disk shows a fault while on line, release it from AOS/VS (if possible) and turn it off. On a line printer, the `TAPE FAULT` light may mean EXEC's `XLPT` process terminated; check with `?`; if there is no `XLPT` process, start it with EXEC's `START` and `CONTINUE` commands (syntax is in `UP.CLI` macro). If a printer `FORMAT` light won't go off, turn the printer off and on, then type `CX ALIGN @devicename` to it, align the paper, and type `CX ALIGN/CONTINUE @devicename`. If the `FORMAT` light remains lit, turn printer power off, terminate the `XLPT` process with `CX TERM @devicename`, turn power on, bring `XLPT` up again (as above), then type `ALIGN` and `ALIGN/CONTINUE` commands as above. On a hardcopy console, a fault light may mean that there is a jammed or damaged ribbon; check. If the ribbon is okay, turn console power off and on again to clear the fault.

**help** — Use `help` or `XHELP`; or `? or CX STATUS` or `CX MOUNTSTATUS`. Call on a resource person: a system expert or DG support organization.

**labeling diskettes** — Use the CLI's labeling mechanism.

**labeling tape** — Use `XEQ LABEL @unitname labelname`, up to six characters; or, with `PCOPY`, use `PCOPY`.

**line printer** — If it won't stay on line, EXEC's `XLPT` cooperative process may have terminated; check with `? macro`; restart if needed with `EXEC START` and `CONTINUE` commands contained in `:UP.CLI`. (See also the subject **fault light**.)

**macros** — CLI macros are a key to easy operation. Use the ones available (some are shown in Chapter 5, Chapter 9, and Chapter 10); write your own as needed.

**magnetic tapes** — These are often the mainstay of data backup. You can label them with the `LABEL` utility at any time, even when EXEC is prompting for a `UNIT MOUNT`. Backup tapes should have paper labels on them and be stored routinely in a library. Suggestions for storage appear in Chapter 10.

**magnetic tape units** — Keep unloaded and off line unless they are in use. Soft errors can sometimes be reduced if you clean the read/write heads with an alcohol-soaked cotton swab.

**panics** — See errors.

**preventive maintenance** — Make sure it's done routinely; it can save a lot of time and money.

**processes** — Use ? or XEQ PED as needed.

**shutdown, normal** — Pause streams and printer(s) with CX PAUSE commands; get all users out of text editors and other interactive programs (SEND or BROADCAST); get back to master CLI (BYE or UNLOCK, password, BYE for LOCK\_CLI); then BYE and YES.

**slow, sluggish system** — A high-priority process (like a dump) may be consuming most of the system's resources. Or, many batch streams may be running. Generally, run dumps and multiple batch streams after normal working hours. Possibly, if your system console is a hard-copy console, it may be having hardware faults (like a worn-out ribbon); a system console fault that slows console printing can slow the whole system.

**startup, cold** — Power up system console; power up and ready disks; set CPU switch in LOCK position (if there is one); power up CPU; put tape unit on and on line; wait for time-out; set date/time if prompted and default everything else; UP ).

**super- privileges** — Don't leave them on; a super prompt showing on an unattended system console means that the system is wide open. Set ACLs to minimize the need for Superuser. Use EXEC commands where possible.

**terms** — See the Glossary.

**text editing** — You can do this with either the SED or SPEED text editor; SED is sketched in Chapter 5.

**users** —To check, use ? or XEQ PED. For a new user, run PREDITOR. Within reason, do what you can to boost productivity; use LOGON.MESSAGE for news; encourage use of help messages; create your own help messages (Chapter 5). For a user's view of AOS/VS, read *Learning to Use Your AOS/VS System*.

Use the following blank lines for your own notes or comments.

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## **What Next?**

This chapter suggested some things to avoid and some things to consider, for the person who is acting as the system operator.

You may want to look at the next chapters, review earlier material, or read another pertinent book, or maybe simply run the system.

End of Chapter



# Chapter 15

## System Management Considerations — Excluding Security

Read this chapter

- when you want to understand process and disk space concepts to run your system more effectively;
- for a summary of the things that should be done regularly (logs, dumps, preventive maintenance, etc.)
- when you receive an AOS/VS update, new revision, or new revision of microcode from DG;
- when you want to know how to get help from DG;
- for an example of a real UP.CLI macro.

Thus far, this book has simply given information, without caring about the role of the reader. This chapter and the next one touch on some management issues — not *how* to manage, but information and suggestions that can help the person who manages the system make sound system-oriented decisions.

Major sections in this chapter are

- AOS/VS Process Types and How to Use Them
- Running More than 255 Processes on Your System
- Changing PID-size Type
- Multiple-Processor Computers
- Classes and Logical Processors
- Disk Space and Performance
- Using LDUs Shared by Two Computer Systems
- Using Logical Disk Mirroring for High Availability
- Windowing with DG/VIEW
- Routine Procedures (things to do regularly)
- How to Handle Updates and New Revisions from DG
- Getting Help from DG
- Users and Productivity
- A Real System's UP Macro

Issues that relate to system security are concentrated in the next chapter.

## AOS/VS Process Types and How to Use Them

This section explains how AOS/VS manages processes, then offers some suggestions for your own system.

In the main, AOS/VS manages its resources quite efficiently, giving memory and CPU time to interactive and batch processes according to their types, priorities, and groups. But there are some steps you can take to optimize this for your own needs.

As described in Chapter 4, AOS/VS is a virtual memory, demand-paged system. Virtual memory means that memory is a composite of physical (computer) memory and disk memory. Demand-paged means that AOS/VS adds a page to each process's working set on demand. AOS/VS releases unused pages as processes require more memory. Some details on AOS/VS memory management appear in the *AOS/VS System Concepts* manual.

### Processes and Virtual Memory

AOS/VS runs each program as a *process*, with its own process ID (PID). A process starts with a certain number of pages of virtual memory — usually from 5 to 100 pages — its initial working set. The working set is a subset of the process's total *logical address space*. When the process needs more pages, (perhaps to execute a routine that isn't in memory), a *page fault* occurs; AOS/VS then adds an additional page to the process working set. The theoretical limit on the number of pages in a process working set exceeds 1,000,000 — providing a limit of 2 gigabytes on any process logical address space.

There can be many processes running simultaneously. Memory contention occurs when all currently active processes (including the AOS/VS system and its peripheral manager) desire a working set larger than the computer's physical memory. Memory contention can occur much of the time.

In *light* memory contention, AOS/VS resolves the situation by removing inactive pages from processes and storing their images in its PAGE directory. The processes remain in physical memory, but with fewer pages in their working sets. Later, if demanded, the pages are restored to the working sets. This is called *paging*.

In *heavy* memory contention, AOS/VS removes whole *processes* (selecting blocked processes first), and stores their images in its SWAP directory. Their entire working sets are removed from memory. Later, AOS/VS restores the working sets to physical memory and the processes can run again. This is called *swapping*.

If there is no memory contention, no paging or swapping occurs. But if there is contention, processes may be paged or swapped to disk on the basis of their process priorities.

Getting control of the processor (CPU) is a two-phase operation. Before a process can do it, its working set must be in physical memory.

### Processes and Physical Memory

Processes compete for physical memory according to *type*; priority is secondary. The process types are

- resident
- pre-emptible
- swappable

The AOS/VS system scheduler allots each type memory as follows.

| <b>Process Type</b> | <b>How It Gets Physical Memory</b> |
|---------------------|------------------------------------|
|---------------------|------------------------------------|

|              |                                                                                                                                                                                                                                                                             |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resident     | Gets memory on demand and keeps it. The scheduler retains the process initial working set in main memory; the system may page the process but may not swap it.                                                                                                              |
| Pre-emptible | Gets memory if the memory is not needed by a resident process. The scheduler swaps a pre-emptible process if<br><br>A resident or higher-priority pre-emptible process requires memory; or<br><br>The process becomes blocked and <i>any</i> other process requires memory. |
| Swappable    | Gets memory if the memory is not required by a resident or active pre-emptible process. The scheduler can swap the process as needed during memory contention.                                                                                                              |

Any process may have pages stolen from it by any higher-priority process — or by AOS/VS itself — regardless of its type.

By default, all user processes, including batch processes created for users, are swappable.

## Processes and CPU Time

The AOS/VS scheduler determines how much CPU time a process receives. With AOS/VS Revision 7.00, Data General provides class scheduling, and with the MV/20000 Model 2, multiprocessor support. (In a multiprocessor computer, each CPU is called a job processor.) All computers — with one processor or more — use standard scheduling and can use class scheduling as well.

Standard scheduling, which forms the basis for all scheduling, works like this.

The AOS/VS scheduler runs on each job processor. When a job processor becomes free, that scheduler runs the highest priority, ready process. The process may use the processor for a subslice period (32 milliseconds) if it wants.

At the end of a subslice; or if the process encounters a blocking event; or if a higher-priority process becomes ready, AOS/VS reschedules. Again, the scheduler runs the highest priority, ready process. The chosen process may be the same process or a different one.

There are two methods of scheduling: round robin and heuristic. With round-robin scheduling, the scheduler tries to give each process at the same priority an equal chance to run. A process that uses a lot of processor time isn't penalized.

With heuristic scheduling, the system may reduce a process' internal priority, based on process behavior. A process that uses a lot of processor time *is* penalized — relative to other, more interactive processes at the same priority.

The kind of scheduling a process gets depends on its group (explained later). By default, user processes (and their sons) start in group 2, the heuristic group.

Standard scheduling is meant for general purpose systems. Since, by default, user processes are scheduled heuristically, highly interactive timesharing processes are favored over compute-bound processes. But this interactive bias can be overcome — as desired — if you give user processes a priority that makes them group 1 or group 3. And, standard scheduling allows high priority processes (like the PMGR) to get all the time they need without penalty.

Also, compute-bound processes of the same priority tend to get equal amounts of processor time, regardless of group. This works well in situations where you want to treat compute-bound processes equally.



However, standard scheduling, based on priority only, does have two limitations, as follows:

- You can't give one compute-bound process priority over another compute-bound process without starving the lower priority process.
- You can't give compute-bound processes lower priority than interactive ones without the risk that the compute-bound processes will get *no* time.

With classes and logical processors, you can specify the percentage of time for processes in a class — overcoming both limitations. See the sections “Multiple-Processor Computers” and “Classes and Logical Processors” later in this chapter.

Whether you use classes or not, ready processes get CPU time entirely on the basis of priority within process group. The next section explains how.

## Priority Groups

There are three priority groups, whose ranges are established at VSGEN. They are

Group 1 (high priority, default VSGEN range 1 through 255);

Group 2 (medium priority, used for user processes, default VSGEN range 256 through 258);

Group 3 (low priority, default VSGEN range 259 through 511).

- Group 1 (high priority) processes include resident or pre-emptible processes with priority 1, 2, or 3. And, group 1 processes include *any* processes with priority 4 through  $n$ . The  $n$  is the VSGEN “lowest priority for group 1” choice, default is 255. Group 1 processes of equal priority get CPU time on a round-robin basis: the system doesn't watch or predict their behavior.
- Group 2 (medium priority) processes include all processes whose priority ranges from  $n+1$  through  $m$ . The  $n$ , as above, is the VSGEN “lowest priority for group 1;”  $m$  is the VSGEN “lowest priority for group 2.” The VSGEN default range is priority 256 through 258.

Group 2 processes also include any *swappable* processes with a displayed priority of 1, 2, or 3. By default, this includes user processes and all sons of the master CLI. The system shows swappable priorities  $n+1$  through  $n+3$  as 1, 2, and 3 for compatibility with AOS/VS revisions before 4.00.

Group 2 processes are scheduled *heuristically*, according to their behavior. Based on a group 2 process's prior behavior, the system expects it to have a given number of blocking events within a given time. If the process has *more* blocking events than expected in this given time, the system raises its internal priority, which gives a better shot at the CPU than other equal-priority group 2 processes. On the other hand, if a process has *fewer* blocking events than expected within a given time, it is starting to monopolize the CPU: the system lowers its internal priority, favoring other equal-priority group 2 processes. Thus, within group 2, both priority and the number of blocking events determine which process next gets control of the CPU.

In Group 2 scheduling, interactive processes (which tend to have many blocking events, where people pause for thought), are favored over more CPU-intensive (noninteractive) processes. Thus, group 2 scheduling is ideal for user processes that should each get about the same amount of CPU time. It is *not* ideal for processes that can use a lot of CPU time without blocking — processes like large sorts and batch jobs. (These paragraphs describe what *heuristic scheduling* has always meant in AOS/VS. Before revision 4.00, AOS/VS used it only on swappable processes. For and after revision 4.00, AOS/VS uses it on all group 2 processes.)

- Group 3 (low priority) processes are *any type* of process with priority  $m+1$  through 511. The VSGEN default range is 259 through 511. Unlike group 2 processes, group 3 processes of equal priority get CPU time on a round-robin basis: the system doesn't care about their behavior.

Within groups, the absolute difference between priority numbers has no effect — only the relative difference. This means that running five processes at resident priority 1 and priorities 4, 18, 200, and 201 is exactly the same as running them at resident priority 3 and priorities 4, 5, 6, and 7, if they are the only processes on the system.

## Choosing Process Types, Priorities, and Groups

Process type, priority, and groups offer a lot of flexibility. But things will be simpler if you keep the defaults where possible.

If you take no action to control process types or priorities, nearly all processes will be swappable, priority 2, group 2. This is the master CLI, EXEC, and PREDITOR default type and priority. The qualities and tradeoffs on the types are as follows:

- **Resident Processes.** A resident process cannot become blocked. Its working set always remains in physical memory. A resident process can “wire” additional pages into its working set with the ?WIRE system call. These pages cannot be paged out; they will stay resident, part of the working set, until the process issues an ?UNWIRE call or terminates.

AOS/VS always runs its peripheral manager as a resident process, priority 1. If you have synchronous lines, you must run the GSMGR process resident, as shown in Chapter 5. Other DG products are meant to run resident, as suggested in the product documentation; and you should follow the suggestions. Any process that defines a user device (?IDEF system call) must be resident and must wire all device-handling pages so it can service device interrupts.

Generally, try to avoid running a process resident unless you must, since the memory for *at least* its working set minimum is lost to other processes while it runs. If a process must be resident, run it at a lower priority than the PMGR — perhaps 2, 3, or even 511.

- **Pre-emptible Processes.** A pre-emptible process stays in physical memory as long as it remains unblocked, unless a resident or higher priority pre-emptible process needs the memory. This is a good general-purpose type for a process you want to favor over swappable processes.

Processes that you *might* consider making pre-emptible are the master CLI, PID 2, which you should also give a high priority. Giving the master CLI this advantage can help it get CPU time to control the system if another process runs wild. It consumes few (unshared) pages. Another possibility, if you want fast print request handling, is EXEC's XLPT \* cooperative.

Other candidates include any important short-term processes. For example, assume a short-term process needs to run uninterrupted every 10 minutes, and will then issue a delay call. You might make it pre-emptible, with the highest priority (1). Then, the scheduler will not permit any lower-priority process to displace it while it runs. When it issues the delay call, it becomes blocked and AOS/VS may swap it out. When the delay period has expired and the process is ready again, it can displace any other lower-priority nonresident process in physical memory.

- **Swappable Processes.** Swappable, priority 2 (actually VSGEN  $n+2$ , default 257), is the default for all user processes and their sons. These are group 2 processes. They all compete on an equal footing, and the scheduler tries to give them equal CPU time. Generally, you should take the PREDITOR and system defaults, which makes each process a swappable group 2.

If a swappable process can use a lot of CPU time productively, you can create it with (or change it to) a group 1 priority (like 4); this gives it round-robin scheduling (to avoid penalties for not blocking often), gives it priority over standard user processes, and yet maintains its swappable type.

To give a swappable process a slight advantage, you can give it higher priority, like 1, within the swappable range. This is often done with EXEC and/or XLPT. EXEC manages queues and XLPT manages printers; thus they can benefit from the higher priority.

You can't really decide on the best types, priorities, and groups for your processes until you've had some experience with your applications software. So we suggest that you run with the defaults for a while before setting up your own process parameters. Figure 15-1, next, shows the relationships between type, priority and group.

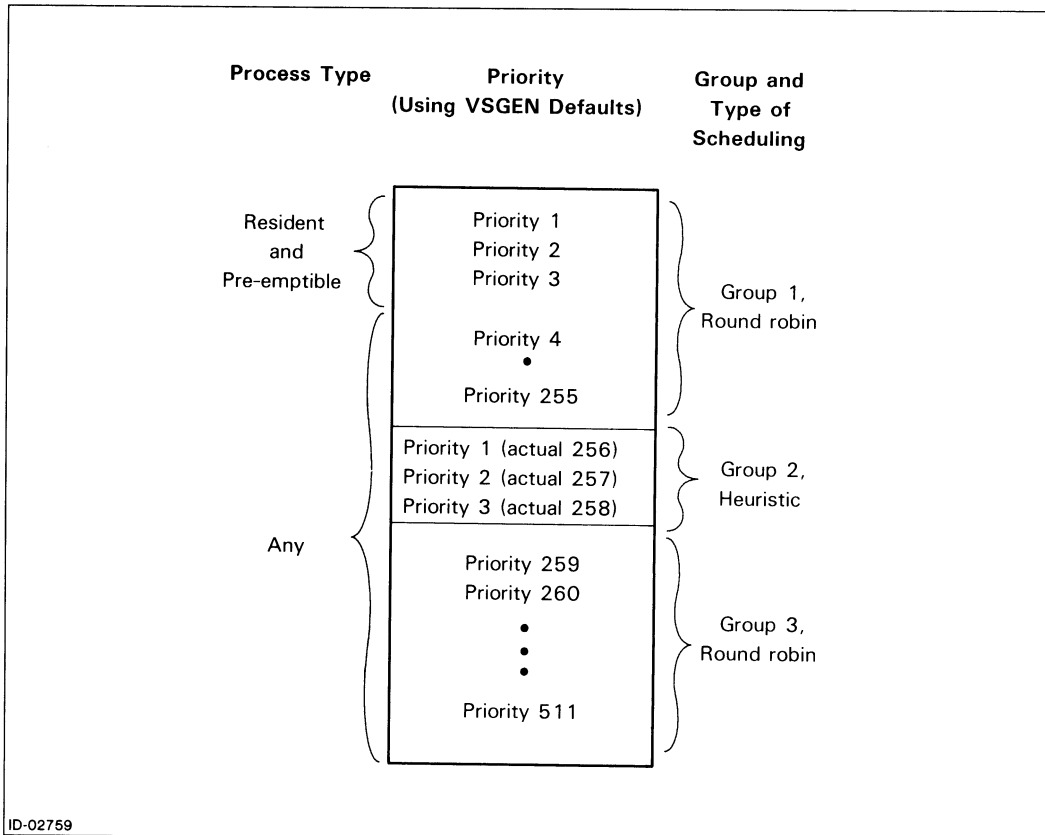


Figure 15-1. Process Types, Priorities, and Groups

## Priority Cautions

Generally, don't allow a user process to run at resident or pre-emptible priority 1 or 2. (A possible exception is a user process that defines a device via call ?IDEF.) Also, *never* make EXEC resident or pre-emptible with a priority of 1 or 2. Having EXEC or a user process run at resident or pre-emptible priority 1 or 2 may create a race condition with the AOS/VS peripheral manager (which is resident at priority 2). Such a race condition can create a system deadlock — forcing you to shut down and restart AOS/VS.

To maintain fast log-on service and other EXEC functions, allow EXEC to run at a higher priority than most user processes.

By default, user processes are created at swappable priority 2 (actual priority 257). You can prevent users from changing priority when you create user profiles by taking the default answer — No — to the PREDITOR question *Change priority?*. By default, EXEC is created with swappable priority 1 (actual priority 256) — and you needn't change this. If you do decide to run EXEC pre-emptible or resident, change its priority to 4 (or a higher number) before changing EXEC's process type.

## Page Faults and Program Design

Good program design is at least as important as the process types and priorities you choose for your system. A very important goal here is *minimizing the number of page faults*.

When a program takes a page fault, AOS/VS must add one or more memory pages to its working set — often via a disk access.

If a little-used program takes many page faults, this is unimportant. But if often-used programs (like your main application programs) take a large number of page faults, everyday system performance will suffer.

Page faults are directly related to program design. Programmers can design programs to localize references, which will reduce page faults. To help with this, they can use a DG programming tool like HISTO, which can tell where a program is spending most of its CPU time (and showing where references should be localized), and LOGCALLS, which shows what a program is doing, and how often.

For often-used programs with many unshared pages, you may be able to improve performance by program loading multiple pages and/or adding more than one page to the working set on a fault. To do either of these, use the SPRED utility (Chapter 9).

And, programmers can make use of *shared pages*. Many DG products, like the CLI and the SED text editor, do this. A shared page can be used by more than one process. Shared pages conserve physical memory and reduce faults, since AOS/VS does not page a shared page out to disk immediately when a process releases it. Shared page concepts are given in the *AOS/VS Programmer's Manual*; they can be applied to higher-level languages in addition to assembly language.

Basically, fine-tuning your processes requires some planning and experience. With your typical applications up, run PED and watch the FTA (page fault) and WSS (working set) columns. Listen to user comments, and note the amount of time programs like big sorts and/or batch jobs take. When you change a process-related setting, note the effects — user response time, FTA figures, total performance — and decide whether or not changing the parameter helped. You might want to change settings based on the time of day.

Ideally, there will be a balance between the resources that interactive (I/O-bound) and noninteractive (compute-bound) processes use. The whole approach depends on what kind of operations you want the system to perform at any given time.

For additional monitor and tuning power, you can acquire the AOS/VS Performance Package — a product designed to help you tune your system.

## Creating Different Kinds of Processes

The primary process-creating command is **PROCESS**. It creates a son process with the type, priority, and other parameters specified with switches.

A process can display or change another process' (or its own) type with the command **PRTYPE**. It can display or change priority with the command **PRIORITY**. To learn the process group, use Table 15-1,

**Table 15-1. How Process Groups Relate to Type and Priority**

| Type                        | Priority |                                 |                                     |                                       |
|-----------------------------|----------|---------------------------------|-------------------------------------|---------------------------------------|
|                             | 1-3      | 4-n<br>(default<br>is<br>4-255) | n+1-m<br>(default<br>is<br>256-258) | m+1-511<br>(default<br>is<br>259-511) |
| Resident or<br>Pre-emptible | Group 1  | Group 1                         | Group 2                             | Group 3                               |
| Swappable                   | Group 2  | Group 1                         | Group 2                             | Group 3                               |

No process can create a son with, or give itself, privileges that are not granted in its user's user profile. The **PREDITOR** defaults don't allow a process to change priority or type.

The master CLI and any of its CLI sons (except **LOCK\_CLI**) can change its type or priority; and it can create sons of different types and priorities. So the system operator, via a privileged CLI, can always create any kind of process; for example:

```
) PROCESS/BLOCK/IOC/RESIDENT/PRIORITY=1/SUPERPROCESS MYPROG ;
```

But probably, you will not want to do this directly. Instead, after deciding on your process parameters, you will want to put them in the **UP.CLI** macro.

If you will want users to be able to create processes of different types and priorities, you must edit their profiles to allow this. Do it with caution, because misuse of these privileges can allow undesirable processes to dominate the system.

Table 15-2 names the **PREDITOR** profile privileges in the order asked, and describes the effect on the user's processes. Each **PREDITOR** question gets more detail in Chapter 7.

**Table 15-2. Profile Privileges That Relate to Process Control**

| Privilege              | What It Allows                                                                                                                                                                                                                                                                                                                                           |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Create without block   | The user process can create sons (that in turn can create sons) without blocking. This allows the user process to proliferate. All its sons (and grandsons) can remain unblocked, increasing system overhead. This privilege relates to the next two. A CEO user needs this privilege.                                                                   |
| Unlimited sons<br>Sons | These two parameters control the number of sons the user process can create. Each son can have all the privileges of its father. Generally, a user should not have the unlimited sons privilege. Each son requires some overhead, especially if its father isn't blocked (first privilege, above).                                                       |
| Change priority        | The user process (and sons) can change its own priority if it has this privilege.                                                                                                                                                                                                                                                                        |
| Change type            | The user process (and sons) can change its own type (e.g., to resident) if it has this privilege. Do not give this privilege to users if you want a secure system.                                                                                                                                                                                       |
| Change username        | The user process can create son processes with different usernames. Effectively, this allows the user to become another user on the system, with OWARE access to that user's files. A user who can change his or her username to OP, for example, could issue EXEC commands. Do not give this privilege to users if you want a secure system.            |
| Access devices         | The user process can define a new device (call ?IDEF), wire pages, access the device, and/or remove the definition. Also, for this privilege to work, the process must be resident, which means the user must also have the <i>Chnage type</i> privilege. These privileges give the user <i>at least</i> the power to dominate or bring down the system. |
| Superuser              | Of itself, this privilege doesn't affect the multiprocess environment. But superusers can run PREDITOR, and give themselves any privilege. Do not give this privilege to users if you want a secure system.                                                                                                                                              |

(continues)

**Table 15-2. Profile Privileges That Relate to Process Control**

| Privilege                                                                                                                                            | What It Allows                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Superprocess                                                                                                                                         | The user process (and sons) can change its own type and priority; and it can block or terminate any other process. Do not give this privilege to users if you want a secure system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| System manager privilege                                                                                                                             | <p>This privilege allows the user to initialize and release job processors (if your computer has more than one job processor), and create and delete classes and logical processors (usually done via the optional CLASP utility).</p> <p>System Manager privilege also allows a user process to issue AOS/VS system calls that change the system date, time, ID (SYSID), and bias factor. Also, the user can start or stop the system log (SYSLOG) and issue EXEC commands. These privileges have significant impact on security (although some expertise is needed to write a program that exploits them).</p> <p>Use of classes and privileged system calls can affect the performance and security of your system. Generally, the master CLI issues all commands that require System Manager privilege; do not give it to any other user unless he or she really needs it.</p> |
| Change working set limit                                                                                                                             | The user process (and sons) can override the working set limit that AOS/VS dynamically assigns to each process. The process must have this privilege to exercise any of the four working set privileges below.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Priority                                                                                                                                             | If given a higher-than-default priority, the user process (and sons) will get CPU preference over processes with lower priority.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Logical address space – batch<br>Logical address space – non-batch                                                                                   | These parameters give the user process (and sons) a nondefault number of memory pages in batch or interactive processing. The default is a very high number. Giving specifics might have some affect.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Minimum working set size – batch<br>Maximum working set size – batch<br>Minimum working set size – non-batch<br>Maximum working set size – non-batch | These parameters give the user process (and sons) specific minimum and maximum working set limits in batch or interactive situations. Giving specifics can have significant effect (usually bad), depending on your applications environment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Use other locality                                                                                                                                   | Changing the user locality by itself confers no special powers, but if you run your system with classes (described later in this a user <i>might</i> be able to run programs faster. This may be what you want, but be careful to whom you give this power.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

(concluded)

## EXEC Process Control Options

EXEC has a number of commands to tailor the multiprocess environment (described in Chapter 8). They are

|           |                                                                                                                                     |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------|
| LIMIT     | can limit CPU time for batch streams or page usage for line printers.                                                               |
| PRIORITY  | can change the process type and priority of batch and XLPT printer processes (combines CLI commands PRTYPE and PRIORITY for these). |
| QPRIORITY | can direct batch streams or devices to accept only requests that fall within a given queue priority range.                          |
| XBIAS     | can instruct batch streams or printer queues to favor small requests or large requests.                                             |

## Running More than 255 Processes on Your System

By default, AOS/VS can run up to 255 processes. With most computers, 255 processes is enough — it allows at least 60 people to use the system simultaneously.

(As a general rule, a CLI user who will not use DG's CEO system needs an average of three processes — the CLI and a text editor, compiler, Link, SWAT debugger, or BASIC process. A CLI user who may also use CEO needs an average of three and a half processes — the CLI and subordinate processes like BASIC or CEO control program process and CEO Word Processor process. A CEO-only user needs an average of two and a half processes. CEO-only users chain from the CLI, thus they don't need a CLI; they need only the two CEO processes. In any case, the "half" process covers extra processes like the SWAT debugger or CEO Spelling or CEO Spreadsheet.)

So, assuming 20 or so processes for the system — 255 processes is enough to support 65 CLI users or 90 CEO-only users simultaneously. If you think that 255 processes is enough — true in the majority of cases — skip to the next section "Multiple-Processor Computers". On the other hand, with a computer like an MV/20000 or MV/10000, you may well want to run more than 255 processes. To do this, read on.

First, some definitions. Any PID over 255 is called a *big PID*. Any program not limited to communication with PIDs beneath 256 is *compatible with big PIDs*. (Limits are based on certain system calls whose PID field can hold only numbers 1 through 255. These calls are ?PSTAT, ?IREC, and ?EXEC.)

You can identify a process as big-PID compatible via a quick edit of its program file. AOS/VS will then accept the process as compatible with big PIDs.

In terms of resources, processes with big PIDs are identical to other processes. They require the same amount of system overhead, and they are governed by the same process type (swappable, pre-emptible, resident) and priority rules as any process. As before, system response generally relates to the number and type of processes that are running.



## Creating a System for Big PIDs

To create a system that can run big PIDs productively, you must

1. Select a nondefault choice for maximum number of processes at VSGEN. This enables the AOS/VS system to run PIDs above 255. There's little extra overhead involved in allowing up to — say — 500 or 600 processes. The maximum number of processes allowed by VSGEN is 1,024.
2. Ensure that any program not created by DG that may run above PID 255 *or* communicate with a PID above 255 doesn't do anything that limits it to small PIDs. These limiting factors are
  - Checking PIDs of son processes with system call ?PSTAT.
  - Checking process termination or obituary messages with call ?IREC.
  - Asking service from EXEC with call ?EXEC, function ?XFSTS (this function gets the process's relationship to EXEC).

If a program doesn't do any of the things above, and it has no functional restriction to small PIDs (for example, such a restriction would be checking PIDs using a one-byte variable), then it's not limited to small PIDs. It's big-PID compatible.

An easy way to check a program for small-PID limitations is to run the DG-supplied macro PIDCALL\_CHECK.CLI on it. This macro searches a file for potentially significant system calls. If the macro finds none of the calls, then the program has no structural small-PID limits. (The macro may find call ?DADID, but ?DADID is okay if there are no other small-PID limits.) Unless the program has a structural restriction, it can handle big PIDs without requiring changes to the source code. The PIDCALL\_CHECK macro also checks object files, overlay files, and libraries.

Generally, if a program is written in a compiled language (FORTRAN, COBOL, C, PASCAL, PL/I), and it doesn't use the AOS/VS system calls mentioned above directly (by a high-level language system call function), then you need not change its sources to handle big PIDs.

Usually, you don't even need to recompile and relink compiled-language programs to handle big PIDs. You must recompile and relink only if your old compiler produces code limited to small PIDs.

Checking and configuring programs for compatibility with any PID is explained later, in "Checking and Configuring Programs for Any PID Size".

3. Tell AOS/VS to recognize each program you checked or configured in step 2 as compatible with big PIDs. To do this, use the SPRED editor to change the program PID-size type.

These steps enable an AOS/VS system to run PIDs larger than 255, maintaining the ability of processes to communicate. The steps don't necessarily *produce* PIDs above 255, nor do they prevent a program with small-PID limitations from running.

In AOS/VS Revision 7.00, most DG utility programs supplied with AOS/VS, including the CLI and EXEC, can communicate with any process. DG has executed steps 2 and 3 on them. By default, every initial user process is the CLI. Thus, by default, any user CLI process can communicate with a process that has any PID, above or below 255. As before, user CLIs *run* with a PID of 255 or below.

### PID-Size Types

When you execute a program, it runs as a process. The PID-size type of the process differs from that of the program. Table 15-3, next, explains program and process PID-size types.

**Table 15-3. Program and Process PID-size Types**

| Program PID-size Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Process PID-size Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>SmallPID-type program</b></p> <p>A smallPID program can't run if PIDs 1-255 are in use.</p> <p>SmallPID is the PID-size type of all programs before AOS/VS Revision 7.00 (except the CLI and EXEC, which were hybrid in Revision 6.00). The Link program creates programs of smallPID size by default.</p>                                                                                                                                                                                                                                                               | <p><b>A-type process</b></p> <p>An A-type process has a PID between 1 and 255. It can't execute any program if PIDs 1-255 are in use. Error conditions may result if a process with a PID over 255 tries to communicate with an A-type process.</p> <p>A is the PID-size type of all processes before AOS/VS Revision 7.00 (except the CLI and EXEC).</p>                                                                                                                                                    |
| <p><b>Hybrid program</b></p> <p>A hybrid program's program file has been linked or edited with the SPRED editor and its PID-size type made hybrid. (You can tell SPRED to label <i>any</i> program as hybrid, but if the program has any small-PID limitations, the process may not be able to communicate with PIDs above 255. And, since AOS/VS thinks the process is a legitimate hybrid, it won't detect any PID-range errors.</p> <p>A hybrid program can't run if PIDs 1-255 are in use.</p> <p>Most programs shipped with AOS/VS Revision 7.00 are hybrid programs.</p> | <p><b>B-type process</b></p> <p>A B-type process has a PID between 1 and 255. It can't run if PIDs 1-255 are in use, but it can create and communicate with a process of any PID-size type.</p> <p>Most DG programs, including the CLI and EXEC, run as B-type processes. By default, each user's CLI is a B-type process. Thus, by default, a user CLI must run in the range 1-255 but can execute any PID-type program.</p> <p>Most processes from programs supplied with AOS/VS are B-type processes.</p> |
| <p><b>AnyPID program</b></p> <p>An anyPID program's program file has been edited with the SPRED editor and its PID-size type made anyPID. (As with a hybrid program, you can tell SPRED to label any program as anyPID, but if the program has small-PID limitations, communication errors may occur and go undetected by AOS/VS.)</p> <p>An anyPID program can run at any PID up to the maximum specified at VSGEN. The system will run it above 255 if possible.</p>                                                                                                         | <p><b>C-type process, if a PID above 255 is free. B-type process if no PID above 255 is free.</b></p> <p>A C-type process can execute any PID-size type program. But error conditions may arise after it executes a smallPID program (since the father process has a PID the son can't understand).</p>                                                                                                                                                                                                      |

Because an anyPID program can run at any PID, it's the most flexible choice. Its only disadvantage appears above PID 255, where A-type processes may not be able to communicate with it. You can avoid this disadvantage by making all smallPID programs hybrid or anyPID.

The PID-size type arrangement shipped with AOS/VS Revision 7.00 provides maximum versatility. It allows you to specify more than 255 PIDs during VSGEN, and run any PID-size type program from user CLIs without errors.

## Checking Program and Process PID-Size Type

You can check a program's PID-size type via SPRED and SPRED's PID-size choice — or, more conveniently — you can use the macro PIDSIZE.CLI, supplied with AOS/VS. This macro runs SPRED for you and gets and displays the PID-size type. It takes about 10 seconds to run. For example,

```
) PIDSIZE :CLI.PR )
... (pause) ...
```

```
PID-size type [HYBRID] (from program file)
)
```

This shows that the CLI is a hybrid program.

To check a *process's* PID-size type, run PED with the /PIDSIZE switch. You can create a macro to show this and most other PED information by writing the following command line into the macro file (call the macro, say, PP\_SIZE.CLI):

```
PED/CYCLE= 10/PID/USER/PROGRAM/ELAPSED/CPU/BS/SH7/US7/PIDSIZE&<nl>
/IO/FTA/WSS
```

This command line omits only the process name from the default PED display.

A typical PED display — showing the CLI as a B-type process (as DG ships it), but showing the SED text editor as a C-type process — might look like Figure 15-2, next.

| PID | USERNAME | PROGRAM  | ELAPS | CPU   | BS | SH7 | US7 | PSZ | I/O   | FTA  | WSS |
|-----|----------|----------|-------|-------|----|-----|-----|-----|-------|------|-----|
| 1   | PMGR     | PMGR     | 2-06  | 78:02 |    | 0   | 1   | B   | 58    | 9389 | 62  |
| 3   | OP       | EXEC     | 2-06  | 22.55 | B  | 1   | 23  | B   | 8686  | 1327 | 60  |
| 4   | XLPT1    | XLPT     | 2-06  | 20.40 | B  | 3   | 3   | B   | 10761 | 46   | 13  |
| 9   | OP       | PED      | 5.00  | 0.20  |    | 15  | 45  | B   | 0     | 57   | 63  |
| 14  | JACK     | F77      | 20.00 | 0.37  |    | 14  | 364 | B   | 9     | 122  | 118 |
| 45  | BEN      | STREAM_3 | 12.01 | 0.81  | B  | 18  | 2   | B   | 38    | 85   | 55  |
| 256 | SALLY    | SED      | 0:24  | 0.34  |    | 42  | 19  | C   | 20    | 42   | 48  |
| 258 | MARC     | SED      | 1:04  | 0.90  |    | 42  | 19  | C   | 55    | 106  | 50  |
| .   | .        | .        | .     | .     | .  | .   | .   | .   | .     | .    | .   |

Figure 15-2. PED Display with Big PIDs

The PED display shows most processes as B-type processes, running below PID 256. The two SED text editor processes — for SALLY and MARC — are C-type processes, running above 255. In this system, the SED text editor has been changed from a hybrid program to an anyPID program.

To some extent, you can tell the program PID-size type from the process PID-size type, as follows. An A-type process can come only from a smallPID program. A B-type process can spring from either a hybrid or anyPID program; PED can't tell you which. A C-type process can come only from an anyPID program.

## Checking and Configuring Programs for Any PID Size

This section tells how to check your programs for small-PID limitations, and eliminate these if you find any. After ensuring that any program you may want to use in the big-PID environment has no such limitations, you're ready for big PIDs. You can change the program PID-size types at will.

### Checking Compiled Language Programs

In a program written in a high-level language like C, PASCAL, FORTRAN, COBOL, or PL/I, run the macro `PIDCALL_CHECK.CLI` on the program file. This macro checks for occurrence of any of the system calls that *may* limit a program to small PIDs.

Macro `PIDCALL_CHECK.CLI` works with both 32-bit and 16-bit program files, and with object (.OB) files and libraries. If you use it to check a 16-bit program file, be sure to run it also on the overlay file (programname.OL) if there is an overlay file. The macro uses the FED text editor to search for the call code, in both 32-bit and 16-bit form. It takes awhile — say 30 to 60 seconds — to run, and produces a report on the pertinent calls. For example,

```
) PIDCALL_CHECK :UDD:DATABASE:ITEMIZE.PR )  
... (pause) ...
```

*Analyzing :UDD:DATABASE:ITEMIZE.PR — please wait 30 to 60 seconds.*

... (longer pause)...  
... (macro displays text of report)...

*The report on the PID-size calls is in file :UDD:JACK:ITEMIZE.PR.BP.REPORT*  
)

The macro writes its report to directory :UDD:username, from which you can print and file it. Only read access to the target file is required.

If the macro finds no occurrences of call ?PSTAT, ?IREC, or ?EXEC, you're nearly done. There are just a few other things to check, as follows.

It's possible for one of the limiting calls to occur at runtime without being built into the program code. This will happen if the process issues a system call function with a *runtime variable* as the system call value. (If a program issues a system call function with a *constant* as the system call value, the call will be present in the program file, and the macro will find it.) Thus, you may want to have someone check the program sources for the appropriate system call text string, then see if a variable that could possibly evaluate to 5, 22, or 216 follows the call text. If there is such a variable, you need to follow the steps described in the next section. (Values 5, 22, and 216 are the values for system calls ?PSTAT, ?IREC, and ?EXEC.) The system call text strings are

|            |                                           |
|------------|-------------------------------------------|
| C          | sys or sys_ (not system) (case sensitive) |
| COBOL      | CBSYS (case sensitive)                    |
| FORTRAN 77 | ISYS (case insensitive)                   |
| Pascal     | SYS (case insensitive)                    |
| PL/I       | SYS (case sensitive)                      |

If the macro finds no occurrences of calls ?PSTAT, ?IREC, or ?EXEC, and there is no system call variable, only structural limits remain (for example, the program reads PIDs into a one-byte variable, limiting the number to 256). Structural limits like this aren't likely, but you might want to ask your programming staff to see if there *could* be any. If there are structural limits to PID numbers in the program, the source code must be changed to eliminate them; then someone must recompile and relink.

If none of these checks reveals a limitation, then the program has no inherent smallPID limitation. You can use SPRED to change its PID-size type to hybrid or anyPID at will. Generally, if the program won't need to communicate with a smallPID program, choose anyPID, since anyPID can run at any PID.

### **If the Macro Reports System Call ?PSTAT, ?IREC, or ?EXEC**

If the `PIDCALL_CHECK` macro reports call `?PSTAT`, `?IREC`, or `?EXEC`, have a programmer check for direct calls to the system (via the system call function for the language) in the program sources. If the macro reports only `?DADID`, this is not a problem, as explained in the next section.

If there are direct calls to the system, talk with your programming staff and verify that the system call (`?PSTAT`, `?IREC`, and/or `?EXEC`) has no small-PID limitations. These limitations are described below, under “Limiting Contexts in Calls `?PSTAT`, `?IREC`, and `?EXEC`”). If there are small-PID limitations, arrange for the sources to be changed — if possible — for big-PID compatibility. After the change, have the program recompiled and relinked.

If the macro reports `?PSTAT`, `?IREC`, or `?EXEC` and there are no system call functions in your compiled-language sources, this means the compiler is generating the system call from high-level sources. Calls `?PSTAT`, `?IREC`, and `?EXEC` *can* be made in big-PID compatible form; in fact, `?PSTAT` and `?EXEC` are usually in big-PID compatible form.

The best course is to make sure your compiler is generating big-PID compatible code. Read the language product Release Notice for information on big-PID compatibility, or call your DG support organization. The responsibility for generating big-PID compatible code from a high-level language rests with the compiler. You may need to acquire a version of the compiler that produces big-PID compatible code, then recompile and relink.

After you determine that a program has no small-PID limitations, or eliminate such limitations, you're all set. You can run `SPRED` on the program file and label it a hybrid or anyPID program, as described in “Changing PID-size Type”, below.

### **If the Macro Reports System Call ?DADID**

Call `?DADID` is not restricted to small PIDs. It's acceptable in a program that has no small-PID limitations. So, if a program is compatible with big PIDs and it issues `?DADID`, you can make it hybrid or anyPID at will.

However, a smallPID program issuing `?DADID` can be a problem in a big-PID environment. If a C-type process runs a smallPID program, and the small-PID program issues `?DADID`, then the smallPID program will receive a PID number it sees as illegal. This will also happen if the smallPID program issues `?DADID` to any C-type process. Therefore, if a smallPID program issues `?DADID`, you must make the smallPID program big-PID compatible — or, if this is impossible, make sure the smallPID program is run by and communicates with only a B-type or A-type process (not a C-type process).

### **Checking Assembly Language Programs**

You can check assembly language program source files directly for calls `?PSTAT`, `?IREC`, and `?EXEC`; or you can run macro `PIDCALL_CHECK` on the program file. Either test will tell you whether the program issues any of these calls.

If a program doesn't issue call `?PSTAT`, `?IREC`, or `?EXEC`, you don't need to change it. You can change the PID-size type at will (described below).

If a program *does* issue one or more of these calls, check the context (next). If the program issues the call in a context that isn't limited, you don't need to change the program to handle big PIDs.

## Limiting Contexts in Calls ?PSTAT, ?IREC, and ?EXEC

If any program uses ?PSTAT, ?IREC, or ?EXEC as described next, the program sources must be changed if the program is to handle big PIDs.

- The program uses the ?PSTAT system call to get information on its sons. The ?PSTAT call returns status information on processes, including a list of sons. ?PSTAT can describe only sons with PIDs 1-255. ?PSTAT has no other small-PID limitation.

If a program uses ?PSTAT, and relies on the sons information returned in the ?PSTAT packet, arrange to have system call ?SONS added to the program. The program must get the sons information from the ?SONS buffer, not from the ?PSTAT packet.

- The program uses the ?IREC system call to listen for a termination or obituary message. When a process terminates, it sends a termination message to its father. If a process has connected (?CON call) to any other processes, the process also sends an obituary message to all connected processes when it terminates.

The system places termination and obituary messages in the ?IREC packet of your program. If a program checks termination or obituary messages (perhaps it checks to see if or why the process terminated), the program must change the way it parses the message. The format of the message in the ?IREC packet has changed.

- The program uses the ?EXEC system call, function ?XFSTS. This function tells AOS/VS to get a process's relationship to EXEC. If a program uses call ?EXEC, function ?XFSTS, have ?XFSTS replaced with an extended function, ?XFXTS.

After making the source changes needed, have the program assembled and linked using the PIDSIZE switch, or change the PID-size type with SPRED.

Details on the new and changed calls appear in the *AOS/VS System Call Dictionary*. Termination and obituary messages are explained in the *AOS/VS System Concepts* manual.

## Changing PID-Size Type

To change a program's PID-size type, run the SPRED program, edit (choice 6), specify the PID-size type desired, apply changes (choice 8), and leave SPRED by typing BYE. To change a program's PID-size type, you need write access to the program file.

(Once again: Don't use SPRED to make any smallPID program into a hybrid or anyPID program until you've made sure the program doesn't have small-PID limitations. At least, run macro PIDCALL\_CHECK on it to check for any potentially limiting system calls; if the macro finds any, don't change the program PID-size type until you've explored further.)

For example, to change MYPROG from smallPID to anyPID, the dialog might go as in Figure 15-3.

```

) X SPRED MYPROG.PR )
... (SPRED menu) ...

6. Edit PID-size type
...
Enter choice(s), separated by commas: 6 )    (Choose PID-size.)

PID-size type [SMALLPID] (from program file)
Choices are: (SMALLPID, HYBRID, or ANYPID) new value: ANYPID )
... (SPRED redisplay menu) ...

8. Apply changes to program file
....
Enter choice(s), separated by commas: 8 )    (Choose Apply.)

Program type initialization successful      (SPRED confirms.)
... (SPRED redisplay menu)...

Enter choice(s), separated by commas: BYE ) (Leave SPRED.)
)   (Back to the CLI.)

```

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*Figure 15-3. SPRED Dialog to Change a Program's PID-Size Type*

The SPRED program exclusively opens a program file, thus you can't run SPRED on a program anyone is using. To handle this, wait until no one's using the program, then run SPRED on it.

The Link program can create a program with a given PID-size type — via the /PID\_SIZE= value (ANYPID, HYBRID, or SMALLPID).

## Hints for Using Big PIDs

- There are more PIDs above 255 than below it. Thus, it's usually beneficial to make programs anyPID, since this will allow them to run above 255 (if PIDs are available there). If no PID is available above 255, the program will run below 255, as a B-type process.

With most systems that run a lot of PIDs, many processes are based on one program. For example, most user processes are CLIs — based the CLI program. And, at any moment, many user processes may be SED text editors — again one program.

This general use of one DG program can help you implement big PIDs. Most DG programs are hybrid programs. If there are no warnings (in the product Release Notice), you can free many PIDs in the low-PID range by changing one (or more) often-used DG hybrids to anyPIDs — a simple step with SPRED. All processes from such programs will then automatically run above PID 255 — if PIDs above 255 are available — freeing PIDs below 255 for hybrid (and smallPID) programs.

For example, with 50 SED users, making SED an anyPID program will run all SEDs above 255, freeing 50 PIDs in the low range.

- DG wants to ease the transition to big PIDs. Wherever practical, we will ship programs as anyPID programs, which run in the high range if possible — preserving numbers in the low range. With any major product, like CEO, you should check the PID-size type (via macro PIDSIZE or the Release Notice) before planning your big-PID system. You may find, as in the example below, that DG has anticipated your needs and shipped the program as an anyPID program.
- Generally, if you want to run many PIDs on your system, we recommend that you eliminate all small-PID restrictions from your programs (if possible). This will free you from concern about interprocess communication problems — and allow you to concentrate on other demands of your application.

By default, the Link program creates smallPID program files, although code within the program may be big-PID compatible. In a big-PID compatible system, make your site's programs anyPID or hybrid via the Link `/PID_SIZE=ANYPID` or `/PID_SIZE=HYBRID` switch.

- If you can't adapt all your programs for big PIDs (because a program has small-PID restrictions and its source code is lost, or for any reason), then you must find a way to execute the program below PID 255, from a hybrid program. This is one reason why the CLI is shipped as a hybrid program.
- You can make most commonly used DG hybrid programs — including text editors, but not the master CLI or PMGR — an anyPID program. Before doing this with any DG product, check the product Release Notice for warnings of any restrictions.
- You can check any program's PID-size type with macro PIDSIZE.CLI, and check a process's PID-size type with PED and the `/PIDSIZE` switch, described above.
- If, using big PIDs, a PID-size oriented error occurs, check the message in Chapter 17, the error chapter.

## Example of a Big-PID System

In this example, say you want to support 120 users, all of whom will (at one time or another) use CEO. Seventy users will use *only* CEO; at an average of two and one half processes per user, they will need a maximum of 175 processes. Fifty users will need the CLI as well as CEO; at three and one half processes per user, they also will need a maximum of 175 processes. This represents a total of 350 processes for users, so you definitely need big PIDs.

The next step is to clarify your users' needs for processes, as follows:

### General User

Needs the CLI and a DG utility program like the SED text editor *or* CEO Control Program and CEO Word Processor. Total averages three and one half processes.

User profile has CLI as the initial program. At least three sons are allowed.

### CEO-only User

Needs CEO Control Program and CEO Word Processor or other CEO program; occasionally needs CEO Spelling. Total averages two and one half processes.

User profile has CLI as initial program, but the initial IPC file is CEO.STARTUP.CLI, which chains to CEO, eliminating the CLI. At least two sons are allowed.

Next, you need to decide where processes will run. Assume 30 processes for AOS/VS, CEO, and the network. This leaves 225 PIDs available below 256 for users. You need a total of 350 processes for users. Thus, you need to have a minimum of 125 processes above 255.



There are several ways to have 125 processes run above 255. One way would be to run an anyPID CLI for users (that's 50 PIDs above 255) and anyPID text editors and Sort/Merge (say another 50 PIDs above 255). This is total of 100 PIDs above 255 — this might work, depending on what users want to do at any given time. The goal is to prevent anyone from seeing a *TOO MANY PROCESSES* error message. Unfortunately, 100 PIDs above 255 won't always be enough.

Perhaps CEO will offer an alternative. Most of the processes on the system will be CEO Control Program and CEO Word Processor processes. If either of these is anyPID, it will run above 255 — potentially freeing 120 PIDs (50 CLI-CEO users and 70 CEO-only users) below 255.

The CEO Control and Word Processor programs have many interrelationships and dependencies; you can't even *consider* changing their PID-size type. However, you can *check* the PID-size type by reading the product Release Notice or running macro PIDSIZE on the program. You find that the CEO Control Program is hybrid and the CEO Word Processor is anyPID. Having the Word Processor an anyPID program practically solves the problem — making DG-supplied text editors (like SED) into anyPID programs *will* solve it.

The next step is to sketch the arrangement of processes for each class of user when the system runs. The sketch looks something like Figure 15-4.

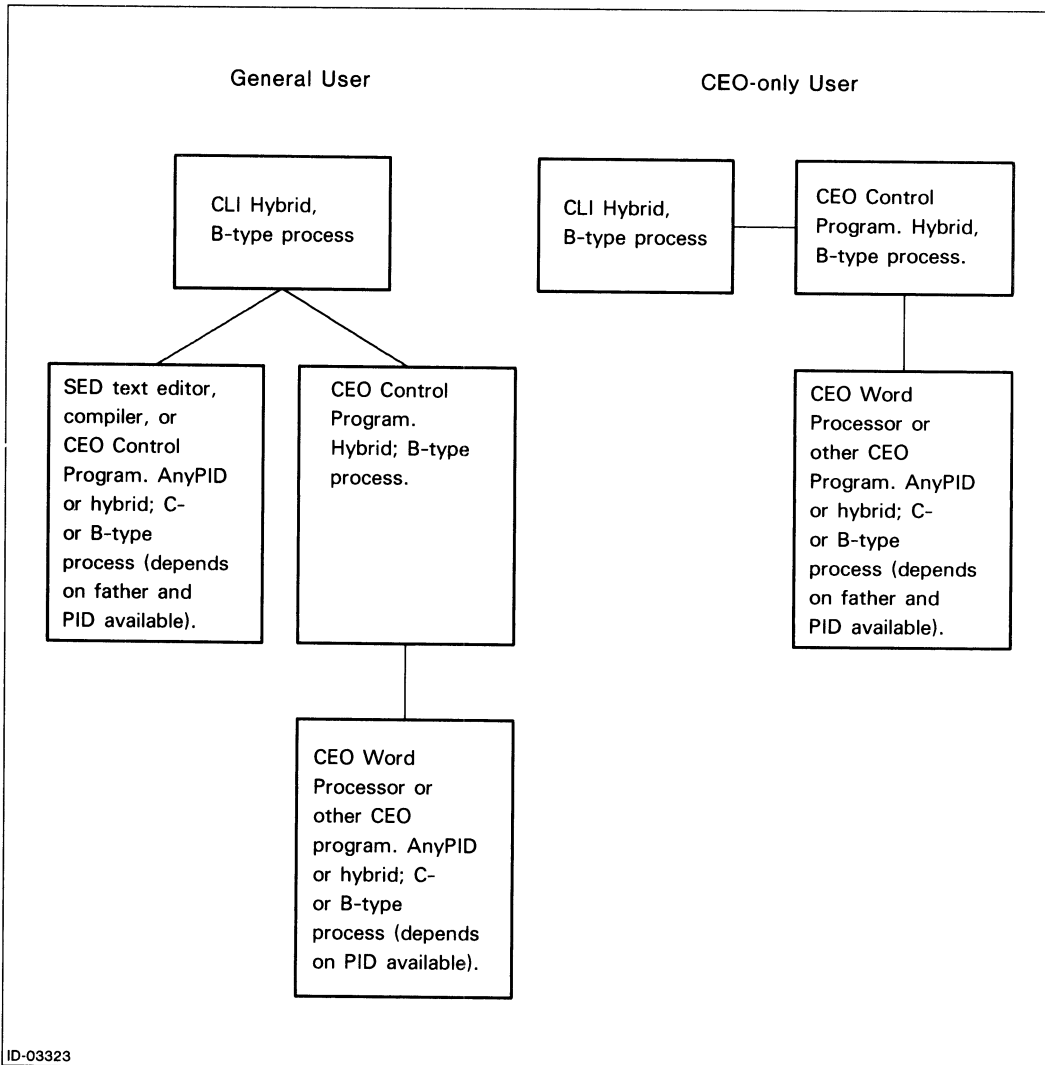


Figure 15-4. User Processes on a Big-PID System

Having planned your big-PID system, you can implement it. As Figure 15-4 implies, many processes may be forced to run as B-type if there are no PIDs available above 255. Therefore, although you really *need* only 125 or so extra processes, choose a larger VSGEN maximum, like 600 processes, to permit more processes to run above 255.

Then, as needed you create and/or edit users' profiles with PREDITOR. And, you run SPRED on the SED text editor and other text editors, changing their PID-size type to anyPID.

Ultimately, when the system runs under maximum load, the PID arrangement looks like this:

| PID       | Program(s)                                                                          | PID-size Type                             |
|-----------|-------------------------------------------------------------------------------------|-------------------------------------------|
| 1         | PMGR                                                                                | Hybrid program, B-type process.           |
| 2         | CLI                                                                                 | Hybrid program, B-type process.           |
| 3         | EXEC                                                                                | Hybrid program, B-type process.           |
| 4 - 25    | Network, data management, and CEO control processes; server processes.              | Hybrid program, B-type process.           |
| 26 - 255  | User CLI, compiler, other other program development processes; CEO Control Program. | Hybrid or AnyPID program, B-type process. |
| 26 - 255  | Old applications with smallPID restrictions that can't be changed (sources lost).   | SmallPID program, A type process.         |
| 256 - 380 | CEO Word Processor and DG text editor processes.                                    | AnyPID program, C-type process.           |

### Running an AnyPID CLI for Users

If more than 200 users will have the CLI as their initial program, you will probably need an anyPID version of the CLI. (Don't make the original CLI an anyPID program, since AOS/VS expects the master CLI to run as PID 2.)

An anyPID CLI behaves like any anyPID program: if a PID above 255 is available, the user's CLI will run as a C-type process. If a PID above 255 isn't available, the user's CLI will run as a B-type process, like the original CLI. (All sons of B-type processes are B-type processes, so the sons may consume all PIDs below 255 — but you can fix this relatively easily by running VSGEN again and allowing more PIDs.)

To create and use an anyPID CLI, copy the original CLI and make the copy an anyPID program. Then run PREDITOR on selected users' profiles and insert this CLI's name as the initial program. The dialog might go

```

*) DIR : )
*) COPY /V CLI_ANY.PR CLI.PR )           (Copy CLI program file.)
CLI.PR
*) COPY /V CLI_ANY.OL CLI.OL )           (Copy CLI overlay file.)
CLI.OL
*) ACL /V CLI_ANY.PR [!USER],WARE +,RE ) (Set ACL to allow access.)
CLI_ANY.PR
*) X SPRED CLI_ANY.PR )                 (Run SPRED, change PID-size type
...                                     to anyPID, apply changes, exit.)

*) X PREDITOR )                         (Run PREDITOR and specify
...                                     :CLI_ANY.PR as initial program
*)                                     for all desired users.)

```

There's one minor disadvantage to running CLIs of different PID-size types: one CLI will have a different name, thus it will not automatically be patched on updates or replaced when you install a new revision. After you *do* install a new revision of AOS/VS, delete the CLI not named CLI.PR, then copy CLI.PR, and run SPRED again as shown above.

## Big-PID Summary

AOS/VS supports up to 255 processes by default. You can create a system for more processes using the following steps.

1. At VSGEN, specify the desired number of processes by editing parameters, question *MAXIMUM NUMBER OF PROCESSES*. Then build, patch, test, optionally install, and run the system as usual.
2. For each program you want to handle any PID size, check for small-PID limitations by running macro *PIDCALL\_CHECK.CLI* as described above. If the macro finds call ?PSTAT, ?IREC, or ?EXEC, explore the code further; change and recompile if needed. If the macro doesn't find any of these calls, the program probably has no small-PID limitations.
3. Using SPRED, change the PID-size type of each program checked or changed in the previous step to hybrid or anyPID. Then apply changes to the program file and leave SPRED.
4. Don't change the PID-size type of any program supplied by DG until until you've checked for warnings — and found none — in the product Release Notice.

Most programs shipped with AOS/VS Revision 7.00 are hybrid programs. They can execute or communicate with programs of any PID-size type — but must run at a PID between 1 and 255.

## Multiple-Processor Computers

Some MV/Family computers, like MV/20000 Model 2s, have more than one main CPU. (In such systems, CPUs are called *job processors*, a standard term; the main job processor is called the "mother" processor; and processors other than the mother are called *child* processors.)

AOS/VS starts running on the mother processor, job processor 0. To enable AOS/VS to recognize and use the child processor(s), someone must issue the CLI command

**JPINITIALIZE n** (n is the number of the child; e.g., 1)

This command puts the child's processing power under AOS/VS control. To issue JPINITIALIZE commands, a process needs the System Manager privilege. Usually, JPINITIALIZE commands are issued by the master CLI, which has all privileges, in the UP macro.

You can release a child processor via the command JPRELEASE — which, again, requires the System Manager privilege. Shutting down AOS/VS releases all job processors, which means the JPRELEASE command isn't needed for shutdown. However, you might use JPRELEASE if you wanted to remove a child processor from the system and continue running with the mother processor.

The default mother and child processors are defined in hardware. However, you can change the definitions via the SCP command ATTACH. The ATTACH command tells the SCP to execute commands on a different processor, effectively making *it* the mother processor. This ability to change the designation of the mother processor can be useful if — for some reason — you don't want to or can't run the default mother processor, yet do want to run AOS/VS.

For example, the following dialog redefines the mother processor and starts bringing up AOS/VS on the new mother processor.

|                               |                                                                                                                                               |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <i>SCP-CLI&gt; RESET</i> )    | (Reset without an argument resets all job processors.)                                                                                        |
| <i>SCP-CLI&gt; ATTACH 1</i> ) | (Tell the SCP to execute commands on job processor 1, a child. Job processor 0 is the mother.)                                                |
| <i>SCP-CLI&gt; BOOT 24</i> )  | (Start up AOS/VS in job processor 1, the child. You would run AOS/VS in this processor only, not issue any JPINITIALIZE commands to the CLI.) |

## Classes and Logical Processors

Classes and logical processors allow you to give sets of processes more (or less) CPU time. They *may* be helpful in situations where processes need more CPU (job processor) time. They won't help in situations where processes are competing for memory (memory contention) or competing for access to disk.

Assuming processes need more CPU time, class scheduling can help in situations that require nonstandard scheduling. Such situations are those where you need to

- give one compute-bound process priority over another compute-bound process without starving the lower priority process. (Batch jobs are examples of compute-bound processes.)
- give interactive processes higher priority than compute-bound ones without the risk that the compute-bound processes will get *no* time.

A *class* is a set of processes for which you want special scheduling treatment. Usually, this treatment involves allotting a percentage of job processor (CPU) time. Each class has one or more user and program localities (called locality pairs). A process will run in a specific class if its user and program localities match those defined for the class.

The user locality for a process is defined with PREDITOR in a user's profile. If the profile allows, a user can change user locality (CLI command LOCALITY). The program locality is defined with the SPRED editor in the program file. User and program localities each range from 0 through 15.

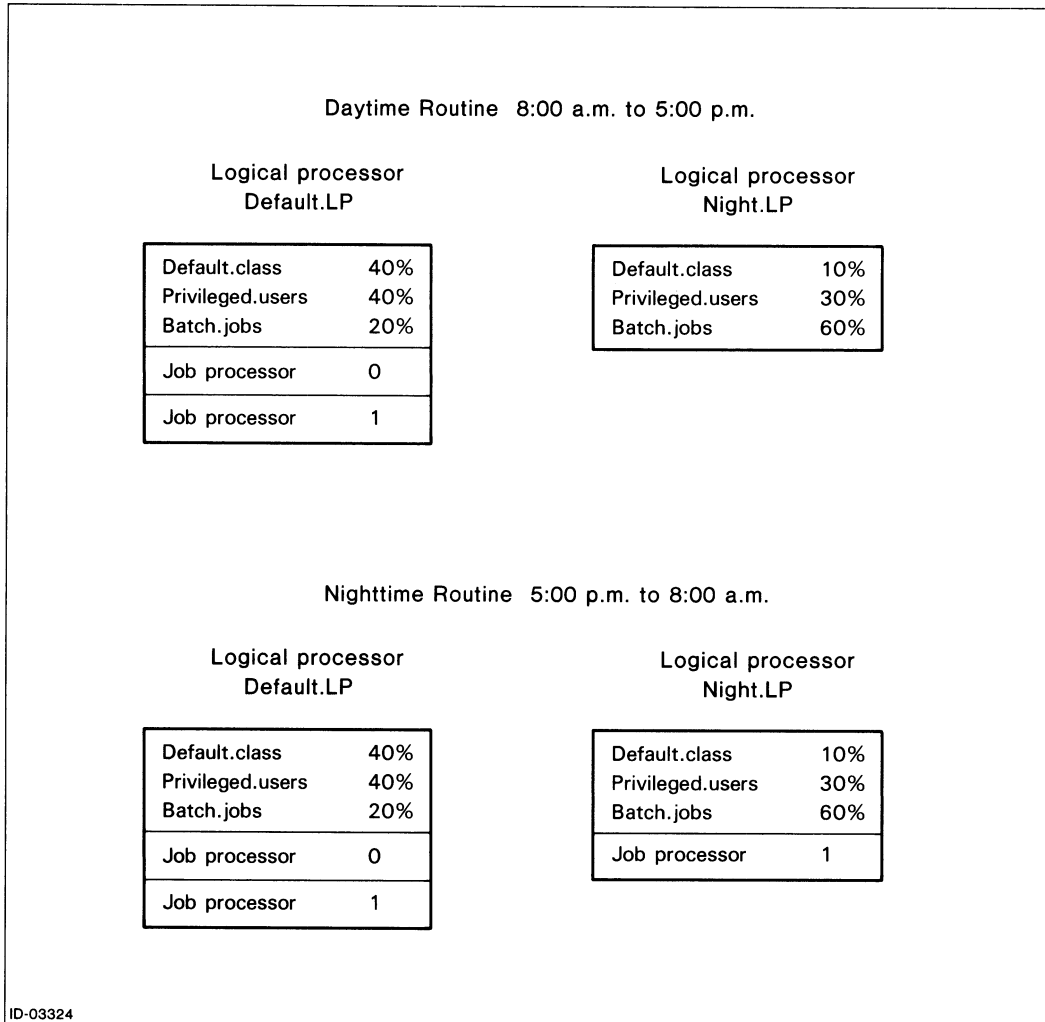
A *logical processor* is a scheduling arrangement that — usually — includes a set of classes. You can move a job processor from one logical processor to another — giving your site an “instant” new scheduling environment.

By default, class scheduling is disabled.

You can create and use classes and logical processors, enable class scheduling, and monitor class use via AOS/VS system calls. Or, much more conveniently, you can use the optional Class Assignment and Scheduling Package (CLASP).

## Classes and Logical Processor Example

An example of an application of class scheduling using two logical processors — on a computer with two job processors — appears in Figure 15-5.



*Figure 15-5. Class and Logical Processor Example*

Figure 15-5 shows a logical processor that favors the default and privileged classes (interactive users) during the working day. At night, one of the job processors is moved to another logical processor — giving computing time to the processes in classes on both logical processors computing time.

## Disk Space and Performance

AOS/VS must make at least one disk access whenever any process wants to read, write, create, or delete a file. In an active system, it may make hundreds of accesses each minute.

When your system is new and its LDU(s) hold relatively little material, file access time is very short. (Creating LDUs is described in Chapter 12, "The Disk Formatter.") But as files accumulate, AOS/VS and the disk hardware may require more time to access files.

There are several things you can do to streamline disk access and keep performance near its optimum. There are four factors involved.

- Overall free space
- File fragmentation
- Bitmap and overlay area addresses
- Directory hash frame size

## Overall Free Space

The amount of free disk space usually affects performance more than any other factor. When more than 70% of an LDU's blocks are occupied, the read/write heads must spend significantly more time moving over the disk to find free space whenever a process creates a file. Above 70% of capacity, the access time needed rises steeply. Much above 70%, everyone on the system may note increased response time. If more than 95% of an LDU is used, you should take immediate action to free some space.

The most convenient way to handle the space factor is by limiting each user's space in his or her PREDITOR profile. Chapter 7, the PREDITOR chapter, explains several ways to approach this. If disk space is tight, and you don't want to acquire more disk units just now, you can ask users to delete all their old .ST, .PR, and .OB files. Temporary files and break files (suffixes .TM, .TMP, and .BRK) can also be deleted; so can backup files (.BU suffix) after the file system is archived (backed up). Having users delete files they don't need can open up a considerable amount of space.

There may also be obsolete files in :UTIL, and obsolete user directories in :UDD. You can simply delete the former via the CLI. You should dump the latter for the record, then use the PREDITOR D command to delete both the obsolete profile and user directory.

Use the CLI command SPACE : (or other control-point directory name) to check number of disk blocks used and remaining. For example, on a 190-megabyte (370889-block) LDU:

```
) SPACE : )  
MAX 370889, CURR 259662, REM 111277      (About 70% of the blocks are used.)
```

(Time passes.)

```
) SPACE : )  
MAX 370889, CURR 315260, REM 55629      (About 85% of the blocks are used.)
```

Get users to clean up.

```
) SPACE : )  
MAX 370889, CURR 240430, REM 130459      (Better; under 70% of the blocks are  
used.)
```

After a large-scale house cleaning, you can run FIXUP to reduce the disk space consumed by directory files.

## File Fragmentation

Each AOS/VS file has one or more data elements. (An element is (by default) four disk blocks, but anyone can specify many more blocks — creating a file with many contiguous blocks — with the CLI CREATE command and /ELEMENTSIZE switch.)

After an LDU begins to fill up, files become fragmented: AOS/VS must search farther on disk for space for new file elements. For example, one element could be near an outer cylinder, and the next available space near an inner cylinder. To write the next element, the system must move the read/write head all the way across the disk.

File fragmentation often occurs when an LDU is nearly full. Simply deleting files (as above) may or may not eliminate it. If cleaning up the LDU doesn't help, and the LDU's unit(s) appear to be doing a lot of seeks, you can suspect fragmentation. Or, you can use the DISCO program described in Chapter 9.

To minimize or eliminate fragmentation, have the LDU cleaned up as above. Then dump all files from the LDU and run a Disk Formatter Full format on it, as described in Chapter 11.

Make sure the bitmap and overlay area are near the "middle" of the first disk. Then reload all the files and see if performance picks up. It usually will.

You can always eliminate fragmentation of a specific file by creating it with a large element size, but this is impractical and inefficient for most files. It is useful — and recommended — for database files that will be used by data management systems like INFOS II.

## Bitmap and Overlay Areas

AOS/VS must write to the bitmap every time it allots a new disk block to a file. It must access the overlay area every time it needs a system page that isn't already in memory. Thus the addresses of these tables can affect performance.

By default — during the Full format that creates an LDU — the Formatter puts the bitmap 3/8 of the distance across the first disk in the LDU. For a system disk, the overlay area follows the bitmap. The Formatter defaults are good general-purpose addresses.

If you use a multiple-disk LDU for a very large file (like a database file that won't fit on one disk), the best place for the bitmap is at the beginning of the LDU. This allows for the largest contiguous amount of file space.

You can check the bitmap and overlay area addresses with a Disk Formatter Partial format run. If you decide to move the bitmap and overlay area (if any) for better performance, and you've been using the LDU for a while, the area you want is probably already allocated to files. The best course is to dump all files from the LDU, run a Full format and put the bitmap (and and overlay area) where you want, and reload the files. This will also reduce fragmentation on the LDU.

## Directory Hash Frame Size

The hash frame size is part of the algorithm that AOS/VS uses to decide where to record any new filename. You don't need to understand how this algorithm works, but you may want to know how to use hash frame sizes to speed up file access.

Each directory has a hash frame size, assigned when the directory was created. The default hash frame — used when the creating process omits a size — is 7. This is suitable for medium size directories. But there are a few directories that contain many files. UTIL, for example, may be home to hundreds of files. And UTIL is an often-used directory.

The best hash frame size for a directory depends on the number of files the directory will contain and the lengths of the filenames. If you expect the directory continually to grow, adjust the projected number of files for growth. You can determine a good hash frame size as follows:

$$\text{size} = \text{number-of-files} / \text{number-of-filenames-that-fit-in-a-disk-block}$$

If filenames are quite short (1 through 10 characters), 31 filenames fit in a disk block. If the filenames are very long (28 through 31 characters), 10 names fit in a disk block. And if filenames vary (as is generally true), assume that 20 filenames will fit in a block.

After deciding on a hash frame size, create the directory, using CREATE with the /HASHFRAMESIZE= switch. The hash frame size is transparent to users; only AOS/VS sees it, so people can access the directory just like any other directory. To check a directory's hash frame size, use FILESTATUS' /HASHFRAMESIZE switch.

If a directory already exists (as UTIL does), and you want to change its hash frame size, you must dump all its files, delete it, create it with the desired hash frame size, and reload the dumped files.

For example, let's assume you've been using your system for a while. UTIL now contains some 300 files, and you want to change its hash frame size. Dividing 300 by 20, and allowing for growth, you decide on a new hash frame size of 17. To implement it, you'd follow these steps:

- Dump UTIL to magnetic tape (DIR :UTIL I, DUMP/V tape I), or to diskettes (DIR :UTIL I, OPERATOR ON I, DUMP/V @LFD:valid:filename I).
- Check UTIL's hash frame size, then delete and recreate it with the following CLI commands.
 

```
* ) FILES/HASH :UTIL I
UTIL 29

* ) DELETE/V # I
... (Files deleted) ...

* ) DIR :I
* ) DELETE/V UTIL I
DELETED UTIL

* ) CREATE/MAX=200000/HASH= 17 UTIL I
```
- Mount the dump tape(s).
 

```
* ) DIR :UTIL I
* ) LOAD/V tape I
```

The hash frame size can make a significant difference in access time to files in *any* directory. For this reason, DG ships AOS/VS system directories with varying frame sizes:

```
:HELP      43
:SYSGEN    7
:UTIL      29
```

These hash frame sizes are based on a large system running CEO, INFOS II, PRESENT, COBOL, XODIAC, and FORTRAN 77, among other things. Generally, these sizes will work well. If you want to change these, or the hash frame size of *any* directory on your system, follow the procedure shown above.

## Using LDUs Shared by Two Computer Systems

One or more LDUs composed of model 6236 and model 6239 disks can be shared between two MV/Family CPUs. (Each computer must have a system disk of its own.) The main advantage of this dual-port arrangement is fast recovery if one system fails — a big advantage for some database applications.

Each computer system runs independently. The system disk must be built, VSGEN run, and queues created as if the computers were not connected (described in Chapters 3, 4, and 5).

You can format the shared LDU from either computer — and, via the Disk Formatter, give the LDU a unique ID and meaningful LDU name. Give the shared LDU a restrictive ACL (for example, null). This will help prevent unauthorized people from initializing the LDU.

You also need to protect the LDU's :PER entries. It's possible, before initialization, for a user to read or write to any of the LDU's disks as a physical device (for example, by typing DUMP/V @DPJ2 MYFILE I). To prevent this, the UP macro in both computer systems should set the unit ACL(s) in :PER to null or for very specific access. For example,

```
ACL/K @DPJ2
```

When one system wants to use the LDU, it can turn Superuser on, initialize the LDU, and change its ACL as needed. Then, users and programs can access it like any LDU, by directory name. After initialization, the LDU is part of the file system, and access controls remain in force.



An LDU cannot be initialized if it's already initialized — this prevents the second system from initializing the shared LDU while the first system is using it. After a system has released the shared LDU, it can be initialized by *either* system.

### Example of a Shared-LDU Application

Assume that two MV/Family systems, each with two 354-Mbyte LDUs, share a 354-Mbyte LDU — shown in Figure 15-6.

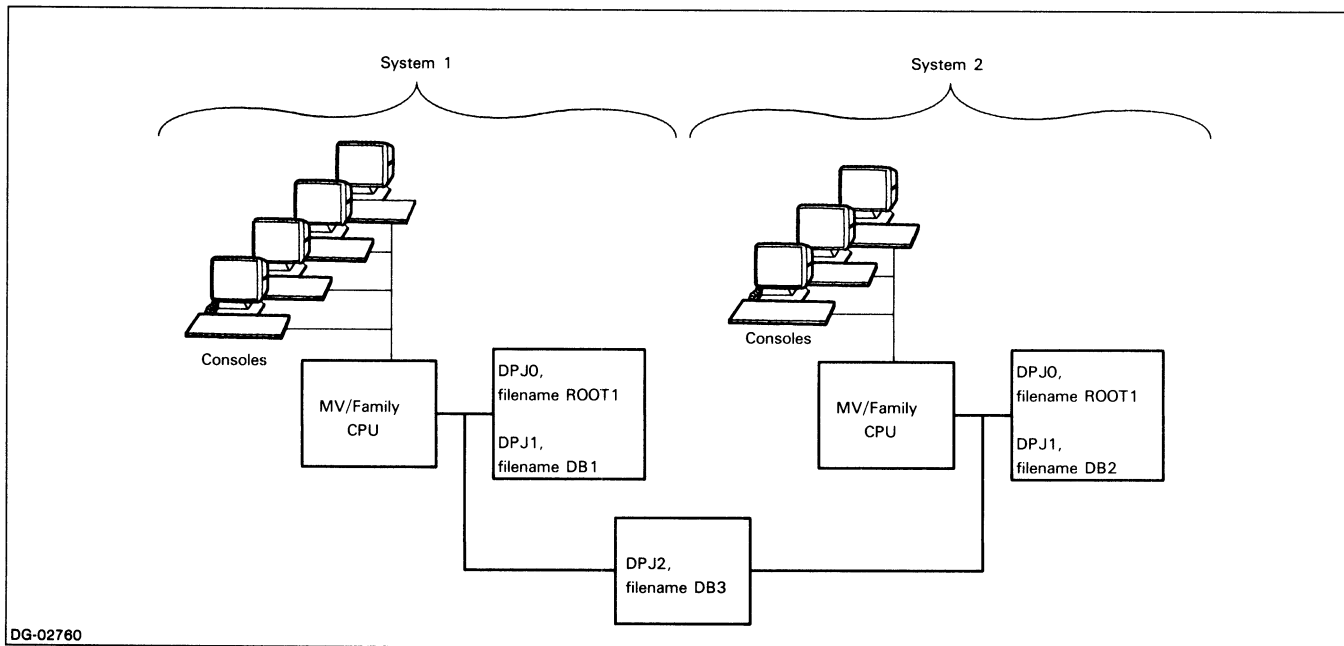


Figure 15-6. MV/Family Systems with a Shared LDU

The site uses the two systems and shared LDU as follows:

- |                         |                                                                                                                                                                                                                                                                  |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8:30 a.m. – 5:00 p.m.   | During a normal working day, System 1 is used for interactive access and update of the primary database LDU, DB1. Three times each day, during coffee breaks and lunch, System 1 initializes the shared LDU, copies the updated database to it, and releases it. |
| 5:00 p.m.               | System 2 is used for program development, with a copy of the most current database on its database LDU, DB2. System 2 has a copy of System 1's applications programs.                                                                                            |
| 5:30 p.m.               | As the working day ends, the load slackens on System 1. Once again, System 1 copies the DB1 database to the shared LDU and releases it. System 1 will remain up through the second and third shift.                                                              |
| 1:00 a.m. and 8:30 a.m. | System 2 initializes the shared LDU and copies the database to its database LDU (DB2). Then, System 2 backs up the shared LDU using its own tape unit(s).                                                                                                        |
| 1:00 a.m. and 8:30 a.m. | At the end of the second and third shift, System 1 copies the updated database to the shared LDU.                                                                                                                                                                |

The next working day, all this repeats, with System 1 updating the on-line database and System 2 using a copy of the database for program development. This arrangement has several advantages:

- *Maximum up time.* Most of the time, the backup database is not open. If System 1 fails while the backup database is closed, System 2 need only initialize the shared LDU and bring up its copy of the application. One or two data entry operators can walk over from System 1 to continue interactive operations, if needed — and database operations can continue. The database is current up to the last update — never more than one shift old.

In the worst case, if System 1 fails while updating the database, the site must back out the updates and run FIXUP on the shared LDU. Even so, System 2 can take over relatively quickly.

And, the primary system need not be shut down for its database to be backed up.

- *Database integrity.* The primary database need never be used for program debugging. As new programs are written, programmers test them with the database on DB2. After testing, the programs are brought into the primary application, running on System 1.
- *Current test base.* Programmers have a nearly current copy of the database for developing and debugging their programs. Even if they destroy the database, they can restore it easily from either the backup tape or the shared LDU.

## Using Logical Disk Mirroring for High Availability

Model 6236- and 6239-class disks permit logical disk mirroring. *Logical disk mirroring* causes the operating system to maintain two logically identical copies of a mirrored LDU. Where performance is not an issue, mirroring may be of interest.

Disk mirroring provides high data availability: with two copies of the mirrored LDU (each of which is called an *LDU image*), the system continues to run on the “good” image if the other image is taken out of service (as for a backup) or goes “bad” (suffers a hardware error).

But disk mirroring may or may not have a performance cost. Each image in a mirrored pair is logically — not physically — identical to the other. This means that a write to two disks will take longer than a write to one disk. On the other hand, the disk controller optimizes each read by reading from the disk where the read/write head is closer to the data. Thus, there’s no way to figure the performance cost of logical disk mirroring since the ratio of reads to writes is application specific.

Figure 15-7 shows a typical case of mirroring. This site has a model 6237 disk drive (three 354 Mbyte disks on one controller). DPJ0 is the system disk. DPJ1 and DPJ2 are mirrored; each holds the LDU named UDD1.

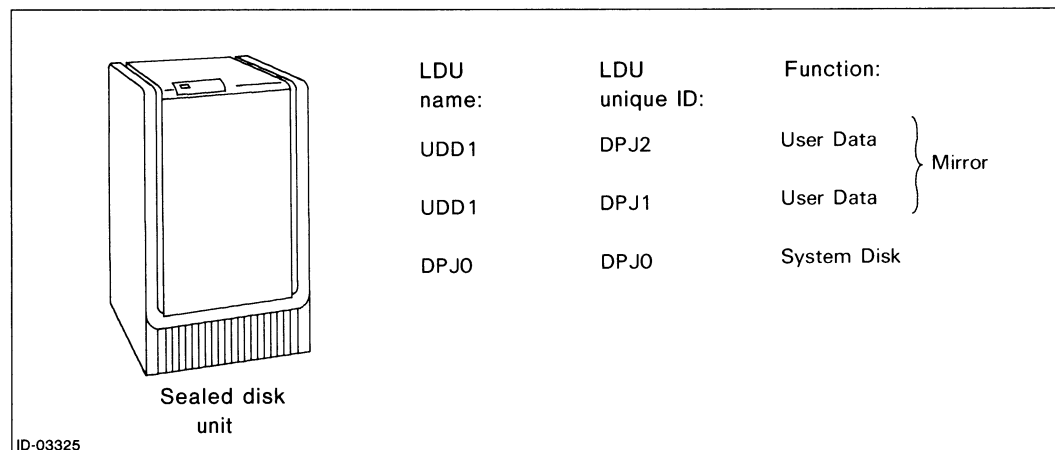


Figure 15-7. Logical Disk Mirroring, Model 6237 Disk Drive

As Figure 15-7 suggests, to implement logical disk mirroring, you must have model 6236- or 6239-class disks. Disks to be mirrored must be the same size and on the same controller. When formatting a mirror, make the following the same for both images: LDU name, bad block table entries, and the sizes and addresses of the remap and the diagnostic areas. The LDU unique IDs, on the other hand, must be different. Chapter 12 shows how to format a mirrored LDU.

The rest of this section explains how to use mirroring. The subsections are:

- Starting Mirroring
- Stopping Mirroring
- Backing Up a Mirror
- Checking Mirror Status
- Mirroring Messages and Errors

## Starting Mirroring

How you start (initialize) a mirror depends on its state: A mirror is *synchronized* if both of its images are the same, *unsynchronized* if the images differ.

Start a *synchronized mirror* using the format

```
INITIALIZE unitname!unitname [unitname!unitname]
```

Unitname!unitname repeats for each disk in the LDU. For now, let's assume that you want to start the LDU UDD1, consisting of two units, DPJ1 and DPJ2. You'd type

```
*) INITIALIZE @DPJ1!@DPJ2 )
```

Start an *unsynchronized mirror* in two steps. First, initialize the preferred image (this is almost always the more recent image) using the format

```
INITIALIZE/NOMIRROR unitname [unitname]
```

Again, one image *can* span several disks. But let's assume you want to start unit DPJ1, one image on one disk. You'd type

```
*) INITIALIZE/NOMIRROR @DPJ1 )           (Initialize one image with /NOMIRROR)
UDD1                                       (The system returns the LDU name)
```

Second, initialize the other image using the CLI command MIRROR, using the format

```
MIRROR/SYNC LDUname unitname [unitname]
```

Once again, one image *can* span several disks. In our example, however, you'd bring in the second image by typing

```
) MIRROR/SYNC UDD1 DPJ2 )
```

This on-the-fly mirroring starts a synchronization process that may take only a few minutes or may take much longer, depending on how much data must be copied from one image to the other. Synchronization can take up to two hours for a 354 Mbyte disk; up to three-and-a-half hours for a 592 Mbyte disk. While the synchronization is going on, normal system activity does, too: the system writes to both disks, but reads only from the "good" disk.

When the synchronization is done, the system logs a message to the system log (if on) and to the system console. In our example, this would be

```
LDU image 'DPJ2' of the LDU named 'UDD1' is now synchronized
```

One kind of unsynchronized mirror is an out-of-phase mirror. In an *out-of-phase* mirror, the initialized LDU image is less recent than the LDU image you're trying to start. An out-of-phase mirror is quite unexpected, but could happen in the rare case. Because it is unexpected, the operating system will send you an error message and will not start the mirror. To forestall this, you can use the format

```
MIRROR/FORCESYNC LDUname unitname [unitname]
```

For example, suppose DPJ1 is already initialized and you want to bring in DPJ2, which is more recent. You'd type

```
*) MIRROR/FORCESYNC UDD1 DPJ2 )
```

Finally, you can also use the /WAIT switch with either /SYNC or /FORCESYNC. With /WAIT, the issuing CLI pends until the synchronization has completed, which can take several hours.

## Stopping Mirroring

You need to stop mirroring before you can do a backup. (By the way, in case of a hard disk error, the system will stop mirroring for you. It "breaks" the mirror by removing the "bad" image, continues to run on the good image, and sends a message to the error log and the system console. You have to fix the hardware problem and start resynchronization. See "Mirroring Messages and Errors" at the end of this section or the specific errors in Chapter 17.)

To stop mirroring, use the CLI command RELEASE to release the LDU. For example, to take LDU UDD1 out of service, you'd type

```
*) RELEASE UDD1 )
```

If you then want to run on DPJ1 of UDD1, you'd have to initialize (with the INITIALIZE/NOMIRROR command) DPJ1.

## Backing Up a Mirror

How you back up a mirror depends on whether you use the CLI command DUMP (or the DUMP\_II utility) or either MSCOPY or PCOPY. Using the DUMP or DUMP\_II approach, you *should* release the LDU (to make sure that files are closed). Using MSCOPY or PCOPY you *must* release the LDU. Whichever approach you take, however, you can immediately reinitialize one image (using INITIALIZE/NOMIRROR), and continue to run. "Bouncing" the LDU can take less than a minute.

While users continue to use the system, you can proceed with the backup. When you are done, "bounce" the system again, reinitialize, and resynchronize.

(Understand that if you continue to run with one image, the LDUs are not synchronized until several hours after the backup. For this reason, if having two copies of your data is important, you may choose not to run with one image (in the DUMP or DUMP\_II approach), or may prefer to release both images, backup either of them, and then start again. Each of these alternatives provides full data integrity.)

If you use DUMP or DUMP\_II, before you can back up an image, you must initialize it in a different directory. (You need to initialize the image in a different directory because you can't initialize two LDUs with the same name in the same directory.)

After you have grafted the LDU onto an appropriate directory, you can then use DUMP or DUMP\_II to perform the backup, as described in Chapter 10.

If you use the MSCOPY or PCOPY approach, you don't initialize the second image in a different directory. Instead, you type its name to the MSCOPY or PCOPY prompt, and proceed with the backup as described in Chapter 10.

With either method, when the backup is complete, release the LDU and make the root directory your working directory. Initialize the two images (if both were released and one was not reinitialized), or initialize (with /NOMIRROR) one image and then the other (with MIRROR/SYNC).

## An Example of Backing Up a Mirrored LDU Image

Backing up a mirrored LDU requires a brief pause in system activity. Because you want to make sure that files are closed, it's best to shut the system down, even though briefly. Users should exit from their text editors. If you are running a CEO system, shut it down. As soon as it is safe to do so, release the LDU. (You don't have to do this with the DUMP or DUMP\_II approach, but it's recommended.)

If you use DUMP or DUMP\_II for backup, you can initialize (/NOMIRROR) one of the images, restart the CEO system and/or notify users that they may safely resume their work. Then, after this brief pause, you can start the backup.

Here is an example of a procedure and dialog you could use to back up a mirrored LDU image using DUMP or DUMP\_II.

1. Inform people of the time of the backup, and that the system will be down briefly at that time.
2. Just before the appointed time, prevent users from logging on by issuing the command  
`CONTROL @EXEC DISABLE / ALL`
3. Have users close their files or bring down CEO.  
`) BROADCAST About to do a backup. Please log off. )`  
or  
`) BROADCAST CEO coming down. Please log off. )`
4. If you run CEO, shut it down.  
`) CEO.SYSTEM STOP`
5. When ? shows that the system is quiescent, proceed.
6. Turn on Superuser and make the root your working directory.  
`) SUPERUSER ON`  
`*) DIRECTORY :`
7. Now, release the LDU.  
`*) RELEASE UDD1`
8. Initialize one of the UDD1 images:  
`*) INITIALIZE /NOMIRROR @DPJ1`
9. Enable all consoles.  
`CONTROL @EXEC ENABLE / ALL` (Users will see the log-on banner or screen and can resume their work)
10. Make a directory other than the root your working directory. In our example, the directory :BACKUP is that directory. Type  
`*) DIRECTORY :BACKUP` (Move to a different directory)
11. Initialize the "second" UDD1 image.  
`*) INITIALIZE /NOMIRROR @DPJ2` (Initialize DPJ2 with /NOMIRROR)
12. Perform the backup, using DUMP or DUMP\_II.  
... perform the backup ...  
... (time passes) ...  
... backup is complete ...

13. After the backup is complete, you need to bring DPJ2 back into play as a synchronized mirror. Do this with these commands:

```
*) RELEASE UDD1 )      (Release DPJ2)
*) DIRECTORY : )      (Make the root your working
                      directory again)
*) MIRROR / SYNC UDD1 @DPJ2 ) (Start the resynchronization
                              process)
```

... (time passes) ...

*LDU image 'DPJ2' of the LDU named 'UDD1' is now synchronized*

## Checking Mirror Status

As you have seen, how you start a mirror always depends on knowing the exact state of each of the images. The MIRRORINFO utility reports on the status of initialized mirror images.

To run MIRRORINFO, you need to have the PREDITOR privilege Superprocess and read access to the system's symbol table file. For example, to execute MIRRORINFO, use the format

```
X MIRRORINFO / ST=system.ST [/L=outputfile/O=outputfile]
```

where

**system.ST** is the symbol table filename of the system that is currently running.

**L=outputfile** is @LIST if you omit outputfile or a file that MIRRORINFO creates if it doesn't exist or appends to if it does exist.

**O=outputfile** is a file that MIRRORINFO creates, or deletes and recreates if it does exist.

A typical display looks like this:

*Mirror 1 - state is: synchronized LDU name: UDD1*

*First image  
unique ID: DPJ1  
unit: DPJ1*

*Second image  
unique ID: DPJ2  
unit: DPJ2*

MIRRORINFO can report on three states, summarized in Table 15-4.

**Table 15-4. Mirror States**

| <b>MIRRORINFO reports</b>       | <b>Means</b>                                                                                                                                                  |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>synchronized</i>             | Both images are the same. They are initialized and contain the same data.                                                                                     |
| <i>synchronized in progress</i> | The images differ, but the system is resynchronizing the mirror. (You typed INIT / NOMIRROR unitname and MIRROR / SYNC LDUname otherunitname)                 |
| <i>broken</i>                   | Either there is a hard disk error or someone aborted a command to resynchronize the mirror. You must fix the hardware problem and/or restart synchronization. |

## Mirroring Messages and Errors

When using logical disk mirroring, you may get one of the messages reported in Table 15-5. (For convenience, the error messages also appear in Chapter 17.)

**Table 15-5. Mirroring Messages and Errors**

| Message                                                                                 | Meaning and Action                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>CANNOT INIT AN LDU IMAGE THAT WAS PREVIOUSLY BEING SYNCHRONIZED</i>                  | Someone aborted a command line that contained a MIRROR/WAIT command using this LDU image as an argument, or there was a system panic or hardware failure. Since you cannot initialize the image specified in the INITIALIZE command line, release the LDU containing the other image and reverse the order. Issue the INITIALIZE command, giving the other image as an argument. |
| <i>CONTROLLER DOES NOT SUPPORT LDU MIRRORING</i>                                        | In AOS/VS Revision 7.00, logical disk mirroring requires 6236- or 6239-class disks. You tried to mirror an invalid type of disk, or your disk microcode is the wrong revision.                                                                                                                                                                                                   |
| <i>INCOMPLETE MIRRORED LDU SPECIFIED</i>                                                | You used the CLI INITIALIZE command to start mirroring, but specified only one LDU image. Type the command again, but specify two images using the format<br><br>INITIALIZE unitname!unitname<br><br>or use the command INITIALIZE/NOMIRROR if one image is not available.                                                                                                       |
| <i>LDU DOES NOT EXIST</i>                                                               | The LDU specified with the MIRROR command does not exist. Check the command line.                                                                                                                                                                                                                                                                                                |
| <i>LDU FORMAT MISMATCH - NOT A VALID MIRROR</i>                                         | The bad block table entries or the sizes or addresses of the remap areas on the two images differ. You must run a Disk Formatter Partial format on the disks and make the values match.                                                                                                                                                                                          |
| <i>LDU IMAGE 'LDU unique ID' OF THE LDU NAMED 'name' HAS BEEN REMOVED BY THE SYSTEM</i> | The system has removed one of the LDU images because of a hardware failure. Fix the problem. Then, start mirroring again with the CLI command MIRROR/SYNC.                                                                                                                                                                                                                       |
| <i>LDU IMAGE 'LDU unique ID' OF THE LDU NAMED 'name' IS NOW SYNCHRONIZED</i>            | You started a mirror synchronization using the CLI command MIRROR. The synchronization is complete.                                                                                                                                                                                                                                                                              |
| <i>LDU IS NOT MIRRORED</i>                                                              | You used the CLI INITIALIZE command to initialize a synchronized mirror, but the LDU is not part of a mirror.                                                                                                                                                                                                                                                                    |
| <i>LDU NAME MISMATCH - NOT A VALID MIRROR</i>                                           | You used the CLI INITIALIZE or MIRROR command to start mirroring, but the two LDUs have different LDU names. Check the command line or run a Disk Formatter Partial format on each LDU and make the names the same.                                                                                                                                                              |
| <i>LDU SIZE MISMATCH - NOT A VALID MIRROR</i>                                           | You used the CLI INITIALIZE or MIRROR command to start mirroring, but the LDUs differ in size. Make sure the disks are the same size. If they are, check to see if the size of the diagnostic area on each disk is the same. If not, run the Disk Formatter Full format on the second disk and make these values (and the sizes) the same.                                       |

(continues)

**Table 15-5. Mirroring Messages and Errors**

| Message                                                                            | Meaning and Action                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>LDU UNIQUE IDS ARE NOT UNIQUE - NOT A VALID MIRROR</i>                          | You used the CLI INITIALIZE or MIRROR command to start mirroring, but the LDU unique IDs are the same (they must be different). Run a Disk Formatter Partial format on either disk and make the LDU unique IDs different. Suggestion: make the LDU unique ID the same as the disk unit name (for example, DPJ1).                                                                                  |
| <i>LDU WAS RELEASED DURING SYNCHRONIZATION - LDU IS NOT SYNCHRONIZED</i>           | Someone released an LDU image before a MIRROR/WAIT command that specified this image had completed. Issue the command INITIALIZE/NOMIRROR, giving as an argument the name of the preferred mirror. Then, issue the command MIRROR/SYNC, giving the other image as an argument.                                                                                                                    |
| <i>MIRRORED LDU IS NOT SYNCHRONIZED</i>                                            | You used the CLI INITIALIZE command to start mirroring, but one of the images is less recent than the other. (If you don't know which is more recent, you can run FIXUP.) Then, use the CLI command INITIALIZE with the /NOMIRROR switch, giving the name of the more recent image as the argument. Finally, use the CLI command MIRROR/SYNC, giving the name of the other image as the argument. |
| <i>MIRRORED LDU IS OUT OF PHASE</i>                                                | You used the CLI MIRROR command to start mirroring, but the LDU image is more recent than the initialized LDU image. If this is what you want to do, use the command MIRROR/FORCESYNC.                                                                                                                                                                                                            |
| <i>MIRRORED LDU SYNCHRONIZATION FAILED</i>                                         | An error condition occurred before a MIRROR/WAIT completed. Fix the problem and start over.                                                                                                                                                                                                                                                                                                       |
| <i>SYNCHRONIZATION OF LDU IMAGE 'LDU unique ID' OF THE LDU NAMED 'name' FAILED</i> | Someone aborted a command line that contained a MIRROR/WAIT command, or they released the LDU, or there was a problem with the hardware. If there was a hardware problem fix it. In all cases, use the CLI command MIRROR/SYNC, giving the name of the other image as an argument.                                                                                                                |

(concluded)

## Windowing with DG/VIEW

Windowing allows a user to run one or more processes in windows (rectangular areas on the console screen). Each process takes input and displays output in its window. A major advantage to windowing is the ability to see what's happening with several programs simultaneously.

Windowing with DG/VIEW (DG's window management program) is supplied with DS/7000-series computers. DG/VIEW is an independent product, which you (or someone) must install from tape or diskette. It works on pixel-mapped (graphics) consoles only.

Users can execute DG/VIEW via the XEQ command, or you can make it a user's initial program via PREDITOR. Its pathname is :DGVIEW\_UTIL:SYSTEM:DGVIEW.PR.

In DG/VIEW, via menu entries, a user can choose his or her own list of applications from a predefined program list. The predefined program list can include often-used programs that are appropriate for windows, like the CLI, CEO or SED editor. And a user can add other applications, like CAD/CAM software that you've installed. After a user changes his or her applications list, DG/VIEW stores the modified list for that user (not for everyone) and displays it in menu form when he or she runs DG/VIEW.

You can modify the predefined program list (displayed for users when they want to add a program to their menus) as follows.



Pathname and other information on programs in the predefined program list is maintained in a *program information file* (.PIF file) — in directory :DGVIEW\_UTIL:PIFS. DG/VIEW looks for .PIF names in this directory and displays the name (without .PIF) on the predefined program list.

Manufacturers can create .PIF files and ship the files with their software, or you can create them with the DG/VIEW program information editor. When you run this editor (from the DG/VIEW Main Menu), it asks for program pathname and other information, then creates the .PIF file (by default in your user directory). The .PIF file has the program filename with the suffix .PIF instead of .PR. With Superuser on, you can then move the .PIF file to directory :DG\_VIEW:PIFS and change the .PIF (and program) ACL to allow access. Thereafter, the program name will appear in users' predefined program lists and they can add it to their initial DG/VIEW menus very easily.

For example, say there's program :UTIL:ANYPROG.PR, which may be an application from a vendor other than DG, or a DG program (like CEO or the CLI), or a program written at your own site. ANYPROG can run in a window, and you want all users to have access to it from DG/VIEW. You *could* have them all add it by pathname to their program lists — or you could create a .PIF file and move it to directory :DG\_VIEW:PIF.

To create a .PIF file, you'd

- Run DG/VIEW and use the program information editor to create a program information file (for example, in your user directory, so the pathname is :UDD:your-username:ANYPROG.PIFS).
- Move the PIF file and change ACLs as follows:

```
) DIR :UDD:[username] )  
) SUPERUSER ON )  
) MOVE/V :DG_VIEW:PIFS ANYPROG.PIF )  
  ANYPROG.PIF  
) ACL :UTIL:ANYPROG.PR +,E )  
) ACL :DG_VIEW:PIFS:ANYPROG.PIF +,RE )  
) SUPERUSER OFF )  
)
```

Now, each user who wants to add a program to his or her initial DG/VIEW menu will see the name of ANYPROG and can add it easily. Any program supplied with AOS/VS Revision 7.00 (and any program that can run on a DASHER D460 console) can run in a window.

DG/VIEW users can make menu choices via terminal keys or, if the terminal has one, a mouse or stylus.

After users specify the applications they want (and assuming someone has provided .PIF files for needed applications or users know where the applications are), DG/VIEW needs little attention. It maintains all data and files automatically. However, DG/VIEW doesn't provide a way to delete its user directories (as you might want to do if you deleted a user account); to do this, turn Superuser on and type DELETE :DGVIEW\_UTIL:USERS:username: ).

By providing a base for a menu-driven system, DG/VIEW can help people become productive users quickly. *Using* the DG/VIEW product is further described in *Using DG/VIEW*. Windowing concepts are explained in *AOS/VS System Concepts*.

## Routine Procedures

This section touches on some things you might want to consider doing regularly to keep things running well.

- Backup procedures. These are very important and ideally they will be done each day. You can use the DUMP command or DUMP\_II utility, the PCOPY program, or MSCOPY program. Chapter 10 explains CLI macros for backup that are shipped with AOS/VS.
- Log files. The system log (SYSLOG) and the error log record user account and error information.

If you want system logging, consider starting it in the UP macro. The system log file (SYSLOG) grows fast, so someone should dump and delete it regularly. This is critically important with full detail logging, since the system will panic if it runs out of log space. For logging to be worthwhile, reports should be generated and examined routinely (for errors and signs of security violations). This is further described in Chapter 16.

The SCP log, ERRLOG (if any), is also a good soft/hard error indicator. If your computer has a diskette, someone should clear the log periodically (say every 2 weeks) using the ERRLOG INIT command.

- Diagnostics. Some organizations may want to run the supplied CPU FRU tests or the Advanced Diagnostic Executive System (MV/ADES) tests as a matter of course, say every two weeks. They take less than an hour, but require that AOS/VS be down.

Periodically, you may want to run the CONTEST AOS/VS-hardware exerciser package to identify possible potential problems.

- Preventive maintenance. This can help safeguard your hardware, and keep your whole system running smoothly.

## How to Handle Updates and New Revisions from DG

DG continually improves its software products and updates its technical manuals. It sends the improved products and manuals to all customers who are on the *Software Subscription Service*.

So, if you subscribe to this service, you will periodically get tapes or diskettes and new manuals. Generally, you should install the updated software. In nearly all cases, it will run your existing applications even better than your current revision.

Each AOS/VS revision is one integer number greater than the last; the revisions go 6.00, 7.00, 8.00, 9.00, and so on. DG may issue multiple AOS/VS *updates* for each revision. The updates are numbered on the right of the decimal point; for example, for Revision 7.00, the updates go 7.01, 7.02, 7.03, 7.04, and so on.

### AOS/VS Updates

AOS/VS updates consist of patches (needed changes to one or more program disk files), shipped on magnetic tape or diskette. The paper label has UD on it. When you receive an AOS/VS update, load it from tape or diskette as follows.

```
) SUPERUSER ON )  
* ) OPERATOR ON )
```

(Operator mode is needed for labeled diskettes.)

```
* ) DIR : )  
* ) DELETE /2=IGNORE PATCH_FILES )
```

This file contains old patch file names.)

\*) LOAD/V/DELETE/L=PATCH\_FILES name ↓

(For tape, name is @MTx:0, where x is B, C, or D, depending on unit. For diskette, name is LFD:VOL 1:UPDATE — the CLI will prompt you to insert the diskette; press ↓.)

... (CLI verifies old files deleted and new files loaded) ...

\*) QPRINT AOSVS\_UPDATE\_NOTICE ↓

(Print — or TYPE, without a line printer — the update notice file.)

Now, read the notice and apply the needed patches using the PATCH utility. This is described in Chapter 4, near the end.

If any of the patches involve VSGEN, you may want to generate a new AOS/VS system after installing the VSGEN patch(es). You can use the VSGEN /DEFAULT=oldname switch for this. Then, be sure to apply pertinent AOS/VS patches to the new system file.

## Loading a New AOS/VS Revision

Each AOS/VS revision includes new versions of *all AOS/VS program and support files*, on an AOS/VS system tape or on diskettes. A revision also includes a printed Release Notice — also supplied as a disk file in :UTIL, form RELEASEnn.nn. A revision does *not* include updates. If you receive a revision and update at the same time, load the revision first, then the update.

If, as might happen, you receive a *microcode* update with an AOS/VS revision or update, load the microcode file onto disk before loading the AOS/VS software. Microcode updates are described later in this chapter.

If, after receiving a new AOS/VS revision, you want to load *all* the new AOS/VS files, follow the steps described next. The steps advise you to install the new starter system — overwriting the current installed system, if any — but you can always install your new tailored system over this with little effort.

To start, read the Release Notice, “Notes and Warnings” section, to check for any interrevision incompatibilities. The Release Notice also names all directories and files on the new AOS/VS system tape or diskettes. Generally, the only files shipped in an AOS/VS revision are those in the root, and directories :UTIL, :SYSGEN, and :HELP.

By default, each file loaded will overwrite its older version on your LDU (if there is an older version). So you will want to protect certain files during the update. The files you will want to protect include UP.CLI, LINK\_ERMES, and any other DG-supplied files that you have tailored for your system.

So, from the CLI, turn PERMANENCE on in the root and :UTIL for the tailored files that you don’t want overwritten with new ones. For example:

\*) DIR :UTIL ↓

\*) PERMANENCE LINK\_ERMES.CLI ON ↓

\*) PERMANENCE UP.CLI+ ON ↓

Shut down AOS/VS.

Mount the new AOS/VS system tape or diskette on unit 0 on the first controller.

Proceed to the appropriate section: “Loading a New Revision from Tape,” or “Loading a New Revision from Diskettes.”

## Loading a New Revision from Tape

Boot from tape and install the new bootstraps and starter system as follows:

```
SCP-CLI> RESET ↵
SCP-CLI> BOOT 22 ↵ (or 62 if tape is on an MTD unit.)
Tape file number? 3 ↵ (Specify tape file 3.)
AOS/VS Installer Rev n
Specify each disk in the LDU
Disk unit name? DPF0 ↵ (Type master LDU unit name.)
Device code [default] ? ↵ (Enter all the units in the LDU.)
-- Disk bootstrap installed
Do you want to install a System Bootstrap [Y] ? ↵
Intall from which unit [MTB0] ? ↵
Device code [22] ↵ (or 62 for an MTD unit)
File number [4] ? ↵
-- System Bootstrap installed
Do you want to install a System [Y] ? ↵
Install from which unit [MTB0] ? ↵
Device code [22] ↵ (or 62 for an MTD unit)
File number [5] ?
-- System installed
Done!
```

Now, bring up the new starter system and specify an initial load.

```
SCP-CLI> RESET ↵
SCP-CLI> BOOT 27 ↵ (Use device code of master LDU unit.)
```

### Operating System Load Menu

```
...
Enter choice [1]: ↵ (Load and start operating system.)
AOS/VS Rev n
Date (MM/DD/YY)? 12 19 86 ↵ (Type current date.)
Time (HH:MM:SS)? 15 01 ↵ (Type current time.)
Override default specs? Y ↵
Swap directory ... ↵
Page directory ... ↵
Number of buffers ... ↵
Initial load [N] Y ↵
Filename [@MTC0:6] ↵
```

The system will try to load the new files from tape file 6 into the root directory. For each file that already exists in the root, it will ask whether or not you want to replace the old copy. Since you are updating, answer Y ↵. For example:

```
FILE ALREADY EXISTS: AGENT.PR
REPLACE OLD COPY? Y ↵
```

```
FILE ALREADY EXISTS: FIXUP
REPLACE OLD COPY? Y ↵
```

...

When you've finished, the AOS/VS CLI prompt will come up on the system console. Since you are updating, use the LOAD command with the /DELETE switch, which automatically replaces each file with the revised version, where this applies. Type

```
) SUPERUSER ON ↓
```

```
*) LOAD/V/DELETE @MTC0:7 ↓ (Use @MTC0:7 with tape on an MTB or MTC  
unit; use @MTD0:7 with tape on an MTD unit.)
```

```
DELETED...
```

```
DELETED...
```

```
DELETED...
```

```
*) REWIND @MTC0 ↓ (or @MTD0)
```

```
*)
```

If you have an MV/4000 with hardware floating point, change the default microcode filename to MV4000FP.MCF, as described in Chapter 6.

Dismount the tape and skip to the section "Generating a New System."

## Loading a New Revision from Diskettes

Boot from diskette and install the new bootstraps and starter system as follows.

```
SCP-CLI> RESET ↓
```

```
SCP-CLI> BOOT 64 ↓
```

```
Operating System Load Menu
```

```
...
```

```
Enter choice [1]: 2 ↓ (Choose option 2)
```

```
Technical Maintenance Menu
```

```
...
```

```
Enter choice [1]: 6 ↓ (Choose option 6)
```

```
Pathname? INSTL ↓
```

```
AOS/VS Installer Rev n
```

```
Specify each disk in the LDU
```

```
Disk unit name? DPJ0 ↓
```

```
Device code [default] ↓
```

```
-- Disk bootstrap installed
```

```
Do you want to install a System Bootstrap [Y] ?
```

Remove AOS/VS diskette number 1 from unit 0 and insert AOS/VS diskette number 2.

```
Press ↓
```

```
Install from which unit [MTB0] ? DPJ10 ↓
```

```
Device code? ↓
```

```
-- System Bootstrap installed
```

```
Do you want to install a System [Y] ?
```

Remove the diskette from unit 0 and insert AOS/VS diskette number 3.

Press ↵

*Install from which unit [DPJ10] ?* ↵

*Device code?* ↵

*-- System installed*

*Done!*

Now, bring up the new starter system and specify an initial load.

SCP-CLI> RESET ↵

SCP-CLI> BOOT 24 ↵

#### *Operating System Load Menu*

...

*Enter choice [1]:* ↵ (Load and start operating system.)

*AOS/VS Rev n*

*Date (MM/DD/YY)?* 12 19 86 ↵ (Type current date.)

*Time (HH/MM/SS)?* 15 01 ↵ (Type current time.)

*Override default specs?* Y ↵

*Swap directory ...* ↵

*Page directory ...* ↵

*Number of buffers ...* ↵

*Initial load [N]* Y ↵

*Filename [@MTC0:6]?*

Remove the diskette from unit 0 and insert AOS/VS diskette number 4. This is the first diskette of the AOS/VS first dump file.

Type @LFD:VOL1:FIRST\_DUMP\_FILE ↵ (name is @LFD:VOL1:FIRST\_DUMP\_FILE)

*PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED*

*UNIT [@DPJ10] VOLUME ID [VOL1] ? [Y]* ↵

The system will try to load the new files from the diskette into the root directory. For each file that already exists in the root, it will ask whether or not you want to replace the old copy. Since you are updating, answer Y ↵. For example:

*FILE ALREADY EXISTS: AGENT.PR*

*REPLACE OLD COPY?* Y ↵

*FILE ALREADY EXISTS: FIXUP*

*REPLACE OLD COPY?* Y ↵

...

When all files have been copied from diskette, it will ask for another diskette. Insert the next diskette in the set, and press ↵. Usually, there will be only two diskettes in the first dump file set. Continue with diskettes until you see

*PLEASE REMOVE THE DISKETTE*

)

The AOS/VS CLI prompt has come up on the system console. To load from labeled tapes, turn Superuser and Operator mode on. Then, since you are updating, use the LOAD command with the /DELETE switch, which automatically replaces each file with the revised version, where this applies. Type

) SUPERUSER ON ↵

\*) OPERATOR ON ↵

\*) LOAD /V /DELETE @LFD:VOL1:SECOND\_DUMP\_FILE ↵

(The name is @LFD:VOL1:SECOND\_DUMP\_FILE)

The CLI prompts for a diskette. Remove the diskette from unit 0 and insert the next diskette (first diskette in the second dump file) in unit 0. Then press ↵.

DELETED...  
DELETED...  
DELETED...

When all files have been loaded from this diskette, the CLI prompts for another diskette. Insert the next diskette in the set, and press ↵. There will probably be 9 or 10 diskettes in the second dump file. Continue feeding diskettes as prompted until you see

PLEASE REMOVE THE DISKETTE  
\*)

Remove the last diskette.

If your machine has hardware floating point or the graphics instruction set, change the default microcode filename as described in Chapter 6.

## Generating a New System

The next step is to generate a new AOS/VS system *from your old system.SSF* file. This is easy:

\*) SEARCH :UTIL ↵  
\*) DIR :SYSGEN ↵  
\*) XEQ VSGEN/DEFAULT=oldsysname ↵

VSGEN now comes up. You need specify only the name of the new system, using the N command (e.g., SYS\_7.00) and build it (B command). All specifications except the name will be the same as the old system's.

When the CLI prompt returns, shut down the starter system and, when SYSBOOT comes up, choose option 2, "Enter the Technical Maintenance Menu." Make the tailored system the default system system, and bring it up.

\*) BYE ↵  
Do you really want to ... Y ↵  
SCP-CLI> RESET ↵  
SCP-CLI> BOOT 27 ↵ (Use the correct device code.)

### Operating System Load Menu

...  
Enter choice [1]: 2 ↵ (Choose option 2.)  
Technical Maintenance Menu  
... 8 View or change the default operating system filename  
...

Enter choice [1]: 8 ↵ (Choose option 8.)  
Default operating system [INSTALLED SYSTEM]: :SYSGEN:newsysname.PR ↵  
Enter choice [1]: ↵  
Date (MM/DD/YY)? 12 19 86 ↵ (Type current date.)  
Time (HH:MM:SS)? 15 01 ↵ (Type current time.)  
Override default specs [N] ↵

After the new system comes up, build a new ERMES by typing

```
) SUPERUSER ON )
*) DIR :UTIL )
*) LINK_ERMES )
*)
```

then bring up EXEC and the multiuser environment:

```
*) :UP )
...
```

Turn PERMANENCE off for the files you made permanent (if you leave permanence on, text editing the files will be more difficult).

```
*) DIR :UTIL )
*) PERM LINK_ERMES.CLI OFF )
*) PERM UP.CLI+ OFF )
*)
```

If there were no errors, patch the new system and make a system tape or diskette (as described in Chapter 4) and you're done. LDUs that you've built with the older Disk Formatter will work perfectly with the new AOS/VS software (such programs are designed to be revision-independent).

If, for any reason, you wish to reload the *old revision*, get out the old AOS/VS system tape or diskette set and follow the appropriate procedure above.

As you can see, the update procedure isn't difficult. Restrictions and possible problems with it are as follows.

- It assumes that you haven't reconfigured the directory structure shipped by DG. For example, if the old revision of SED is not in directory :UTIL, the new revision will not overwrite it; there will be two versions of the program on the LDU.
- Your master LDU cannot include disks other than those on the first disk controller, because the starter system supports only the primary controllers.
- The new LOCK\_CLI, with the original password, PASSWORD, will overwrite the old one; so, if you care about LOCK\_CLI, you must edit its program file and insert the desired password (covered in Chapter 16).
- DG utility programs whose preambles you've edited (to take advantage of PID-size type, for example) will be overwritten by newer versions. You must use SPRED on them again. (Chapter 9 explains how.)

Note that you *can* load new files selectively; for example, LOAD/V/DEL @MTC0:7 :UTIL:SED.PR ). But this is not recommended because the error message (ERMES) file may differ between the revisions. Better to do the whole thing.

## Updating Your Manuals

DG ships the Release Notice both in printed form and as a disk file. Updates to your *manuals* are provided only as disk files. The pathnames are :UTIL:sss\_pppppp\_rr, where sss is the series, pppppp is the part number, and rr is the revision. For example, for manual 093-000122-06, the pathname is

```
:UTIL:093_000122_06
```

To keep your manuals up to date, we suggest that you read these files, print the ones you want, and correct the pertinent manuals. Then — if you need the disk space — delete the files. You can always reload any or all of them, if needed, from the AOS/VS system tape or diskette set.



## Computer Microcode, SCP, and Emulator Updates

Microcode is the foundation of your MV/Family CPU. It's important to run the current revision of both microcode and the SCP-OS.

DG maintains a microcode subscription service, similar to its software subscription service. New customers get membership automatically for a certain amount of time. If your membership has expired, we suggest that you renew it.

With the microcode subscription service, you will periodically receive new revisions of microcode, the SCP operating system, and FRU diagnostics. For original MV/8000s, these are shipped on diskette in a format the SCP can read. When you get the diskette, simply remove the old diskette from the CPU diskette unit, insert the new one, and turn CPU power off and on again to try it.

For MV/Family machines other than MV/8000s, the microcode, the SCP-OS, and the FRUs are shipped on tape or on a set of two diskettes. For tape, this is usually a 1600-bpi tape; file 0 is the SCP-DTOS system, bootable from tape. File 1 is the combined microcode/SCP-OS file, in AOS/VS DUMP format.

For diskettes, the second diskette (AOS FMT) has the microcode file in DUMP format.

To load the new microcode file:

- Mount the tape or diskette on unit 0.
- Type the following commands

```
) SUPERUSER ON ↓
```

```
*) DIR : ↓
```

```
*) RENAME MVn.MCF MVn.rev.MCF ↓
```

(n is the name of your machine; rev is the revision of old microcode. For example, the new name might be MV6000.5.0.MCF. For MV/4000s with FPU, the old filename is MV4000FP.MCF; rename it MV4000FP.rev.MCF. The rename step saves the old microcode file, which you would otherwise need to delete to load the new one.) For tape, type

```
*) LOAD/V @MTx0:1 ↓ (x is B, C, or D, depending on the tape unit.)
```

For diskette, type

```
*) LOAD/V @DPJ10 ↓
```

*MVn.MCF* (CLI verifies load of the the new file.)

For tape, type **REWIND @MTx0 ↓**. Dismount the tape or diskette and store it safely.

To try the new microcode or SCP-OS, shut down AOS/VS. Then reboot it (**RESET ↓**, **BOOT nn ↓**, etc.). When SYSBOOT asks about microcode, say that you want to load and verify microcode. For example

*Operating System Load Menu*

...

*Enter choice [1]: 2 ↓* (Choose option 2.)

*Technical Maintenance Menu*

...

*2 Load and verify microcode*

...

*Enter choice [1]: 2 ↓* (Choose option 2.)

... (SYSBOOT loads and verifies new microcode.) ...

If — for whatever reason — you ever want to load an older or different revision of microcode or SCP-OS, you can tell SYSBOOT that you want to view or change the microcode filename, then type the microcode filename. For example, on warm start:

#### *Operating System Load Menu*

...

Enter choice [1]: 2 ↵ (Choose option 2.)

#### *Technical Maintenance Menu*

...

9 View or change the microcode filename

... Enter choice [1]: 9 ↵ (Choose option 9.)

Default microcode filename [:MV4000FP.MCF]: MV4000FP.5.0.MCF ↵

Enter choice [1]: 2 ↵ (Choose option 2.)

... (SYSBOOT loads and verifies microcode.) ...

If you have a machine that uses emulator firmware (for example, an MV/4000 DC, which runs an emulator in its IOC), you may also receive new emulator revisions. If you receive a new emulator, install it via the dialog shown in Chapter 2, taking steps that include the “I/O CB EMULATOR” diskette.

Needless to say, keep all the system tapes and diskettes you receive from DG, and those you make yourself, in a safe place.

## **Disk Microcode Updates**

Model 6236 and 6239 disk units have their own microcode, which is independent of CPU microcode. Disk microcode is stored on part of the disk that's invisible to AOS/VS. It's loaded into disk controller memory automatically the first time AOS/VS accesses a disk on the controller.

DG installs an initial version of microcode on each model 6236 and 6239 disk before shipment. However, the current revision of AOS/VS, or a program like MSCOPY, may require updated disk microcode. If updated microcode is needed, AOS/VS will display the message *CONTROLLER MICROCODE NEEDS TO BE UPDATED*.

A program to update disk microcode is shipped on tape, along with the disk controller. The updating program is called the *Peripheral Microcode Installer* — its model number is 30976. You can run this program, when AOS/VS is not running, by mounting the tape on unit 0 of your primary tape controller and typing *BOOT nn ↵* to the SCP CLI. For example,

*SCP-CLI> BOOT 22 ↵*

... (Peripheral microcode installer prompt) ...

The peripheral microcode installer program will then lead you through the steps needed to update your disk microcode. Afterward, it will return to the SCP CLI and you can bring up AOS/VS. You need not update disk microcode again unless you see the *CONTROLLER MICROCODE...* message.

## **Getting Help from DG**

Generally, when a customer buys a DG system, the price includes a certain period of engineer/support time, time on the Software Subscription Service, and perhaps training courses.

After the initial period has expired, customers must renew service contracts to assure continued support.

In the United States, support people work from the Atlanta Service Center; and, depending on your contract, you can call this center for help.

Outside the US, the support people are often DG system engineers; your system engineer can give you more information on support.

## Users and Productivity

A user is any person who can log onto the system, not only under EXEC, but under another DG product like TPMS or DG/SNA.

A user can be an applications or systems programmer, system operator, manager, or a nontechnical person like a data entry operator, word processing typist, executive seeking summary information, someone keeping files of personal information, or someone wanting to communicate over a network.

Usually, organizations acquire computer systems to increase productivity. For this to happen, users need to work effectively. This means keeping them happy.

Generally, anything you can do to make the system appear easier to use will please users. Users love easily accessible, pertinent help messages. They hate meaningless error messages. Interactive users hate slow response time.

Many DG products have help function keys; others (like the CLI) have help commands. Encourage users to try these. For your own applications, think about setting up easy to use, articulate help messages; this will probably pay dividends in productivity.

If response time seems long at user consoles, think about running fewer batch streams. Use PED to see how each process is behaving, and its working set and I/O usage parameters. MV/Family systems are fast — you can take advantage of this by basing process parameters on users' primary requirements at any given time.

For some perspective on a CLI user's point of view, sit down at a user console with *Learning to Use Your AOS/VS System*. It leads the reader through sessions with the CLI, text editors, FORTRAN 77, COBOL, Interactive COBOL, AOS/VS BASIC, Business BASIC, C, Pascal and AOS/VS assembly language programming.

## A Real System's UP Macro

An UP macro can give you a perspective of an entire AOS/VS operating system: how it configures its devices, queues, and consoles for users; and what products it runs.

The UP macro shown in Figure 15-8 was adapted from a real AOS/VS system at DG. This macro defines its own switches, creates a system banner (Coldspot, followed by the system and system revision), sets tape unit ACLs, starts the system log, initializes LDUs and sets their ACLs, runs the QCMP queue compacter, starts up EXEC and continues batch streams, starts printer queues, sets specifications for printers, continues printers, starts an INFOS II process, enables local and virtual user consoles, brings up the network, sets type and priority for PID 2, and finally runs LOCK\_CLI.

Three macros called by this UP\_CLI are not shown. They are SYSLOG\_UP\_CLI (which resembles the one shown in Chapter 9); UP\_NETWORK\_CLI (supplied with the XODIAC networking system and tailored for this installation); and CEO.SYSTEM\_CLI (supplied with DG's Comprehensive Electronic Office (CEO) system). The original macro is more complex than this, but we've simplified it for illustration.

```

[!equal,([!une,002,[!pid]]Error[!end])).()]
  searchlist :UTIL
  push
  write [!read [!ascii 207] Press NEW LINE when printers are aligned. ]
  superuser on
  delete/2=ignore :REV
  revision/1=REV :AGENT.PR
  string Coldspot [!system] [REV]
  sysid [!string]
  directory :
  acl @NULL +,WARE
  acl @MTB- +,WARE
  write Initializing DPF30 as :UDD
  initialize/1=warning/2=warning @DPF30
  push
  directory :MAGIC
  write Initializing DPF31 as :UPDATE.40
  initialize/1=warning/2=warning @DPF31
  acl UPDATE.40 $+, ATLANTA,, OP,OWARE +,RE
  write Initializing DPF20 as :UPDATE.50
  initialize/1=warning/2=warning @DPF20
  acl UPDATE.50 $+, ATLANTA,, OP,OWARE +,RE
  pop
  write Initializing DPF1 as :PENDING
  initialize/1=warning/2=warning @DPF1
  write Initializing DPF11 as :INFOS
  initialize/1=warning/2=warning @DPF11
  acl UDD OP,WARE +,E
  acl :BOTH $+,E ATLANTA,E +,RE
  :SYSLOG_UP
  [!equal,(/NOQCM),(/%NOQCM%)]
  write Compacting the queues...
  xeq QCM/YES
  [!end]
  searchlist [!searchlist], :UTIL:CEO_DIR
  process/default/directory=@/name=EXEC EXEC
  pause 2
  control @exec prompts off
  control @exec qpriority (2,3) 0 250
  control @exec qpriority 1 1 254
  control @exec qpriority 4 255 255
  [!equal,(/NOCONTINUE),(/%NOCONTINUE%)]
  control @exec continue
  control @exec silence
  directory :UTIL
  control @exec start (BATCH<OUTPUT LIST> LPT) @LPB
  control @exec start LPT1 @LPB1
  pause 3
  control @exec cpl @LPB1 136
  control @exec continue (@LPB,@LPB1)
  [!end]
  control @exec silence (@LPB,@LPB1)
  pause 3
  pop

```

Figure 15-8. A Tailored UP.CLI Macro (continues)

```

prompt time checkterms
[!nequal,(/NOINFOS),(%/NOINFOS%)]
write Bringing up INFOS II now...
directory :INFOS
[!equal,(/IVERIFY),(%/IVERIFY%)]
push
searchlist :INFOS:UTIL
directory :UDD:PENDING
pause 3
xeq :INFOS:UTIL:IVERIFY PENDINGINFO.DB
pop
[!end]
process/default/dir=@/name=INFOS :INFOS_II
pause 3
directory :
[!end]
[!nequal,(/NOCEO),(%/NOCEO%)]
dir :UTIL:CEO_DIR
CEO.SYSTEM START NOLOG
dir :
[!end]
[!nequal,(/NONET),(%/NONET%)]
:UP.NETWORK
[!end]
[!nequal,(/NC),(%/NC%)]
control @exec enable/all
pause 10
[!end]
control @exec priority (@LPB, @LPB1) 1
control @exec prompts on
superuser on
prtype 2 preemptible
priority 2 1
xeq :LOCK_CLI
superuser off
[!else]

write *Error*
write %0\% works only when invoked from the master CLI.
write Required arguments: None
write Optional switches: ,/NC - Do not enable consoles.
write ...../NOQCMP - Do not run QCMP.
write ...../NOINFOS - Do not PROC up INFOS II.
write ...../IVERIFY - Run IVERIFY before starting INFOS II.
write ...../NOCONTINUE - Do not continue batch or printers.
write ...../NOCEO - Do not start up CEO.
write ...../NONET - Do not bring up the network.

[!end]

```

*Figure 15-8. A Tailored UP.CLI Macro (concluded)*

## What Next?

Chapters 1 through 5 of this book describe *bringing up* an AOS/VS system from scratch. Chapters 6 through 14 explain *running* the system; and Chapters 15 (this one) and 16 touch on system management issues.

At this point, you might want to read about system management vis-a-vis security, in the next chapter. Or, you might want simply to run your AOS/VS system.

End of Chapter



# Chapter 16

## System Management Considerations — Security

Read this chapter

- when you want perspective on system security;
- when you want to understand how user privileges and access control prevent system break-ins and abuse;
- when you want to run a secure system;
- when you need advice to run detailed system logging.

In this book, Chapters 1 through 14 give information without identifying the reader as manager. This chapter and the previous one touch on some management issues — not *how* to manage, but information and suggestions that can help the person who manages the system make good system-oriented decisions.

Management-oriented issues that don't relate to system security (for example, process concepts and information on installing updates) are described in the previous chapter.

Major sections within this chapter are

- Closed or Open Shop?
- Subjects and Objects
- AOS/VS Security Summary
- User Privileges and Security
- File Access Control with ACL
- Protecting System Site and Backup Media
- Log-on, Password, and User Guidelines
- Using the System Log File
- Danger Signals — Signs of Break-in
- Deleting a User Profile (Revoking an Account)
- System Architecture — Hardware Protection Features
- Security Check List
- How to Adapt This Book for Restricted System Operators

### Closed or Open Shop?

From the standpoint of security, computer sites range from tightly controlled *closed shops* to casual, relaxed *open shops*. In the center are *medium-security shops*. In reality, of course, there are more than three variations — the definitions used here are meant as general examples.

Table 16-1 offers perspective on security for your own site. In this table, “users” represent the average user, not every user.



**Table 16-1. User Action and Security Levels**

| In Your Ideal System,                                                            | Closed | Medium-Security | Open                    |
|----------------------------------------------------------------------------------|--------|-----------------|-------------------------|
| Can users access files without leaving tracks (records in a log file)?           | No     | Maybe           | Yes                     |
| Can one account be used by the general public (is there a public account)?       | No     | Yes             | Yes (may not be needed) |
| Can users learn the names of other users' files?                                 | No     | Maybe           | Yes                     |
| Can remote users learn the names of other users' files?                          | No     | No              | Yes                     |
| Can users read and copy other users' files?                                      | No     | Maybe           | Yes                     |
| Can users read other users' electronic mail?                                     | No     | No              | Yes                     |
| Can users change or delete other users' files?                                   | No     | No              | Yes                     |
| Can users mount and read backup tapes or disks?                                  | No     | Maybe           | Yes                     |
| Can users consume system resources by writing personal letters or playing games? | No     | Maybe           | Yes                     |
| Can users log on as other users?                                                 | No     | No              | Maybe                   |
| Can users give themselves additional privileges?                                 | No     | No              | Maybe                   |

This table is just a guideline. If you want to prevent users from doing most of the actions described, then your security needs are high: you need a closed shop. If most of the actions described are okay, then your security needs are low: an open shop will suit you.

## The Closed Shop

In a closed shop, few people have physical access to the computer, disk units, or system console. Users (including application programmers) work on consoles in a separate area. The CPU, disk and tape units, and even line printers are out of bounds to all but a few carefully screened and trained people. In closed shops, system operators are on duty most of the time. They mount and dismount tapes for users, handle printers, start application programs, do backups, bring the system up and down, and so on.

The core of a closed shop is the system — software and hardware — that people rely on to operate securely. This system core is sometimes called the *Trusted Computing Base* (TCB).

A number of security levels for TCBs have been defined — for example, the C1, C2, and B1 classes. The security rating of a manufacturer's system depends on evaluation standards established by the U.S. National Computer Security Center (NCSC). Details on these standards appear in the manual *Department of Defense Trusted Computer System Evaluation Criteria*, number CSC-STD-001-83.

For AOS/VS, software in the TCB includes the

- AOS/VS kernel and tailored system (which enforce access controls);
- Peripheral manager (PMGR and its companion IACRS or CPIRS programs, which manage user consoles);
- PREDITOR profile editor, which creates and edits user profiles, and can provide password encryption;

- EXEC and companion XLPT program, which oversee user log on and tape mount requests, and manage batch and printer processes. EXEC has Superuser privilege and can bypass access controls;
- Agent and CLI, which provide the user interface and, with Superuser on, can bypass access controls.
- Other utility programs and files supplied with AOS/VS. There's a complete list in Appendix C.
- MV/ADES diagnostic system, to verify your hardware using the same microcode as AOS/VS.

Hardware in the TCB includes the system console (because anyone with access to it can penetrate all safeguards), MV/Family CPU and microcode, disk units, and tape units. It includes all removable media (like backup tapes) that contain security-related information. It also includes printers, if they print sensitive material and are accessible to users.

A closed shop should have someone check periodically — perhaps daily — for security violations and potential (and actual) break-ins. The site can run system logging with detail set to full, generate reports, and have the assigned person examine the reports for signs of unauthorized access.

Very few users in closed shops have Superuser or other special privileges, since these privileges would make them part of the TCB. Any privilege that allows a user to bypass access controls means that he or she must be *trusted* — part of the TCB. System security depends as much on privileged users as on AOS/VS enforcement of access controls.

ACLs in closed shops are quite restrictive. When multiple users need access to a file, a closed shop may use explicit ACLs that spell out usernames, instead of using templates.

Software that's not part of the TCB — like networking software — should be used very carefully in closed shops because it can compromise all security.

Someone may check the files accessed by application programs for signs of Trojan horse incursions. (A Trojan horse is a program designed to do something useful for a site — and does this — but also does things it was not authorized to do, like gather confidential information, such as passwords, for its author.) When new versions of application programs are built, the new program file(s) or source file(s) may be compared to the old versions (using the FILCOM or SCOM program), and the differences examined.

The *people* in a closed shop are essential to its security. Users can't touch disk and tape units, so at least one system operator stays on duty while the system runs. Administrators (system managers and operators) make decisions that can affect all access controls. They must plan and implement a secure system (using secure profiles, secure hardware, and ACLs) start logging, generate and check reports, plan user education, enforce password changes, and so on.

In some closed shops, system operators themselves have limited powers. A locked CLI runs on the system console, and very few people know the password. The operator must use EXEC and other CONTROL commands to run the system. If you want to limit system operators' powers, this chapter tells how to make *this book* suitable for restricted operators (see "How to Adapt this Book for Restricted Operators").

## The Medium-Security Shop

The medium-security shop wants some measure of security, without the inconvenience and performance penalties of a closed shop. More trust is placed in the people than in a closed shop.

In the medium-security shop, the computer and system console are less restricted than in a closed shop. (They can't be open to the public, though, since anyone with access to them can break into the system easily.) The concept of a trusted computing base still applies, since people want security and privacy for their files. The desire for privacy is only human, but — from a security viewpoint — the TCB concept is valuable because it minimizes chances for exposure or loss of sensitive material.

A medium-security shop may or may not have a system operator. If not, LOCK\_CLI will be run on the system console. Several people may have Superuser privilege, and/or know the LOCK\_CLI and privileged profile password.

No user's profile allows both special local privileges (like Superuser) and network or modem privileges. A user with powerful local and remote privileges in one profile can roam the system from outside the site, browsing, reading, deleting, and placing Trojan horses at will.

Backup media is well organized — it may or may not be kept physically locked up.

Software that may represent a threat to security — like application programs — may be checked for possible trespass (detailed under “Closed Shop”, above).

## The Open Shop

The category of open shop includes systems like single-user and graphics workstations — any system where system user(s) don't need privacy or fear deletion or vandalism.

In an open shop, the hardware and system console may be open to programmers and even nonusers. Usually, LOCK\_CLI is not run on the system console. Access control for the tailored AOS/VS system may not be enabled (enabling access control is a VSGEN option — you must enable it to have AOS/VS control access).

Generally, if you want to run an open shop (as defined here), you don't really need to read this chapter. Possibly, though, you might want to see how much work is involved in running a secure system — or learn about common break-in tactics. You might also want some points on full detail logging (given later in this chapter).

The closed/medium-security/open shop issue is a management call; we can't tell you which way to go. Ultimately, you must balance the risk of losing critical information — causing delays and possibly jeopardizing deadlines, projects, corporations, or even people — against the cost and inconvenience of maintaining security. The files and information on your system may be even more important than the hardware. The general rules of risk analysis apply.

## Subjects and Objects

The words *subject* and *object* provide a common ground in the context of computer security. A *subject* is an active entity that causes information to flow among objects or changes system state. Examples of subjects include: users, processes, CLI commands (like ACL, MOVE, LOAD, or SUPERUSER), and system calls in running programs.

An *object* is a passive entity that contains or receives information. Access to an object implies access to the information it contains. Examples of objects are devices, LDUs, directories, files, processes, IPC ports, disk blocks, page frames, arrays or buffers in running programs, mounted tape reels, diskettes, console screens, and printers. And *object reuse* is the reuse of an entity that contained one or more objects. For a system to be secure, all information in such entities must be removed before they are reused.

One criterion for a secure system is control of data flow between subjects and objects. AOS/VS controls data flow via username/password checking at logon, enforcement of access control list settings, zeroing of disk blocks and page frames before reuse, hardware ring boundary restrictions, and other means. AOS/VS protects all system devices from users and protects users from one another.

## AOS/VS Security Features — a Summary

The U.S. National Computer Security Center (NCSC) defines four security-related areas in data processing: discretionary access control, object reuse, identification and authentication, and audit. AOS/VS security features in each area are as follows:

## Access Control (NCSC Area Discretionary Access Control)

Every file has an access control list (ACL), created when the file is created. For a file created by a user, the ACL is the user's default ACL, which prevents access by anyone other than this user (except for a superuser). *System* files are shipped with ACLs that protect them from all users except the system operator (username OP). Only a superuser can bypass ACLs. The ACL mechanism implements the data control mechanism known as *discretionary access control* — the control of data flow between named users and named objects.

ACLs are described in detail later in this chapter.

## Object Reuse (NCSC Area Object Reuse)

Deleting a file nullifies the filename, which makes the file's data inaccessible by name and frees the data blocks allocated to the file. AOS/VS zeroes these data blocks *before* it allocates them to any other file. This prevents users from creating new files, using positioning calls to allocate blocks that may contain data, and then reading the blocks.

AOS/VS manages main memory pages much the same way as it does files. Memory pages used by a program are not zeroed when the program terminates or when it's paged — but the page frames *are* zeroed before being assigned to another program. (Specifics on memory page reuse appear in the *System Call Dictionary (AOS/VS and AOS/DVS)*, under calls ?ALLOC, ?ISEND, ?IS.R, ?MEMI, ?SPAGE, ?READ, ?WRITE, ?RDB/?WRB, and ?PRDB/?PWRB.)

In these ways, AOS/VS prevents users from retrieving sensitive information through object reuse.

## User Identification (NCSC Area Identification and Authentication)

Each person is identified (known to AOS/VS) through a username — a unique 1 to 15 character name that's part of the user's account.

To log on, a person must have a valid user profile (valid account); and he or she must type the username and password stored in the profile file. Passwords are 6 to 15 characters long and can — at the system manager's discretion — be encrypted.

All user profiles are stored in directory :UPD and have null access control lists (ACLs), which means that only privileged users (superusers) can read or change them. Profiles are created, changed, and deleted via PREDITOR, the user profile editor. PREDITOR requires Superuser privilege to run, which prevents any but a superuser from creating, examining, or changing *any* profile. By default, PREDITOR does not grant Superuser or other special privileges.

While a user is logged on, his or her username remains constant. (The ability to change username requires a special privilege).

The username/password arrangement, combined with ACLs, enables AOS/VS to identify and authenticate users.

User privileges and security, and ACLs, are explained later in this chapter. Details on PREDITOR appear in Chapter 7.

## System Log (NCSC Area Audit)

At the discretion of the system manager, AOS/VS can run a detailed system log — which records each file access and other security-related event. From a detailed log, the AOS/VS REPORT program can create reports based on username, filename, or failed logon. For each event, the report includes error information (if access failed); the absence of error information means that access succeeded.

The ability to audit users and events can help security-conscious sites determine whether someone has tried to, or actually *has*, broken into a system.

Detailed logging and REPORT program operations are explained in Chapter 9.

## AOS/VS Security Summary

A standard user

- cannot access other users' files;
- cannot delete or modify system files;
- cannot add files to system directories;
- cannot examine data in deleted files or previously used memory pages;
- must have a valid account to log on;
- cannot edit his or her profile to become privileged.

Optionally, a standard user will have every file access and log-on attempt recorded.

If you use the default privileges and ACLs, AOS/VS software will protect your system from casual trespass or file violation. If security is very important to you, you can run a detailed log and — periodically — create reports and check user activities.

The security of the system console, central processor, and disk units is up to you. Anyone who can touch the computer or disk units can flip a switch, bring the system down, run ESD, then restart and come up in the master CLI. The only way to protect key peripherals is to lock them up and/or keep a reliable system operator on duty at all times. In any shop, you must trust the people who have physical access to the hardware.

## Human Factors in Security

It's impossible to maintain security, in any shop, without the commitment and support of your key employees. This book can't tell you how to maintain morale — but, unless you do it, your site will be vulnerable from within.

Anger and a desire for revenge are often factors in security breaches. So is opportunity — people who might otherwise respect the security of your system can be tempted by the sight of a Superuser prompt or tapes that obviously hold a backup image of the system disk.

Each site needs a security program that motivates people to protect information and limits exposure to sensitive information.

## Changing Security Levels

The easiest course is to define the security level you want before your system is built — then to build the system and live with that level. But people's needs change, and things may evolve to the point where you need to change security levels.

To *increase* security, you'll need to edit user profiles, and you'll probably need to change ACLs. You'll need to run LOCK\_CLI on the system console (if you don't run it already). You may need to run system logging with detail set to full. Some of the actions to take are

- Tell your user community why you're tightening security.
- In user profiles, with PREDITOR, remove special privileges: Change Username, Superuser, Superprocess, and Access Devices.
- For each user who deals with sensitive information, run PREDITOR and choose password encryption. (If any of these users relies on a network to other DG systems, encryption may interfere with network access. Password encryption won't prevent use of CEO Mail between systems, but encryption *will* prevent access by XODIAC's RMA and FTA agents to any system that doesn't run AOS/VS Revision 7.00 or later and a revision of XODIAC that supports encryption. Read your XODIAC Release Notice to see if encryption is supported.

If you determine that password encryption *will* interfere with network access, you may want to create a new, secure profile for the user and encrypt the password. Then, you can use the MOVE command to copy all files from the user's old directory to the new, secure one. From the new directory, change all ACLs to new-username,OWARE.

Then, have the user delete all sensitive files from the old directory. In the future, have the user log on under the old username for network access, and under the *new* profile to work on sensitive files. (This may seem a lot of work, for both you and the user, but the increased security gained by password encryption and isolation from the network is worth the extra effort.)

- Perhaps, make ACLs more restrictive. For example, if your default ACLs have been [!USERNAME],OWARE +,RE, you might make them [!USERNAME],OWARE. You can change existing ACLs *en masse* with Superuser and the # template (shown later in the chapter).

Changing the default ACL is easy if you have a central log-on macro: just put or edit the DEFACL command in the central macro. Using a central log-on macro involves running a single macro for every user at logon (it's the initial IPC file for each user), then having this macro execute a user-accessible macro in each user directory. Setting up a central log-on macro is explained in Chapter 5.

If there is no central log-on macro, put the DEFACL command in each user's log-on macro.

If multiple users need access to a file, you may want to use tailored ACLs that spell out usernames, instead of using templates. Doing this effectively may mean eliminating automatic ACL assignment (via DEFACL) for some users. These ACL steps can tighten security quite a bit, at the cost of some extra work. CLI macros — run periodically during the day or after hours — can help ease such operations.

- Safeguard the system console. Either run LOCK\_CLI on it, or keep it under continuous supervision, or both.
- To monitor user activity, you may want to use system logging, with detail full. The reports from this can tell you which users and processes are trying to touch (and actually touching) specific files.
- You may need to check your applications programs more carefully than before, restrict use of network software, and eliminate certain amenities like guest profiles.
- You may want to design some kind of orientation program to raise user consciousness about, and appreciation of, security.

Loosening security is — generally — easier than tightening it. You can't simply let things degenerate into chaos, though. Some of the steps involved in loosening security are

- Tell your user community why you're loosening security.
- Widen the scope of ACLs. For example, include read and execute access for all users (via +,RE) in each user's default ACL.
- Use logging with minimal detail or don't log at all.
- Unlock your hardware (if physically locked away from users) and reduce the time an operator is on duty.
- Run a standard CLI on the system console.
- Give special privileges to more users. This is last in the "loosening" list, since it's potentially the most harmful.

## Tradeoffs — Security Versus Convenience

At first, you may want to pursue maximum security — after all, why *not* provide the greatest amount of protection and privacy? Unfortunately, all security improvements cost something. The cost may be obvious (for example, hiring a system operator or buying an extra disk unit for logging) or hidden (for example, logging with full detail slows down general processing).

Users often find that very secure systems are the least friendly and hardest to learn. And, hiring full-time operators and providing physical security for your hardware is expensive.

Also, security controls alone won't give you a secure system. They can't prevent authorized users from stealing or destroying data. Your perceptions and judgments about the people you employ and create profiles for (your users) are at least as important as your implementation of security controls. This means a continuing commitment of time and energy to security.

On the other hand, the potential loss from lax security can be staggering. Users find it very unfriendly if your system is down for days while its file system is restored, or if your company suffers because competitors learn about its plans.

You must weigh user-friendliness and performance against data security, confidentiality, and integrity — and strike a good balance for your site. This will probably take some trial and error experience, and the arrangements you choose will need regular review.

Some major tradeoffs between closed and open systems follow:

### Closed or Medium-Security System

High startup expense. The need to protect hardware forces you to hire system operators, build lockable areas and divert your attention from other things.

Inconvenience for users. Unprivileged profiles force users to seek help with file access from the operator or a privileged user.

Audit trail drawbacks. Logging consumes disk space and CPU time, slowing system response. Checking log reports requires your time (or someone's time).

Lack of trust harms morale. Treating users and employees as if no one were trustworthy may cause resentment. Maintaining morale requires special effort, perhaps an entire program.

Sense of privacy and confidence can raise morale. User trust in the privacy of their files may increase productivity. For example, someone may do confidential work on the system instead of using a typewriter.

A secure system may lead to financial rewards. A specific standard of security is required by some government and private organizations — without it, you don't qualify for contracts.

Security standards limit the risk in computer operations. They can help you minimize chances of disastrous loss. Security standards may simply be a matter of common sense.

### Open System

Low startup expense. Hardware doesn't need protection, and users can monitor themselves, avoiding the need for operators and your attention.

Convenience for users. Privileged profiles allow users to handle file access problems by themselves (via Superuser or Change Username privilege).

Easy logging or no logging. There's no need to check for security violations (although you might want to use log files for user accounting).

Implied trust of users does not hurt morale.

Wariness about open system harms morale. The possibility of trespass and lack of privacy may prevent users from using the system for confidential work. Or, data loss resulting from accidental or malicious trespass may disrupt work and schedules.

An open system may reduce opportunity for company growth. Your competitors may win contracts that require security standards.

Without security standards, there's no practical limit to the loss you can suffer. Loss of data in essential files, or theft of confidential material, can be disastrous — to people, companies, and even nations.

## User Privileges and Security

The process created for each user at logon has only those privileges specified in the user's profile. Unless a user has special privileges, AOS/VS will reject commands that might threaten system security. For example, if a user tries to type a file he or she's not authorized to read, the system will respond with an *ACCESS DENIED* message; and if a user who lacks Superuser privilege tries to turn Superuser mode on, the system will respond *CALLER NOT PRIVILEGED FOR THIS ACTION*. Thus, the primary basis for a secure system is user profiles, created by the PREDITOR profile editor. Your system is only as secure as its users' profiles.

Table 16-2 names and describes privileges that can threaten system security (it resembles a table in the previous chapter and is repeated here for your convenience). The privilege questions appear in the order asked by PREDITOR. Details on all privileges appear in Chapter 7.

**Table 16-2. User Profile Privileges That Relate to Security**

| Privilege                                                             | What It Allows                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Encrypt password                                                      | Without this privilege, a user's password is stored in the :UPD file in such a way that a superuser may be able to see it by reading the profile file. Encrypting the password makes it impossible to read. This is very desirable from a security viewpoint, but it may prevent certain kinds of network access. Encryption tradeoffs are described later, under "Passwords".                                                                                                                                                                                                                                                                                                                                          |
| Initial IPC file                                                      | This value determines which file (if any) will be executed for the user at logon. The IPC file can be a macro that sets default ACL (DEFACL), search list, and other things. For greatest control, we suggest you use a central log-on macro (perhaps in :UTIL) to execute individual user log-on macros. Give the central macro's name as the initial IPC file. Doing this is described in Chapter 5.                                                                                                                                                                                                                                                                                                                  |
| Use virtual console<br>Access local resources<br>from remote machines | <p>These two values determine whether the user will be able to log on to your system, or to use resources on your system, from a remote system over a XODIAC network. A network is not part of the AOS/VS TCB software, but you may want (or need) to allow selected people to use it.</p> <p>A privileged user (one with the Superuser or Superprocess privilege) should <i>not</i> have either network privilege, since he/she could then explore your system at leisure from a remote site. If you want a user to have both network and either Superuser or Superprocess privileges, create two profiles for the user, one profile with network privileges, the other with Superuser or Superprocess privileges.</p> |
| Create without block                                                  | A Yes value allows the user process to create sons (that in turn can create sons) without blocking. All its sons (and grandsons) can remain unblocked, increasing system overhead. This privilege relates to the next two. A CEO user needs this privilege.                                                                                                                                                                                                                                                                                                                                                                                                                                                             |



**Table 16-2. User Profile Privileges That Relate to Security**

| Privilege              | What It Allows                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unlimited sons<br>Sons | These two values control the number of sons the user process can create. Generally, a user should not have the unlimited sons privilege. Each son requires some system overhead, especially if its father isn't blocked (above). Five sons is enough for practically anyone.                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Change priority        | The user process (and sons) can change its own priority if it has this privilege. It can gain favor over other processes, thus restricting access to others.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Change type            | The user process (and sons) can change type (for example, to resident) if it has this privilege — gaining favor over other processes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Change username        | <p>The user process can create a son process that has a different username. The ability to change username allows the user to <i>become</i> any other user, with the original user's access to the user's files. With the username OP, the user can issue EXEC commands (allowing the user to terminate user processes or change priority or type). Also, any user with this privilege can't be traced; he or she can try to break security under another person's username.</p> <p>For user files to remain secure, and logging to be useful, every user on your system should have his/her unique username — and be unable to change it. Do not give users this privilege if you want a secure system.</p> |
| Access devices         | The user process can define a new device (call ?IDEF), wire pages, access the device, and/or remove the definition. Also, for this privilege to work, the process must be resident, which means the user must also have the <i>Change type</i> privilege. These privileges give the user <i>at least</i> the power to dominate or bring down the system.                                                                                                                                                                                                                                                                                                                                                     |
| Superuser              | Superusers can bypass all file access controls. And, they can run PREDITOR to give themselves any privilege — or possibly learn other users' passwords (if you don't choose encryption). Do not give users Superuser privilege if you want a secure system.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Superprocess           | The user process (and sons) can change its own type and priority; and it can block or terminate any other process, including LOCK_CLI. Do not give users this privilege if you want a secure system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

**Table 16-2. User Profile Privileges That Relate to Security**

| Privilege                                                          | What It Allows                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| System manager privilege                                           | <p>This privilege allows the user to initialize and release job processors (if your computer has more than one job processor), and create and delete classes and logical processors (usually done via the optional CLASP utility).</p> <p>System Manager privilege also allows a user process to issue AOS/VS system calls that change the system date, time, ID (SYSID), and bias factor. Also, the user can start or stop the system log (SYSLOG) and issue EXEC commands. These privileges have significant impact on security (although some expertise is needed to write a program that exploits them).</p> <p>Use of classes and privileged system calls can affect the performance and security of your system. Generally, the master CLI issues all commands that require system manager privilege; do not give it to any other user unless he or she really needs it.</p> |
| Modem                                                              | <p>A Yes value allows the user to log on to your system from a modem (over a phone line). You may want to allow selected people modem privilege, with certain precautions against break-ins on the line (described later).</p> <p>A privileged user (one with the Superuser or Superprocess privilege) should <i>not</i> have modem access, since he/she could then explore your system at leisure from a remote site. If you want a user to have both modem and either Superuser or Superprocess privileges, create two profiles — one with each privilege — for the user.</p>                                                                                                                                                                                                                                                                                                    |
| Change working set limit                                           | <p>A Yes value allows the user process (and sons) to override the working set limit that AOS/VS dynamically assigns to each process. This privilege is needed for any of the Logical Address space and Minimum/Maximum privileges below. Changing the working set size may allow the user process to monopolize memory and the system.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Priority                                                           | <p>If given a higher-than-default priority, the user process (and sons) will get CPU preference over processes with lower priority. This privilege doesn't allow the user to <i>change</i> priority (see above).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Logical address space – batch<br>Logical address space – non-batch | <p>These parameters give the user process (and sons) a nondefault number of memory pages in batch or interactive processing. The default is a very high number. Giving a nondefault value might have some effect on system performance.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

**Table 16-2. User Profile Privileges That Relate to Security**

| Privilege                                                                                                                                            | What It Allows                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Minimum working set size – batch<br>Maximum working set size – batch<br>Minimum working set size – non-batch<br>Maximum working set size – non-batch | These parameters give the user process (and sons) specific minimum and maximum working set limits in batch or interactive situations. Giving a nondefault value can have significant effect (usually bad) on performance, depending on your applications environment.                                                                                                                                                                                            |
| User comment                                                                                                                                         | This question is not — strictly — security related. It allows you to write a line of text into the user's profile. The text can be the user's name followed by any short editorial comment you want to make. We recommend including the user's complete name. You can also include the user's console number and phone number or extension. Or, if the user has any special privilege, you can include a brief explanation of his or her need for the privilege. |

(concluded)

User profile privileges apply only to user processes, not to the master CLI running on the system console. Protecting the system console is described later in this chapter.

## File Access Control with ACL

This section explains ACLs and how to use them. It is based on the section with the same name in Chapter 9, and has some additional details. The material is repeated here for your convenience.

In a multiuser system, users need access to, and privacy for, their own files. System and user files need protection from accidental (or malicious) deletion. AOS/VS file access control lists (ACLs) help ensure this.

Each directory, including the root (:), and each nondirectory file, has an ACL. An ACL is a list of matched username-access pairs, with the form

`username, access [username, access] ...`

A username can be a real username, or it can include filename template characters to specify a group of usernames. Access types are O, W, A, R, E, and null. They have the following meanings.

| Access Type | Allows                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| O (Owner)   | <p>Owner access to a directory allows a user to change directory ACL, rename, or delete the directory, regardless of the ACLs of files in it. The user can also change the ACL of any file — directory or nondirectory — within the directory. In addition to O, E access is needed if the user wants to enter the directory or use its name in a pathname.</p> <p>Owner access to a logical disk unit (LDU, set by the Disk Formatter) is needed for a user to initialize the LDU.</p> <p>Owner access to a nondirectory file allows a user to change ACL, rename or delete the file, check file status, check or change permanence, or create, read, edit, or delete a user data area (UDA) for the file.</p> <p>For a directory or nondirectory file, Owner access differs from Write access as follows: with Owner access, a user can delete the file <i>without having Write access to its parent directory</i>; the user needs only E access to the parent directory. With Write (but not Owner access), a user can't delete the file unless he/she has Write or Owner access to the parent directory. This means that, if you want a user to be able to add to (but not rename or delete) a file in a directory to which the user has only E (or RE) access, give the file an ACL of username,WARE (not username,OWARE).</p> |
| W (Write)   | <p>Write access to a directory allows a user to delete or rename any file (including directories) in the directory — regardless of the file's ACL. To delete or rename the directory itself, a user needs Owner access to it or Write access to its parent directory.</p> <p>Write access to a directory also allows a user to create files and change file ACLs there. Write access allows a user to initialize and release an LDU there (the user also needs Owner access to the LDU and Execute access to the disk entry in :PER).</p> <p>Write access to a directory has little value by itself. To do anything in the directory, a user also needs Execute access to the directory.</p> <p>Write access to a nondirectory file allows a user to change file contents (for example, by editing with a disk file editor or adding text from another file), get a complete pathname, check file status, check or change permanence, and create or edit a user data area (UDA).</p>                                                                                                                                                                                                                                                                                                                                          |

| Access Type              | Allows                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| W (Write)<br>(continued) | <p>Write access has little value without read access — since, without read access, the user can't tell what's in the file.</p> <p>Generally, a user can't modify a file with a text editor unless he or she is able to delete it (he or she has Write access to the parent directory). This is true because — at the end of the editing session — the text editor tries to delete the original file and replace it with a new, updated file.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| A (Append)               | <p>Append access to a directory allows a user to add files (directory or nondirectory) to it.</p> <p>Append access to a directory has little value by itself. To do anything in the directory, a user also needs Execute access to the directory.</p> <p>Append access to a nondirectory file allows a user to check the file status, get a complete pathname, and check or change permanence for the file.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| R (Read)                 | <p>Read access to a directory allows a user to read filenames in it (for example, in a FILESTATUS command, with or without templates). Read access also allows you to read ACLs of files <i>in</i> the directory.</p> <p>Read access to a directory has little value by itself. To do anything in the directory, a user also also needs Execute access to the directory.</p> <p>Read access to a nondirectory file allows a user to read it — for example, with the TYPE command or a text editor. The user can also check the file status, get a complete pathname, and check or change permanence. The user also needs at least E access to the parent directory and all higher directories.</p> <p>Read access allows a user to copy a file or debug a program. This is <i>not</i> desirable for a program file, since a user can copy the file to his own directory and explore it at will (via a debugger or DISPLAY program). Or, he can use it to corrupt existing programs (for example, use a compiler to create a devious object file that will be linked into an application program).</p> |
| E (Execute)              | <p>Execute access to a directory allows a user to enter the directory and use its name in a pathname. To list files or check file ACLs in the directory, a user must have both E and R access. (Users <i>can</i> list a specific filename, if they know it, with E access only.)</p> <p>Execute access to a nondirectory file allows the user to execute the file as a program (XEQ or PROCESS command), to read file status, get a complete pathname, and to check or change permanence.</p> <p>Execute access to a program file allows the user to run the program via the XEQ or PROCESS commands. To debug the program or run a disk file editor on it, the user needs R <i>and</i> E access. Since E access alone doesn't allow the user to see the contents of the program, you can give E access safely to programs that (internally) contain sensitive information.</p>                                                                                                                                                                                                                       |

**Access Type****Allows**

,, (null)

Null access excludes a user from access. For a directory, null access prevents the user from accessing files within the directory. The user can list the directory name.

For a nondirectory file, null access prevents the user from accessing the file.

By default, users who are not given access have null access anyway — which implies that you don't need to specify null access. But if you use a template to give a group of users access, null lets you *exclude* users in the group. You can assign null access specifically with ,, (two commas) after the username or template. If you end an ACL command line with null, use one comma instead of two (e.g, ACL FILEA A+,WARE \$+, ,).

For example, assume you want to retain ownership of a file and give most users RE access to the file. You want to exclude users ANDY\_B and any user whose username begins with \$. You could type

```
) ACL pathname [!USERNAME],OWARE ANDY_B,, $+,, +,RE )
```

To deny everyone (including its creator) access to a file, use the ACL /K switch, as follows:

```
) ACL/K pathname )
```

When AOS/VS starts up, it assigns an ACL of +,E to the root directory, to allow users access to their own directories. This +,E ACL remains in force — regardless of any ACL assigned with the Disk Formatter or with the ACL command — while this AOS/VS system is running.

PREDITOR creates each user directory (in :UDD) with an ACL of username,OWARE. Each file the user creates within this directory gets the same ACL (username,OWARE) by default. The user profile files, in :UPD, have null ACLs, which means that only superusers, like EXEC, can read them.

Every user has Owner access, thus can change his/her file ACLs with the ACL command, or change the default ACLs with the DEFACL command.

A user can give another user (or all users) read access to any file by giving E access to his directories — up to :UDD:username — and by giving R access to the file. For example, assume Sam wants to give Al read access to file :UDD:SAM:MARK\_IV:MARKET\_PLAN. Sam can type

```
) ACL :UDD:SAM SAM,OWARE AL,E )
```

```
) ACL :UDD:SAM:MARK_IV SAM,OWARE AL,E )
```

```
) ACL :UDD:SAM:MARK_IV:MARKET_PLAN SAM,OWARE AL,R )
```

(The SAM,OWARE is needed to retain Sam's access rights to his own file.)

If a user will often need a tailored, nondefault ACL, you or the user can specify this ACL in the user's log-on macro with the DEFACL command. For example, assume that Sam will periodically want to give Al read access to selected files. Sam can put the command

```
DEFACL SAM,OWARE AL,E
```

in his log-on macro. This will allow Al to enter Sam's directories (but not browse for files in them). Sam can then let Al read a file by typing only *one* ACL command, regardless of the directory that holds the file; for example

```
) ACL :UDD:SAM:MARK_XV:STRATEGY SAM,OWARE AL,R )
```

In a more relaxed situation, you might want to specify E access for *everyone*. For this, the easiest method is to put the DEFACL command in the *central* log-on macro (that executes user log-on macros). The command would be

```
DEFACL [!USERNAME],OWARE +,E
```

The DEFACL command can be inserted in a log-on macro with a text editor.

The ACL structure makes it very easy to restrict access. All you need do is remove general E access from any directory above the one you want to restrict. For example, changing ACL of user Jan's initial user directory to JAN,OWARE prevents anyone other than Jan without Superuser from accessing any of her files — regardless of the ACLs below directory :UDD:JAN.

## Username Groups

If you want to group a set of users, create a username group. In AOS/VS, a username group is a set of users (usernames) that, combined with ACLs, allows (or restricts) access to a group of users.

To start, you need a unique specifier to use when creating the group's user profiles with PREDITOR. Then, you can use this unique specifier in all pertinent users' default ACL settings (in log-on macros) to establish the needed access to files.

For example, say you want a guest profile for general-purpose access. Your system allows users +,RE access by default, but you don't want guests to access nonguest directories. So, you need a guest username group for restricted access. For a unique specifier, you can use any unique character string that matches the group profile name — here, since there will be only one profile, you can use the profile name, \$GUEST.

Using PREDITOR, you create the user profile with the name \$GUEST and, for easy access, also make the password \$GUEST. Then, to prevent guests from accessing other users' files, you insert the command

```
DEFACL [!USERNAME,OWARE] $GUEST ,, +,RE
```

in each user's log-on macro. (If users didn't have +,RE access on your system, the DEFACL step would be unnecessary, since the original default ACL prevents access by anyone except the user.)

For another example, assume a project called Mark II that involves Sally, Jack, Alexis, and Sam. Sam is the project leader. You want to create a username group that gives each person execute and read access to other group member directories. In addition, you want Sam to have append access to group member directories. As a group name, you can choose something like +.MK2 (the suffix .MK2 is the unique specifier). Using PREDITOR, you create the profiles

```
SALLY.MK2 JACK.MK2 ALEXIS.MK2 SAM.MK2
```

Then, you create a log-on macro for each user's directory. It contains the command

```
DEFACL [!USERNAME,OWARE] SAM.MK2,ARE +.MK2,RE
```

The group's default ACL gives each user OWARE access to his or her files; it gives Sam append, read, and execute access to all group member files; it gives group members other than Sam read and execute access to all group member files; and it gives no access to other users. Since each user has W access, he or she can change ACLs (including the default ACL) at will. You rely on the people in the project to retain the ACLs needed for communication.

After deciding on a unique group identifier, you can check the users that belong to it with either the FILESTATUS command in :UDD or PREDITOR templates. To see which users belong to the Mark II group, you could type

```
) SUPERUSER ON )
```

```
*) FILES /S :UDD:+.MK2 )
```

```
... (it displays sorted list of usernames) ...
```

```
*)
```

Username groups can improve the flow of information, while retaining tight access control; they also make it easy to clean up (by deleting accounts) after a project is completed.

## Order of Usernames in ACLs

When you (or anyone) gives access privileges to different users, be sure to assign specific username group(s) before general username groups (templates). For example, the ACL

```
+ ,RE SALLY,OWARE
```

gives all users (which includes Sally) read and execute access — and *only* read and execute access. The O, W, and A access for Sally are ignored. With this ACL, no one but a superuser can write to the file or change the ACL. But transposing the user groups:

```
SALLY,OWARE + ,RE
```

gives Sally all access, and gives all users read and execute access — which is what people want from ACLs. When you use templates in an ACL, place specific username(s) first and the most general usernames (templates) last.

The specific-to-general rule also applies when you *exclude* users via null access. For an example, here's the example given above: You want to retain owner access, and give all users RE access — except ANDY\_B and any user whose username begins with \$. You can type

```
) ACL pathname [!USERNAME],OWARE ANDY_B ,, $+ ,, +,RE )
```

By specifying null for the usernames you want to exclude, you tell the system to exclude them before it acts on the +,RE template.

Any username template is like a group name. If you like the concept of group names, you can use username templates to achieve the group name effect. For example, for all users associated with project MARK\_II, you could create profiles with usernames that ended in .MII. With these usernames, you'd carefully avoid overlap with irrelevant usernames. Then, you'd configure default ACLs within the +.MII user directories to specify the kind of access you wanted for each person.

The number of user-access pairs you can specify is limited only by the number of characters involved. The maximum number of characters allowed is 255. You can assign a multiple-line ACL easily by writing it into a macro file with a text editor, ending each line with the & continuation character, then using the macro to assign the ACL to the desired file(s). For example, assume you create the macro ACL\_MARK\_II.CLI with the following ACL specification:

```
ACL/V (%-%) a_l,r,RE allan,WRE barnes,RE carnaby_a,RE erm,RE fort-,RE &  
jamison,RE s.a.a.,RE prodigy,AE &
```

You could then assign the long ACL to file(s) quite easily; for example

```
) ACL_MARK_II PROG+ MESSAGES )
```

This assigns the long ACL to all files whose names begin with PROG, and to file MESSAGES, in the working directory. To add OWARE access for the user who runs the macro, you'd insert the characters [!USERNAME],OWARE in the macro before the first username-access pair.

If you (or a user) want to change the ACL of all files in a directory and its subordinates, get into the directory and type an ACL command of the form

```
ACL/V # username-access [username-access ...]
```

For example,

```
*) ACL/V # SALLY,OWARE OP,WARE )
```

With Superuser on, you can bypass all ACLs. But so can any user who has Superuser privilege. The ideal arrangement allows people to work productively without Superuser.



## Device and LDU ACLs

Devices — like disk and tape units, and consoles — are accessed through filenames in the peripherals directory (:PER). The default ACL of :PER is +, RE — but ACLs of files in it are more restrictive. For disk, diskette, and tape units the default ACL is OP, WARE. For consoles, it's PMGR,OWARE.

The default tape unit ACL (OP,WARE) allows users other than OP no access. To allow user access, many sites use the UP macro to change tape unit ACLs to +,WARE. Unfortunately, An ACL of +,WARE allows any user to read or write any tape that happens to be mounted on a unit — an obvious security risk.

One way to keep tape units secure is to make users employ the MOUNT command, which asks the operator to mount a tape. After the operator mounts the tape and informs EXEC, EXEC changes the unit ACL to give the user exclusive access (username,WARE). The user retains exclusive access during the tape mount; then EXEC restores the old unit ACL.

You can restrict users who don't have Superuser to the MOUNT command by leaving tape unit ACLs as OP,WARE or making them null. Since users won't be able to access units directly, they must rely on EXEC to allow them access. Thus, they must use the MOUNT command.

Default disk and diskette unit names — like tape unit names — are OP, WARE. For diskette units — like tape units — many sites use the UP macro to change the unit ACL to +,WARE.

The ACL of a disk or diskette unit remains in force only while there is no initialized LDU in the unit. After a disk has been initialized into the file system, the ACL assigned to the LDU with the Disk Formatter takes effect. (But for the system LDU, the root ACL is always +,E.) An initialized LDU is treated like any directory; its ACL can be changed by an owner of the parent directory. To initialize an LDU, a user needs owner access to the LDU (set by the Formatter), write access to the directory, and execute access to the unit name(s) in directory :PER. Setting ACLs with the Disk Formatter is described in Chapter 12.

Before an LDU is initialized, it's vulnerable. Anyone at the system console or logged on with username OP can read from or write to it as a physical device (for example, DUMP/V @DPJ10 MYFILE .) To prevent this, have all on-line disks initialized as soon as possible after starting AOS/VS, or leave disk power off, or change disk unit name ACLs in :PER to null.

Any standard CLI process with username OP can overcome many ACLs. If you're concerned with file security, avoid leaving such a process running unattended. On the system console, run LOCK\_CLI.

After you've established the ACL standards that you want, the ACL mechanism works pretty well by itself. You don't need to change ACLs very often. But you do need to understand them.

## ACLs of AOS/VS Files

The ACLs of files shipped with AOS/VS (and created by AOS/VS utilities) are shown in Table 16-3. Do not change these ACLs (except user ACLs) unless you have specific reasons for doing so. Changing them can imperil the security or operation of your system.

**Table 16-3. ACLs of AOS/VS and Selected Other Files**

| File                            | Default ACL                     | Reason for Default and Comments                                                                                                                                                                                                                                      |
|---------------------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| : (root directory)              | +,E                             | Users need access to the root to log on to their own directories. (E access is required for access to any directory, with or without other access.)                                                                                                                  |
| :CEO_FILES                      | +,AE                            | Users need to add files to the directory (through CEO).                                                                                                                                                                                                              |
| :CEO_MAIL                       | OP, OWARE +,E                   | The operator needs access without turning Superuser on. Users need access (through CEO).                                                                                                                                                                             |
| CEO_DIR (path<br>:UTIL:CEO_DIR) | OP, OWARE +,RE                  | The operator needs access without turning Superuser on. Users need to read files in the directory and execute programs in it (through CEO).                                                                                                                          |
| devices                         |                                 | See :PER.                                                                                                                                                                                                                                                            |
| :CLI files                      | +,RE                            | Users need to be able to read and execute the CLI to log on.                                                                                                                                                                                                         |
| :HELP                           | OP, OWARE +,RE                  | The operator needs access without turning Superuser on. Users need to read help files in the directory. This ACL is also used for all files in the directory. Possibly, you might restrict operator access and/or user access to some files.                         |
| LINK.PR (:UTIL)                 | +, RE                           | Programmers need Execute access to write applications. For Link, other program (.PR) files in :UTIL, and compilers and other directories, we recommend removing R access from the ACL (for example, make the ACL +,E). Don't change the ACLs of overlay (.OL) files. |
| :LOCK_CLI.OL<br>:LOCK_CLI.PR    | OP,R<br>(null)                  | A null ACL for LOCK_CLI prevents any but a superuser from reading it (and learning the password). The overlay file's ACL of OP,R lets the CLI program read it.                                                                                                       |
| magnetic tape units             |                                 | See :PER.                                                                                                                                                                                                                                                            |
| :NET<br>:NET:UTIL               | OP, WARE +,RE<br>OP, OWARE +,RE | The operator needs access without turning Superuser on. Users need to read network files and execute network agent programs.                                                                                                                                         |
| :PAGE                           | +,E                             | User processes must access this directory. Page files <i>in</i> the directory have null ACLs.                                                                                                                                                                        |

(continues)

**Table 16-3. ACLs of AOS/VS and Selected Other Files**

| File      | Default ACL | Reason for Default and Comments                                                                                                                                                                                                                                                                                                           |
|-----------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| :PATCH    | +,RE        | The operator and users must be able to read patch files in the directory and enter the directory. This ACL also applies to files in :PATCH. You might consider giving :PATCH a null ACL, since probably only a superuser will apply patches, and — possibly — a sophisticated user could learn points of weakness by reading patch files. |
| :PER      | +,RE        | User processes may need access to files in the the peripherals directory (file ACLs follow).                                                                                                                                                                                                                                              |
| :PER:CONn | PMGR, OWARE | These are user console ACLs. The peripheral manager must own consoles to manage them. The peripheral manager assigns them to EXEC as users log on.                                                                                                                                                                                        |
| :PER:DPxn | OP, WARE    | These are disk unit ACLs. The operator needs WARE access to initialize disk units. User processes <i>may</i> need access to diskette units; if so, you can change diskette unit ACLs, perhaps in the UP macro. Generally, only superusers should access hard disks, so you shouldn't expand hard disk unit ACLs.                          |
| :PER:MTxn | OP, WARE    | These are tape unit ACLs. The operator needs to read and write to tapes. If users need tape access, a secure system would keep a restrictive ACL and require users to ask for labeled tape mounts, which lets EXEC supervise ACLs.                                                                                                        |
| :PROC     | +,E         | User processes need to access this directory.                                                                                                                                                                                                                                                                                             |
| :QUEUE    | +,AE        | User processes need to add files (to be printed or run in batch) to this directory. The ACL of file Q is +,R, to allow user processes to read QDISPLAY information. Users can read only the files that they have queued in :QUEUE.                                                                                                        |
| :SWAP     | +,E         | User processes must access this directory. Swap files <i>in</i> the directory have null ACLs.                                                                                                                                                                                                                                             |
| :SYSGEN   | +,RE        | Users may want to read system spec files. This directory is no great security risk, but you may want to change its ACL to null — on the theory that only a superuser will be generating an AOS/VS system.                                                                                                                                 |

(continued)

**Table 16-3. ACLs of AOS/VS and Selected Other Files**

| File              | Default ACL    | Reason for Default and Comments                                                                                                                                                                                                                                                                                                                                                               |
|-------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| :UDD              | +,E            | Users must be able to access their own directories.                                                                                                                                                                                                                                                                                                                                           |
| :UPD              | null           | Only superusers like EXEC and PREDITOR should read or change profile files.                                                                                                                                                                                                                                                                                                                   |
| user directories  | username,OWARE | Users should be able to do what they want in their directories. A user's files should not be accessible to other users.<br><br>This username,OWARE ACL is the default ACL for all files created by the user — in <i>any</i> directory where he/she creates files. You — or the user — can change the default ACL with the command DEFACL. Default ACLs are described earlier in this chapter. |
| :UTIL (utilities) | +,RE           | Users must be able to execute utility programs; the programs need to read overlay and data files.<br><br>All files in :UTIL are shipped with an ACL of +,RE. If you want users to be able to add files to :UTIL, give :UTIL an ACL of +,ARE (or, more specifically, use username,ARE before the +,RE).                                                                                        |

(concluded)

Aside from the recommendations above, you generally don't need to change the ACLs of files supplied by DG and created by DG programs.

### Preventing Unauthorized Access to Windows

AOS/VS Revision 7.00 supports windowing on graphics (pixel-mapped) consoles on systems like the DS/7700 computer. On such systems, a user can create windows on a graphics console, but in order to do so, must first assign (get ownership of) the PMAP, an entry in :PER, for the device. Unauthorized access to PMAP entries represents a potential security risk because whoever has access to a PMAP entry can run programs (like a password-stealing program) in a related window. To prevent unauthorized access to windows, add a line to your system's UP macro that assign PMAPs to PID 2 before the line enabling consoles. See "If You Have Graphics Consoles" in Chapter 5.

## Protecting the System Site and Backup Media

Software and hardware protection features are effective only if the hardware in the TCB — and your backup media — are physically secure from user access.

### System Console

If the system console is accessible to the user community, and runs a standard CLI, it's a serious security risk. A standard CLI on the system console has all privileges, or it can be terminated to expose a CLI with all privileges.

LOCK\_CLI is a lockable CLI that cannot be signed off or aborted while locked. While locked, it ignores commands that may threaten system security.

If you care about security, and your system console is accessible to users, you should run LOCK\_CLI on it. Even if you have trusted operators, you may want to run LOCK\_CLI as an additional security aid — or, if you want to limit the operator's powers.

The operation of LOCK\_CLI is described in Chapter 9. But how to set the password is described only here.

## Changing the Password of LOCK\_CLI

LOCK\_CLI, like the standard CLI, consists of two files, LOCK\_CLI.PR and LOCK\_CLI.OL. It is in directory :UTIL.

The password supplied with LOCK\_CLI is PASSWORD, but you should change this before running LOCK\_CLI. To do it, you must edit file LOCK\_CLI.PR with the FED disk file editor, put the new password in location PASSW, and end the password with a null (ASCII 0). Up to 31 filename characters, including spaces and control characters (but not CTRL-L) are allowed. They must all be uppercase.

The following example shows you how to change the original password (PASSWORD) to MAGIC

Choose a display console. If this is a user console, log on with a profile that has Superuser privilege.

If this is the system console and it is running a locked LOCK\_CLI, unlock it by typing UNLOCK ), then PASSWORD ). If you are in a normal CLI, proceed.

After FED starts, you can use its Help feature (type ESC H) if needed.

Press the ALPHA LOCK key on the console. Then type the following:

```
) SUPERUSER ON )
* ) DIR : )
* ) XEQ FED LOCK_CLI.PR )
```

*FED- Disk File Editor REV n*

```
_ PASSW/ 050101 )
```

```
BREAK/ESC T 00...01 _ 7 )
```

```
_ PASSW/ PA _ "MA CR
```

```
PASSW+1/SS _ "GI CR
```

Type PASSW/ to see start of current password. The \_ is the FED prompt, don't type it.

Press BREAK/ESC key and T to open the display mode register. Then type 7 ) to make its value 7 for ASCII display. Press ).

Open location PASSW again to see what the values are in ASCII. The first two characters are PA. Type a quotation mark ("), then the first two characters of the new password. Here, type MA ; then press the CR key to open the next location. "

Type a quotation mark, then the next two characters. Here, type GI then press CR to open the next location.

(For a password with an even number of characters, type the last two characters, press CR, then type 0 (zero) to end the password, and press ) to close the location.)

PASSW+2/ WO 'C\*400 }

\_ PASSW/ MA \_ CR

PASSW+1/ GI \_ CR

PASSW+2/ C<0> }

\_ ESC Z

DONE!

\*) XEQ LOCK\_CLI }

AOS/V\$ CLI REV n ....

) SUPERUSER ON }

)

) UNLOCK }

MAGIC }

) SUPERUSER ON }

\*) LOCK }

)

If you cannot make the new password work, log on to a user console with a privileged profile, turn Superuser on, and use FED to check :UTIL:LOCK\_CLI.PR, locations PASSW, again; then try the UNLOCK again.

Note that file LOCK\_CLI.PR should have a null ACL, but file LOCK\_CLI.OL should have an ACL of OP,R so this CLI can read its own overlay file. The files are shipped with these ACLs, but you can assign them as follows:

\*) ACL/K LOCK\_CLI.PR }

\*) ACL/V LOCK\_CLI.PR }

LOCK\_CLI.PR

\*) ACL LOCK\_CLI.OL OP,R }

\*) ACL/V LOCK\_CLI.OL }

LOCK\_CLI.OL OP,R

\*)

C is the last letter in the example password. To specify one character, type an apostrophe rather than a quotation mark, then the character. Then, to put a null in the right byte, you must multiply the character by 400 as shown. The syntax is

'char\*400

(As mentioned above, this isn't needed for a password with an even number of characters: you simply keep typing "xx CR until you've entered the whole thing; then type 0 } to produce the terminating null in the next word.)

When done with the password, go back and verify it. The first two characters are okay.

The second two characters are okay...

And the third two characters (last in the example) are okay.

Press ESC key and Z to leave FED.

Back to the CLI. Try the new password...

Try SUPERUSER...

LOCK\_CLI ignores the command.

Type UNLOCK...

and the new password (doesn't echo).

See if it's unlocked...

Yes, success. Lock it again.

(The CLI displays nothing, which means that the ACL is null.)

(The CLI displays an ACL of OP,R.)

Now, with the new password and correct ACLs, LOCK\_CLI can safeguard the system console, user processes, and the system itself. To run it automatically, edit the UP\_CLI macro as described under LOCK\_CLI in Chapter 9.

The people who operate the system don't absolutely *need* to know LOCK\_CLI's password. If they don't know it, they won't be able to shut the system down normally from the system console — which might be what you want. (Anyone who has Superuser can get Superprocess, and terminate the LOCK\_CLI or master CLI from a *user* console — so if the operator has a privileged profile, he or she can do this.)

In any case, the fewer people who know the password the better — because anyone who knows it can UNLOCK, read or modify files, or turn on Superuser and take control.

LOCK\_CLI retains the username OP, so it can issue commands to EXEC while locked. Thus, the operator can issue EXEC commands even while restricted to a locked CLI.

## Disabling the Break Sequence

Even with LOCK\_CLI running, someone can enter the break sequence, halt the CPU, and cause delays while ESD or FIXUP is run. Even worse, the person could run ESD, reboot AOS/VS, and come up in the master CLI, with all its powers.

You can prevent this by disabling the break sequence. This is useful only when the system console is separate from the CPU, because anyone can create the effect of a break sequence with CPU switches.

On MV/10000 SX, MV/10000, MV/8000 II, MV/8000 C, and MV/4000 machines, use the CPU LOCK switch to disable the break sequence. On MV/6000s, you should not disable the break sequence.

On an MV/8000, the only way to disable the break sequence is with the SCP command LOCK. You can do it at any time. If AOS/VS is running, enter the break sequence (CMD and BREAK, or BRK, or BREAK, depending on the system console); this gives control to the SCP-CLI. If AOS/VS is not running, simply type the SCP lock command. The SCP lock command is

```
SCP-CLI> FLAGS LOCK Y )
SCP-CLI>
```

The break sequence is now disabled; you can return to or boot AOS/VS as desired. The lock cannot be cleared until the SCP-CLI is active again and someone types

```
SCP-CLI> FLAGS LOCK N )
SCP-CLI>
```

A power outage to the CPU will also clear the flag. Pressing the CPU CONSOLE switch to RESET will give control to the SCP CLI, regardless of the lock flag.

On MV/4000 DC, MV/4000 SC, and Data General DS/4000-series systems, the only way to disable the break sequence is to type the SCP command FLAGS LOCK Y ).

Don't disable break on these systems, however, unless it's critically important to deny access to the SCP. If the system hangs while the break sequence is disabled, you won't be able use break to enter the SCP and run ESD. To shut down, you'll need to turn power off, which means FIXUP will be needed on all disks.

## Computer and Power Source

Anyone who can touch the computer can unlock it, halt and reset it, run ESD, restart AOS/VS, and come up in the master CLI with all its powers. The system is only as secure as the people who have access to the CPU. In a closed system, the computer should be locked away from the user community or have a trusted operator nearby.

The computer, and disk and tape units, are always vulnerable to vandalism.

Cutting AC power to the system doesn't represent a security violation per se, but it may bring everything down — reducing productivity, increasing downtime and expenditures, and perhaps jeopardizing deadlines and projects. If you can, make your computer system power source secure (keep all power lines covered and out of plain sight).

## **Disk and Tape Units**

Cable lengths require disk and tape units to be fairly close to the computer. Thus, the same steps taken to protect the computer often serve to protect disk and tape units.

A user with access to disk units can bring down AOS/VS (by cutting power to the system disk or page/swap disk) or halt application-related work (by cutting power to other disks). If a disk unit has a removable pack, a user can remove the entire pack — perhaps to read it at leisure on a different system. Regardless of the disk type, a user with access to disks can harm the site and its productivity.

Tape units are less of a risk than disk units, but they still represent an opportunity — a user may be able to mount and read a nearby and sensitive tape.

## **Storing Backup Media**

Anyone with physical access to backup media has an open ticket. He or she needs only a tape or diskette unit (or compatible disk unit, for disk backups) to read the entire contents of your system: passwords, private databases — anything. Sophisticated users can use the DISPLAY program to learn tape- or diskette-set volume IDs and filenames, and they can use the LOAD command and pathname templates at leisure to get the information they want. Or, for revenge, they can destroy data on backup tapes (simply a `DUMP/V @MTxn:1 MYFILE` typed to the first volume of a multivolume backup destroys the whole backup).

Access to backup media makes trespass and break-in relatively easy for experienced users who have access to devices (the devices can be on any DG system).

However, storing backup media securely isn't easy (even if you don't care about security). For a closed shop, you should observe the same precautions as for the computer: lock up the backup media or keep it under the observation of a trusted operator.

For ultimate safety, store backups away from the computer site, using a company that understands magnetic media storage. Keep backups near the computer for only a short period, say a week. Don't let users carry backup media (like tapes) away from the site. Lock up write-enable rings.

## **Log-on, Password, and User Guidelines**

Before logon, the username-password pair are the first — and sometimes only — line of defense from break-in. After logon, there are sometimes signs of break-in that users can notice. This section tells you how to maintain the strength of the username-password defense and how users can help protect themselves.

### **Log-on Tries**

To log on, a user must type his/her username and password correctly. By default, EXEC allows 5 log-on tries (which may be break-in attempts). After 5 unsuccessful log-on tries, EXEC locks the console for 10 seconds (local line) or breaks the connection (modem line). The console lock and broken connection are designed to discourage break-ins.

In the ENABLE command that activates each console line, you can specify a different number of log-on tries allowed — from 1 to 10. And, you can tell EXEC to disable the line (instead of locking it for 10 seconds or breaking the connection) after a given number of log-on tries. A disabled line can't be used again until someone at the system console re-enables it using the EXEC command ENABLE.



For greatest security, you might allow only one or two tries, and tell EXEC to stop (disable) the line thereafter. This is particularly relevant on modem lines (if you have them), since anyone who has a DG-compatible console, modem, and who knows your system's phone number can try to guess a username-password pair and — if she or he succeeds — break into the system. Many people who've used AOS/VS know that each system has an OP profile and that (often) the OP profile is privileged. All they need to do is guess the OP password (this is a good reason to keep modem and Superuser and Superprocess privileges in separate profiles).

EXEC's ENABLE command, which allows you to change the number of tries allowed on a line, and specify what will happen then, is described in Chapter 8.

## User Log-on and Log-off Messages

Log-on and log-off messages can help you — and help users — identify possible system break-ins.

Whenever a user logs on or submits a batch job, the following things happen:

1. A user types username and password, or the system accepts a batch job. Users can post batch jobs with the command QBATCH or QSUBMIT. Normally, a batch job is processed as soon as possible — but, if desired, a user can tell the system to run the job *after* a specific time, using the QBATCH or QSUBMIT switch /AFTER=.
2. EXEC verifies the username and password, and tells the system to create the user process.
3. The system creates the user process for the user, running the initial program specified in the user profile.
4. The system writes the greeting message (LOGON.MESSAGE) to the user.
5. The system tells the initial program to execute the initial IPC file specified in the profile.
6. The system notes the date and time in the user's profile file (in :UPD) and in the system log (if logging is on).

The process then runs for the user until he or she logs off or the batch job terminates. Then, the following things happen:

1. The user logs off or the batch job terminates.
2. The system terminates the user process.
3. The system notes the date/time in the user's profile file (overwriting the log-on time) and in the log file (if any).
4. The system writes a process termination message to the user. If the user was logged on over a modem line, EXEC automatically hangs up, breaking the connection.

During logon and logoff, messages are written to the console. For batch, messages are written to the batch output file (by default, the line printer).

Encourage users to *check* the displayed date/times each time they log on. If the displayed date/time doesn't match the last time the user logged on, this means someone else is using this user's account. The user should change his/her password immediately and tell you (or tell the security person, if it isn't you) about the breach.

Sample system log-on and log-off sequences follow.

(Log-on sequence: *), username ), password )*)

-----  
*LAST MESSAGE CHANGE 1-JUN-86 15:32:08*

... (System displays contents of file LOGON.MESSAGE) ...

-----  
*LAST PREVIOUS LOGON 2-JUN-86 8:22:59*

... (System executes commands in user log-on macro, if any) ...

*AOS/VS CLI REV n 3-JUN-86 8:23:01*  
*)*

... (User works with system — workday passes) ...

*) BYE )*

*AOS/VS CLI TERMINATING 3-JUN-86 17:34:44*

*PROCESS n TERMINATED*

*CONNECT TIME 9:11:43*

*USER 'xxx' LOGGED OFF @CONn 3-JUN-86 17:34:47*

If another user process with the same username is still running, the termination (obituary) message looks like this:

*PROCESS n TERMINATED*

*CONNECT TIME hh:mm:ss* (The batch message is *CONNECT TIME hh:mm:ss*)

*(OTHER JOBS, SAME USERNAME)*

*USER 'xxx' LOGGED OFF dd-mon-yy hh:mm:ss*

Ask users, when they log off, to

- Check for an *(OTHER JOBS, SAME USERNAME)* message. This message means the system is running another process for the same username. The message is normal after someone submits a batch job from a console (since two processes — for batch and console — run for the user and the message is displayed when one process terminates). The message is also normal if someone has logged on to two consoles at once and logs off one of them.

But if a user sees this *OTHER JOBS* message and didn't post a batch job, and was not logged on to a second console, then someone else is using the account. The user should tell you at once.

Ask users, when they log on, to

- Check the *LAST PREVIOUS LOGON* date and time, as described above. If this doesn't match the time they remember, someone else may be using the account. The user should tell you at once.

## User Passwords

The person who creates a user profile also assigns the user's password. The password must be from 6 through 15 characters long. Case of letters is ignored. More than 15 characters won't work — if the password is 15 characters, and the user types these 15 and one more, the system will reject the password.

A user's password can include any printable character. Obviously, a password like *!\*%EO(~* is hard to guess (and, perhaps, to remember).

With AOS/VS Revision 7.00, you can tell PREDITOR to encrypt a user's password before storing it. From a security standpoint, this is desirable because no one — not even a superuser — can figure out an encrypted password. But if the user relies on a network to other DG

systems, encrypting the password may interfere with user access to other hosts. For any remote host running a revision of XODIAC that doesn't support encryption, encryption will prevent access via XODIAC's RMA and FTA agents. CEO doesn't need these agents for CEO Mail to work between hosts; however, CEO does rely on RMA for remote printer use). Read your XODIAC Release Notice to see if encryption is supported.

For a network user, you may decide against encryption, or encrypt on all systems (all must be running AOS/VS Revision 7.00 or later), or you might maintain two accounts for the user: one secure local account, with password encrypted, and one general-purpose account, with password unencrypted, to serve for network access.

Anyone who edits the profile can change the existing password without knowing the old one.

Users may be allowed to change their passwords. By default, PREDITOR grants this privilege (the default answer allows it).

Generally, users should be able to change their passwords — since, if a user originates a password, he/she is likely to remember it. If someone else originates the password, the user is likely to forget it — and will probably write it down, producing a security risk.

Unfortunately, given free choice, users are likely to choose obvious passwords. Passwords that users should avoid (because they are easy to try) are

- initials or part of name (particularly the username, which is very easy for people to try);
- name of housemate, spouse, child, or pet;
- make or model of favorite auto;
- name, make, or model of boat;
- phone number;
- name associated with work, like company, group, or project; and
- anything people know this user cares about.

Good password choices include a mixture of letters, numbers, and punctuation; for example WLS1.1

One way to build good, memorable passwords is to create them from phonetic syllables. For example, take the syllables

ang  
fof  
lal  
dan  
pok  
soo

There are many combinations of these — memorable through their phonetic construction — and obscure enough not even to exist in the dictionary.

Another possibility is a foreign language, if you know it well. Avoid obvious words or phrases.

Yet another possibility for a password is a phrase, with words separated by periods or underscores. For example,

save.my.files

Passwords should be changed regularly — depending on the sensitivity of a user's data. They should be changed *at once* if you suspect your system is under attack (signs are described later). Also, passwords should be changed whenever a privileged user plans to leave, or leaves, your organization. This is true because a person who leaves a group also leaves group rules and sanctions — in theory, he or she has nothing to lose by taking information.

The XODIAC RMA agent (also used by CEO) requires that a person have the same password on each system on which he/she will use remote printers. This means that a break-in on one system may indicate vulnerability in all systems on the network. All the more reason to make passwords very difficult to guess.

From time to time, users will forget their passwords. You can assign a new one via PREDITOR, if you edit the user profile. You need not know the original password to create a new password.

You can monitor user password changes with detailed logging.

## Guest Accounts and Shared Passwords

A guest account, which allows users without accounts to log on to your system, is a useful communications aid. Such profiles have public usernames and passwords which may be the same; for example \$GUEST and \$GUEST. Guest accounts are useful because they allow people without accounts to read general-distribution bulletins and mail.

Unfortunately, guest accounts represent holes in security, because — since many people know the password — it's difficult to identify an account abuser. You can trace suspicious activity only to the username, not to a person. This is a problem with *any* account that two or more people share.

If security is critically important to you (closed shop), avoid creating a guest account.

If you really need a guest account, give it a username that has a unique character (for example, \$ in \$GUEST), so you can specifically *deny* access to this username in other users' default ACLs. For example, the central log-on macro could include the command

```
DEFACL [!USERNAME],OWARE $+ ,, +,RE
```

This would give the user ownership (as usual), anyone whose username began with \$ (like \$GUEST) *no* access, and other users read and execute access. Some files, like SED.PR in :UTIL, and mail files, must be accessible to users — access R or E, or RE. Log on as guest and try the operations you want guests to be able to do.

Avoid giving the guest account any of the privileges shown in Table 16-2. You might want to restrict the number of sons (to 0 or 1) to conserve system resources. And, you might restrict disk space to a reasonable minimum — say 500 or 1000 blocks.

## Users and Unattended Consoles

Anyone who is logged onto a console and leaves it unattended risks all his or her files. Any passer-by can read or delete them.

If a user has sensitive data or special privileges, he or she should *never* leave a console logged on. It takes only a moment to move a sensitive file into a common directory, where it can be studied later, at leisure. Also, a trespasser may be able to use a privileged process to learn passwords. Even a naive trespasser, if angry, can delete all the original user's files — which can take a lot of time to restore. (Files not backed up *cannot* be restored).

Even in a medium-security or closed shop, users should log off when they leave the site. It's a good idea to urge them to log off for lunch, or whenever their consoles will be unattended for 10 minutes or more.

## Password-Stealing Programs

Any console left unattended (whether or not a user is logged on) is vulnerable to a password-stealing program or CLI macro (sometimes called a spoofer or password-grabber).

Any programmer, or relatively knowledgeable CLI user, can write a program or macro that duplicates your system log-on banner.

In one scenario, the program author runs the stealing program on an unused console, using a public account to avoid identification. Eventually, a user tries to log on, typing username and password. The program stores them in a file that its author can access (in some public directory). Then, the program displays *Invalid username-password pair* and terminates. The system displays *PROCESS TERMINATED* and *USER 'xxx' LOGGED OFF*, identifying the username. The giveaway here is the *TERMINATED* and *LOGGED OFF* messages, which never appear in a real log-on sequence.

A stealing program run from a user process (a console left unattended) is more subtle. The original user returns to find the system banner on his/her console. He/she may not remember logging off, but blames the inconsistency on poor memory. He/she types username and password, and the program copies username and password as before; but then it chains to the CLI. It can produce a log-on message and AOS/VS CLI banner identical to the original. The only clue is the *PROCESS CONNECT TIME* message displayed when the user logs off. This message will show a longer connect time than expected, since the user's initial process was running the whole time.

There is no real defense against password-stealing programs — there's only detection. User awareness is needed to detect the first type of stealing program (*TERMINATED* message). User consistency can prevent the second type of stealer: users who always log off when leaving their consoles won't be fooled.

When you, or a user, thinks a password might have been stolen, the user must change that password immediately.

The log file, with detail full, yields evidence of the second type of password stealing: a report of the original username's file accesses will show the steal file pathname.

Generally, you need the cooperation of users in many ways to run a secure system. For users, security features of AOS/VS are described in the manual *Learning to Use Your AOS/VS System*. You might encourage users to read that book.

## Using the System Log File

Security doesn't maintain itself — it requires vigilance and review of system activity. The most important tool for review is the log file. This section outlines using the system log file and suggests procedures to follow. A section in Chapter 9, "Event Logging with SYSLOG, the Error Log, and REPORT," goes into the details.

Normally, if you want to run a secure system, you will run the system log with detail set to full. Therefore, the log file will provide information about nearly everything that happened on the system. From a detailed log, you can create reports based on

- username
- file pathname
- failed logons

Logging without full detail produces a log that can tell you how much system time each user consumed, and who privileged users are, but that cannot tell you about file access or failed log-on attempts. In a closed shop, you will probably want to check for unwarranted file access and possible break-ins — so you will need full-detail logging.

## Logging Procedures

System logging (minimal or full detail) requires effort. Log files grow rapidly in a timesharing system, and — with full-detail logging — the system will panic if it runs out of log space. In any case, disk space is valuable. Here is an outline of the steps needed to use logging effectively.

1. Start logging. The SYSLOG command starts logging, and can rename the old log file. The system always writes user log information to file SYSLOG in the root directory. For full detail, add the /DETAIL=FULL switch to the SYSLOG command. SYSLOG is a privileged command; only the master CLI, PID 2, or a process with System Manager privilege can issue it. (Chapter 9 describes SYSLOG command syntax in detail.)

If security is important to you, start logging as soon as possible in the UP macro and stop logging as late as possible in the DOWN macro. Do not start or stop SYSLOG while the multiuser environment is active. And avoid using the SYSLOG command with the /DETAIL switch, which implicitly stops and then restarts logging.

If you do start logging while the multiuser environment is up, SYSLOG cannot record information you need. If a process is running before SYSLOG starts, reports will identify the process by PID number only, not username. And for a file open before logging starts, reports will include only the channel number and PID, not pathname. Thus for both processes and files, reports might not make clear the identities of users or of objects on your system.

2. Monitor disk space use periodically. With full-detail logging, if the log file grows to consume all available disk space, AOS/VS will panic. Chapter 9 suggests using a separate directory or LDU for logging and explains a macro (supplied with the system) for monitoring disk space.
3. Generate a report from the log file. Use the new log filename if the file was renamed in the SYSLOG command; use the log filename SYSLOG if the log file wasn't renamed.

You can choose content for the report with switches, but first you must decide *what* you want to see. From the standpoint of security, the most useful reports include events by

- Username. The report lists all files a user accessed or tried to access, logons, processes created, and so on, with date and time; this is useful for new users. Since application programs run under specific usernames (like OP), a report by username tells what files an application program accessed — a good way to check for Trojan horses. (Use switch /TRACE=username.)
- File pathname. The report lists all users who accessed or tried to access a file. This is useful as a check on sensitive files like :UPD, LOCK\_CLI.PR, EXEC.PR, or your application program and data files. (Use switch /FILE=full pathname.)
- Failed logons. An increasing number of incomplete log-on tries may indicate that someone's trying to break into your system. (Use switch /FAILED\_LOGONS.)

A list of events included in each report appears in Chapter 9, section "Event Logging with SYSLOG, the Error Log, and Report" in the switch description.

If, in the report of an event, you see an error message, this indicates the user attempt failed. If there is no error message, the user attempt succeeded.

The choice of report content is very important. Generating a report can take a long time — 10 minutes, 20 minutes, even an hour. This practically eliminates spontaneous checking. But don't automatically include *everything* in your reports; aside from the resources and time required to generate large reports, too much material will overwhelm the person who reviews the reports.

4. After the report is generated, print it.

5. Read the report. As you read a report, apply the same rationale used to choose report content.

If you see signs of trespass or break-in, follow them up carefully. You should have the power to react: discipline the offender(s) and tighten security after trespass, or tighten security (require password changes) after a break-in.

6. At least weekly — better daily — dump the log file(s) and report(s) to backup media and delete them. Labeled media are best for this (described in Chapters 10 and 8). Log files are sensitive material, so store the log archives as securely as your other backup media.

Old log files and reports can be very useful. Often, they can reveal when an intrusion started, and precisely what happened. Knowing these things gives you some picture of the damage — and, possibly some way to minimize this damage.

## **Danger Signals — Signs of Security Breach**

Recognizing that your system is under attack — or that a breach has occurred — is as important as the steps taken to ensure security.

It's essential to understand the *types* of violation that can occur, and the types of people who are motivated to do it. Generally, there are three types of threats to security. They are

- probing
- irresponsibility
- break-in

*Probing* is often undertaken as a contest between a user and the system — an intellectual challenge. Many probers are motivated by curiosity and a desire to outwit system designers and security planners. They are often young and rarely malicious; they are not prototypical felons (although breaking into computer systems is a crime).

You can detect probing by checking reports from detailed system logs. Probing may involve log-on attempts or attempted access to files.

### **Probing — Failed Log-on Attempts**

If the log shows many failed log-on attempts on local consoles, the prober may be a current user trying to log on to a privileged account (look for users trying to log on to privileged accounts, like OP). Since the log-on try was made locally, the person is probably (although not definitely) a user or a known person, since a stranger using a local console might be noticed and reported.

If the failed attempts occurred over a modem line or virtual console, the user may not be a current user but an unhappy ex-user or skilled break-in person who knows AOS/VS. The username recorded for the failed logon may offer some clues.

### **Probing — Attempted Access to Files**

A large number of failed file accesses (to :UPD, :LOCK\_CLI, or applications programs) may indicate probing. The username is a matter of record, and you should talk with the user who has this username. To be tactful, say that you assume the account is being used by someone else, and have the user change passwords at once.

Then, if the failed accesses continue with the same username, this person is almost certainly the culprit; further disciplinary action is needed. If the failed accesses stop, either someone else was using the account and was foiled by the password change, or the user was doing the probing and has stopped. In any case, you win: you've identified the prober or stopped the probing.

Password stealing, described earlier in this chapter, is another kind of probing. It's usually discovered by users. The best defense against it is user awareness.

## **Irresponsibility**

On most systems, there are users whose access rights allow them to take confidential or privileged information, or to corrupt data or files. If such users abuse their privileges (steal passwords or copy sensitive data files), they lack a sense of responsibility. The system's security controls aren't to blame.

If a user is irresponsible with his own account — by telling people his password or allowing them to see him type it — you can suggest that he be more careful.

You can minimize damage done by irresponsible users by restricting access as far as possible. Review user privileges and sensitive file ACLs periodically. As important as system control, though, is a user's behavior. Is he or she acting responsibly? Working competently? Looking for another job? If a user's status within your organization is about to decline (or end), you should think about reducing his/her privileges — or even deleting his/her account.

## **Break-In**

A person who breaks into your system (penetrates the secure perimeter) is often highly skilled and motivated. There are several forms of break-in: by a successful prober; by a programmer who, through a Trojan horse, learns privileged passwords and confidential information; by an agent or covert operative who has planned the assault for a long time.

Whoever does it, a break-in is serious. Typically, the person doesn't leave obvious tracks — detection may be a matter of luck or occur from events that have nothing to do with your security arrangements. However, if you maintain security awareness, study the log file regularly, and watch for signs of break-in, you will improve your chances of detecting a break-in.

The person who probes or breaks in may be a student, middle manager, or agent of a rival organization or country. Some sample sites, people, roles, and goals follow.



|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| College or high school                      | A student may break in, moved by curiosity, intellectual challenge, or the appeal of free computer time. His or her resources include time and ingenuity.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Retail chain or any industrial firm         | <p>A clerk may break in, moved by resentment. His or her resources include familiarity with the site and access to the system.</p> <p>A manager may break in, moved by desire for capital gain or by resentment. His or her resources include access to the system, its records, and — perhaps — privileges like Superuser to bypass all controls.</p> <p>An industrial spy may break in, moved by desire for capital gain or for trade secrets. His or her resources include computer expertise and money.</p> <p>An applications programmer may break in, moved by desire for capital gain or for trade secrets. His or her resources include computer expertise, intimate knowledge of the computer system, and access to applications code.</p> <p>An outsider may break in, moved by desire for trade secrets or by resentment. His or her resources include time and money.</p> |
| Bank or Stock Exchange                      | <p>A manager or officer may break in, moved by desire for capital gain, for inside information, or by resentment. His or her resources include familiarity with the system and money.</p> <p>An applications programmer may break in, moved by desire for capital gain, for inside information, or by resentment. His or her resources include computer expertise, knowledge of the system, and access to applications code.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Phone network, power grid, or military site | <p>A terrorist and/or religious fanatic may break in, moved by desire to destroy order. His or her resources include dedication and money.</p> <p>An agent of an unfriendly nation may break in, moved by desire for strategic advantage and/or political gain. His or her resources include computer expertise, new technology, and money.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

Students (hackers) are most likely to probe — and possibly break-in. But they don't often do serious damage. Managers and bank officials often represent cases of irresponsibility — and possible probing. An outsider who attempts access to a phone network or military site represents the most serious threat — and will often have the resources to break through security safeguards.

## Detecting Security Breaches

If your system is vulnerable to attack — perhaps under attack — warning signals usually come from several sources:

- users
- your own observations
- study of log reports.

## User Observations

Users have the power of numbers. Often, there are many users. They can be very helpful (and occasionally frustrating, by reporting anomalies that have an obvious explanation). Users may report the following kinds of events:

- Files are missing or inaccessible.
- A log-on message indicates that the user logged on when he or she did not. Or, at logoff, a user sees a *OTHER JOBS, SAME USERNAME* message when he or she has not logged on to another terminal or submitted a batch job.
- A list of processes (displayed by the ? macro) shows a user logged onto a second console when he/she is not.
- Users find software and/or data files that they didn't write in their directories.
- Printed files with a user's username on the header are found, but the user didn't print them.
- Users of modem lines encounter busy signals more often.
- Off-hour users find the system unusually slow.

Any of these observations could indicate trouble, and you should explore it promptly — checking the complaint against reality. If the unusual situation really exists and doesn't result from user error, treat the situation as a real break-in attempt and take action to identify the perpetrator and his/her access method (compromised password, insider access, etc., perhaps using the log file).

If the user's report is a false alarm — perhaps a result of ignorance — don't castigate the user. User training is the province of system administrators and managers; the responsibility rests with you, not users. It's in both your interest and the user's to increase his level of competence.

In any case, don't insult the user. By doing so, you would lose his/her observation powers, reduce site morale, and — perhaps — create resentment that could lead to future break-ins.

## Your Powers of Observation

As a person who cares about security, you should stay alert to conditions that may indicate future incursions. Here are some of these conditions:

- After you type ? , it displays a process with a username belonging to a user who could not be logged on (he or she is on vacation, or is logged on to a modem line and doesn't have a modem).
- The ? command displays process names or batch streams unknown to you.
- System response changes dramatically and inexplicably from time to time.
- Media (tapes or diskettes) and/or listings are missing.
- You find strange software in directory :UTIL or your main applications directories.
- There's physical evidence of tampering — your papers have been rearranged, or material is missing from a locked closet.
- The system seems to be doing an unusual volume of processing in off hours; for example, it seems to be busy at 6:00 a.m. or 11 p.m.
- There are ACL changes on critical files, like LOCK\_CLI.PR and directory :UPD.
- Your organization has obvious morale problems: lower earnings, layoffs, employee turnover, and/or reorganizations have produced a subdued or hostile atmosphere.

As with user-reported anomalies, each of these observations warrants exploration. You may find that there is a problem and take preventive or other action; or there may be a harmless cause.

## Study of Log Reports

With log detail set to full, you can track every pertinent file access, every process creation, and every failed log-on attempt. (Logging without detail set to full can yield a report of privileged users, and how much system time users consumed, but it cannot provide other security and access-related information.)

Deciding on the information to have reported is sketched earlier (details are in Chapter 9). System files like `LOCK_CLI` and `:UPD`, and Trojan horse candidates like text editors and applications programs, are good candidates. And you can get reports on ACL change attempts. A list of AOS/VS files and their default ACLs appears earlier in the chapter, in Table 16-3.

## When a Breach Occurs

When a breach occurs, or is attempted and fails, there is standard sequence to follow:

- Detecting the breach — you learn that someone is probing or has penetrated your security perimeter.
- Identification — you learn the identity of the offender(s).
- Defense — you adapt security arrangements to prevent further violation.
- Repair — you fix the damage as far as possible.

### Detecting Failed Break-Ins

Acts that suggest failed break-ins include file browsing (going shopping in other users' directories), password guessing, use of password-stealing programs, and unusual activity on console lines.

Browsing is easy to identify from reports from a detailed log file. Browsing often results from natural curiosity, and users may browse without malicious intent. You should treat an innocent browser differently from a malicious one, although it may not be easy to distinguish the two. An easy rule of thumb is to treat first offenses as innocent, other offenses as a sign of — charitably — noncooperation. Browsing *is* theft, theft of information. The value of the information stolen — or vulnerable to theft — should determine the strength of your response.

Password guessing and the use of password-stealing programs are often detected by users. Password guessing produces many failed log-on attempts — but not under the user's actual username.

Password-stealing programs may give clues to their authors — if you get a log file report on file access of the target user's username (described in "Password-Stealing Programs", earlier in this chapter).

When someone is trying to break in, via password guessing or stealing, detailed log reports can tell you at least the *username* tried. Sometimes this is an anonymous name, like `OP`. But it may suggest a real user on your system. If the attempt is occurring from local consoles, you might actually be able to catch the offender in action. If it's occurring over a modem line, identification is harder. You *can* get users to change passwords or phone numbers, or direct `EXEC` in the `ENABLE` command to stop (disable the line) after a given number of retries. The latter solution may interfere with legitimate users, however.

Sometimes, the only way to identify an outsider is simply to wait — taking no new steps to bar intrusion and lay a few traps — in hopes that somehow the perpetrator will yield his/her identity.

## Detecting a Break-In

When you learn of a break-in, it feels like an assault — a violation or theft of something close to you. Coping with trauma and the threat will require user efforts — and your best efforts as a manager.

Detecting a break-in may be easy or not easy — some signs of break-ins are described in previous sections. When you suspect or confirm a break-in, consider the possibility that the perpetrator has been using your system for days or even weeks. Consider what discretionary information you've lost. Then — if you ran detailed logging — dig out the old reports and, maybe, load one or two old log files to generate reports that may tell you when the break-in first occurred.

## Identifying the Offender

After a break-in has occurred, you must decide whether the offender is an insider or outsider. This distinction is important, since it determines your prevention measures. The first step is to accumulate and analyze the information you have:

- user observations,
- your observations,
- your knowledge of the attempt (How well does the intruder seem to know the system? How were break-in attempts made?),
- and your old log files and reports, which may give some history on the break-in attempts.

If all this information suggests someone, fine. You may want to discuss the situation with that person immediately.

Often, though, to make positive identification, you must take some risks. If you really need to identify the intruder, you will probably need to allow more break-ins, while you analyze the intruder's actions. If you're not running a detailed log, start doing so immediately. Check the log file for patterns and clues to motivation. If the break-in occurs under one or two usernames, you might be able to plant identity-revealing traps in the user log-on macro.

Review your backup procedures — and consider more frequent backups — with the goal of minimizing any damage done.

## Identifying an Outside Offender

If the intrusion is on a local console, increase surveillance.

If it's occurring over a modem line, it may be very difficult to trace the caller. Phone traces are expensive, time-consuming, and difficult, and often they don't work. Generally, identifying an intruder through the phone system is worth considering only when substantial cash or property loss is involved. In many cases, spending your energy on preventing recurrences is more cost-effective than traces through the phone system.

## Defending against Break-Ins

The best defense is awareness. Stay alert to changes in behavior and morale; and be willing to implement changes as user and project statuses change. Here are pointers in a few key areas:

- Have users change passwords — with frequency based on the sensitivity of their material.
- Double-check your system software. A sophisticated programmer may have encoded Trojan horses in applications software. Check creation dates of program files, and get a report from the detailed log file on *all file accesses made by those processes*.
- Double-check the UPD directory (this is where profiles and passwords are kept).
- Read the log reports.

## Repair Afterwards

If you think (or know) a break-in has occurred, check for file or data damage and repair it if you can.

To do this, you must identify the files that were accessed; see if the files were changed or corrupted; and restore valid versions from backup media as needed.

If you've identified the offending username, the most thorough check is to get a report on all files accessed — from a few days before the time of the first break-in to the present. Some of these files you can verify by deleting and recreating them; for example, with a user's profile file (in :UPD), you can use PREDITOR to delete and recreate the username (*not the user directory!*).

For files whose contents you can't easily check (like application programs), load earlier files that were backed up before the break-in. Then use the FILCOM or SCOM program to check for differences — and explore the differences. This is easier with a source file (readable text differences are displayed) than a program file (disk location differences are displayed).

You can use source files for comparison if you're sure that the program file wasn't corrupted (via a disk editor), and that a deceptive object file wasn't used to build a Trojan horse into the program. One way to detect program file edits or object file creations is to check reports for access to the disk file editor (:UTIL:FED.PR) and compiler (compiler program files include the language name, and .PR suffix).

Be aware, though, that a sophisticated user can copy editor or compiler programs into his directory under different names, and run the copies (instead of the originals). To prevent this, don't allow Read access to program files — at most, use an ACL of +,E for .PR files.

## Deleting a User Profile (Revoking an Account)

Deleting a user profile prevents a user from logging on. Deleting a user's profile is recommended when a user leaves your organization (for security reasons and/or to reclaim disk space). Also, deletion is an option if you know or strongly suspect that the user has abused his or her account (perhaps by examining other users' files or running a password-stealing program).

Profile information, including username, password, and privileges, is stored in each user's profile file in directory :UPD. The user's *files* are stored in directory :UDD:username.

With PREDITOR, using the DELETE command, you can delete the profile (in :UPD). This prevents the user from logging on but leaves his/her personal files intact. PREDITOR then asks if you want to delete the user directory.

If you care about security, deleting the user's directory (which also deletes all its files) is an important step. You may want to back it up (using the DUMP command and :UDD:username:#template) before deleting it. Deleting the directory removes it from easy reach of superusers and reclaims disk space. (Note, however, that if you store a user's directory on other disk, like UDD1, with a link to that LDU in UDD, you must delete the user's files manually.)

After deleting a profile, think about access that any current user may have given to the deleted username. This represents a potential security risk: if a profile is ever created with the original username, the person with this username will inherit the access of the deleted user. For example, say users Al and JKM are involved in a project and Al gives JKM RE access to some files. JKM leaves the organization; the system manager deletes the JKM profile. Six months later, the organization wants to create a profile for someone whose initials are JKM. If the new account is created with username JKM, chances are that the new user will inherit RE access to Al's files (unless Al remembered to change the ACLs — and perhaps his default ACL, if it included JKM).

One way of preventing this inadvertent granting of access to new users is *never* to reuse a username. Another way is to check ACLs of all directories at the :UDD:username level after creating a new profile. Without at least E access to directory :UDD:username, a user can't access any file in :UDD:username.

You can *temporarily* deny a user access by using PREDITOR to change his/her password (you need not know the old password to change it with PREDITOR). Another way to deny access temporarily is to change the ACL of directory :UDD:username to null. In the first case, the user will get an *Invalid Username/Password Pair* message on every log-on attempt. In the second case, the user will get a *FILE ACCESS DENIED — CONTACT YOUR SYSTEM MANAGER* message.

In either case, the user will be unable to log on without consulting someone in authority. If the person in authority wants to reinstate the user, it's easy enough to tell the user the new password or change the ACL of :UDD:username back to username,OWARE (or whatever it was originally).

## System Architecture — Hardware Security Features

This section describes the protection features of MV/Family computers — features that AOS/VS relies on, and uses, to ensure security of code and data in memory.

MV/Family computers have a hierarchical memory protection mechanism, which protects AOS/VS, its Agent and peripheral manager, some server programs (INFOS II and DG/DBMS), and sensitive user data. This arrangement allows common routines to be used by all programs.

In a computer with the hierarchical protection mechanism, each user's address space includes a copy of AOS/VS. This lets user programs see the entire operating system as a subroutine — accessible via subroutine calls instead of specific system calls.

MV/Family computer memory is divided into eight units of 512 megabytes each, which are called segments. Between the segments are protection systems called *rings*. The lower-numbered segments are the most privileged; the higher-numbered, least privileged. Ring 0 protects segment 0 and allows only privileged instructions to execute in segment 0. Ring 1 protects segment 1, ring 2 segment 2, and so on. The AOS/VS kernel runs in ring 0 and its peripheral manager runs in ring 1. The AOS/VS Agent runs in ring 3, and INFOS II and DG/DBMS data management control programs run in ring 4.

User programs usually run in ring 7 and ring 6, where they have least chance to access AOS/VS code and address space.

Whenever an AOS/VS process refers to an address, the hardware checks the segment field of the address. The ring of the destination segment determines whether the source segment's reference is legal. This check occurs for any reference — a simple data reference or a transfer of control to the new segment.

A register called the segment base register (SBR) contains information about the validity of the referenced segment. If the reference is invalid, a protection fault occurs; the hardware blocks access to the segment, places the fault code 3 in AC3, and AOS/VS reports a protection fault to the process that attempted the access.

### Accessing Other Segments for Data

A process can access data in another segment, depending on

- the process' location in memory;
- the protocol defined by the ring that protects the destination segment.

When the process makes the reference, the computer notes the source segment and destination segment, and determines if the source segment's reference is valid or not. If not valid, a protection fault occurs, similar to the fault described above; the hardware blocks access, places the value 4 in AC3, and AOS/VS reports a protection fault.

The segment hierarchy (low to high, okay; high to low, fault) applies to access for data as well as other access. Table 16-4 shows which accesses are valid or cause a fault.

**Table 16-4. Valid and Invalid Segment Access**

| Process<br>in<br>Source<br>Segment | Destination Segment |       |       |       |       |       |       |       |
|------------------------------------|---------------------|-------|-------|-------|-------|-------|-------|-------|
|                                    | 0                   | 1     | 2     | 3     | 4     | 5     | 6     | 7     |
| 7                                  | fault               | fault | fault | fault | fault | fault | fault | valid |
| 6                                  | fault               | fault | fault | fault | fault | fault | valid | valid |
| 5                                  | fault               | fault | fault | fault | fault | valid | valid | valid |
| 4                                  | fault               | fault | fault | fault | valid | valid | valid | valid |
| 3                                  | fault               | fault | fault | valid | valid | valid | valid | valid |
| 2                                  | fault               | fault | valid | valid | valid | valid | valid | valid |
| 1                                  | fault               | valid | valid | valid | valid | valid | valid | valid |
| 0                                  | valid               | valid | valid | valid | valid | valid | valid | valid |

## Ring Crossing

A ring can't be crossed accidentally, since the computer increments only the part of the program counter that doesn't involve the segment. The program must issue an LCALL instruction to attempt a crossing.

The hardware will allow a process to transfer to another segment only if all the following are true.

- The process must issue a subroutine call or return. No other calls will be accepted across a ring.
- The subroutine call must be inward (toward ring 0), and a return must be outward (toward ring 7). An outward call or inward return will cause a protection fault.
- A program must be running in the destination ring, and this program must have specified one or more *gates*, via a gate array. (A gate array is a series of entry points into the inner segment.) Thus, the inner-ring process must have *invited* access by the outer-ring one.

In the gate array, the inner-ring process specifies

- the number of gates;
- the range of segments that can use this gate; for example, the value 3 allows access by a process in ring 0, 1, 2, or 3. Processes in other rings will take a protection trap and access will fail;
- the address of the gate array.

## Performing the Crossing

When a process issues a ring-crossing call (LCALL), the computer checks its call against settings in the destination segment's gate array. If the crossing is allowed, it occurs. If the gate array doesn't allow it, a protection fault occurs in the *calling process*.

## Protecting Against Hardware Trojan Horse Pointers

Suppose a process in segment 6 calls segment 2, and one of the arguments passed to segment 2 is a pointer to information in segment 2. When the process in segment 2 uses this pointer for reference, the computer will use segment 2's access privileges to determine the validity of the reference. These privileges may allow access to data *that would otherwise be restricted*. A pointer that attempts such access is called a Trojan horse pointer.

AOS/VS guards its kernel (in ring 0) and PMGR (in ring 3) against Trojan horse pointers, using hardware validate instructions. If you run application programs in inner rings, you might want to do the same (although processes are vulnerable to access only through gate arrays that they themselves define).

## Indirection Protection

Whenever a process specifies an indirect address, the computer checks for a valid ring crossing. The first time each memory reference occurs, the computer treats the segment specified in the program counter as the source segment, and the segment specified in the intermediate address as the destination segment. The computer compares the fields; and if the access is invalid, the access is rejected and a protection fault occurs.

If the access is valid, the computer gets the new address specified by the intermediate address. Then, if another indirect address is specified, the computer treats the intermediate address as the source segment, and the segment specified in the new address as the destination segment (as described above).

Up to 15 levels of indirection are allowed. If a process tries more than 15 indirect address references, a protection fault occurs.

## Page Protection

Page protection involves checks to see if an instruction in a process can legally access a page within the segment. There are two kinds of page protection: page-table entry validation and access validation.

### Page-Table Entry (PTE) Validation

The validity bit (0) in the page table entry indicates whether the page is defined. If there's a reference to the page, and it isn't defined, this means it isn't in physical memory; a physical page fault occurs and the page is read from disk.

### Access Validation

When a process tries to access a page that's in physical memory, the computer checks the page's access bits (2–4) for restrictions. For reads, it checks bit 2 (1 indicates a valid read, 0 an invalid read). For writes, it checks bit 3 (1 indicates a valid write, 0 an invalid write).

On transfer of control to the page, the computer checks bit 4 (execute). A 1 in bit 4 indicates a valid transfer, 0 an invalid transfer.

If the access bits forbid the type of access attempted, the access is blocked and a protection fault occurs.



## Protection Fault Summary

MV/Family machines have a number of protection fault codes -- placed in AC1 on a protection fault. These codes are summarized in Table 16-5. AOS/VS interprets the codes and returns an appropriate error message if the errors occur.

**Table 16-5. MV/Family Hardware Protection Fault Codes**

| <b>Fault Code<br/>(Octal)</b> | <b>Meaning and Description</b>                                                                                                                                               |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0                             | Page read violation. The page-table entry denies read access.                                                                                                                |
| 1                             | Page write violation. The page-table entry denies write access.                                                                                                              |
| 2                             | Page execute (transfer) violation. The page-table entry denies execute access.                                                                                               |
| 3                             | Validity violation, ring reference or page-table entry.                                                                                                                      |
| 4                             | Inward address violation. The process tried to access an inner ring.                                                                                                         |
| 5                             | Defer (indirect) violation, more than 15 level of indirection.                                                                                                               |
| 6                             | Illegal gate. The maximum number of gates defined by the gate array has been reached.                                                                                        |
| 7                             | Outward call. The process attempted a subroutine call through an outer ring.                                                                                                 |
| 10                            | Inward return. The process in the current ring tried to return, but the return address specified an inner ring.                                                              |
| 11                            | Privileged instruction violation. A process not in segment 0 attempted a privileged instruction.                                                                             |
| 12                            | I/O protection violation. The process attempted an I/O instruction — but the segment base register of the current segment is set to prevent I/O instructions from executing. |
| 14                            | Invalid microinterrupt return block.                                                                                                                                         |

## Security Check List

Figure 16-1 summarizes the security points mentioned in this chapter. It's a list of one-line questions, followed by check boxes, multiple-choice boxes, or fill-in blanks. The list includes each issue raised in this chapter. It's designed to serve both as a checklist and summary.

If you want to run a secure system, we suggest you fill each space (use pencil). Then, for perspective, or if you want to increase or decrease security at your site, you'll have a point of reference.

### AOS/VS Security Check List

1. My site is a  
Closed shop\_\_\_\_\_ Medium-Security Shop\_\_\_\_\_ Open Shop\_\_\_\_\_
2. My user community includes  
\_\_\_\_\_ User Profiles \_\_\_\_\_ CEO Users  
\_\_\_\_\_ Total Users (include guests and multiple users of one profile)
3. Users in the community fall into the following categories:  
(include users in more than one category as appropriate)  
CEO Users \_\_\_\_\_ Data Entry Clerks \_\_\_\_\_ Managers \_\_\_\_\_ Programmers \_\_\_\_\_  
Secretaries \_\_\_\_\_ Word Processing Typists \_\_\_\_\_
4. Aside from AOS/VS, I run the following software:  
Ada\_\_\_\_\_ BASIC\_\_\_\_\_ C\_\_\_\_\_ CEO\_\_\_\_\_ COBOL\_\_\_\_\_ DG/DBMS\_\_\_\_\_  
DG/SQL\_\_\_\_\_  
FORTRAN 77\_\_\_\_\_ INFOS II\_\_\_\_\_ INTERNET\_\_\_\_\_ PASCAL\_\_\_\_\_ PL/I\_\_\_\_\_  
PRESENT\_\_\_\_\_  
Sort/Merge\_\_\_\_\_ SWAT\_\_\_\_\_ TRENDVIEW\_\_\_\_\_ XODIAC products X.25\_\_\_\_\_  
FTA\_\_\_\_\_  
RMA\_\_\_\_\_ VTA\_\_\_\_\_ Others \_\_\_\_\_
- 4a. My site's application programs are written in the following language(s):  
\_\_\_\_\_
5. Physical security. Are any of the following under supervision of a system operator (Y or N)?  
First shift: CPU\_\_\_\_\_ System console\_\_\_\_\_ Disk units\_\_\_\_\_ Diskette units\_\_\_\_\_ Tape units\_\_\_\_\_  
Second shift: CPU\_\_\_\_\_ System console\_\_\_\_\_ Disk units\_\_\_\_\_ Diskette units\_\_\_\_\_ Tape units\_\_\_\_\_  
Third shift: CPU\_\_\_\_\_ System console\_\_\_\_\_ Disk units\_\_\_\_\_ Diskette units\_\_\_\_\_ Tape units\_\_\_\_\_
6. Physical security. Are any of the following locked away from the user community (Y or N)?  
Computer\_\_\_\_\_ System console\_\_\_\_\_ Disk units\_\_\_\_\_ Diskette units\_\_\_\_\_ Tape units\_\_\_\_\_
- 6a. How do users access tapes?  
Via physical access to units\_\_\_\_\_ Labeled tape mount requests through EXEC\_\_\_\_\_  
Either physical access or labeled tape mount, depending on user \_\_\_\_\_
- 6b. How do users get their printed text from the printer(s).  
Via physical access to printer(s) \_\_\_\_\_ Distributed by operator(s) \_\_\_\_\_
7. Do you encrypt passwords in user's PREDITOR profiles?

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Figure 16-1. AOS/VS Security Check List (continues)

8. How many system users have the following privilege?

Change username\_\_\_\_\_ Superuser\_\_\_\_\_ Superprocess\_\_\_\_\_ Access devices\_\_\_\_\_

8a. Write the username of each privileged person and check privilege(s).

Username\_\_\_\_\_ Change username\_\_\_\_\_ Superuser\_\_\_\_\_ Superprocess\_\_\_\_\_  
Access Devices\_\_\_\_\_ Sys Mgr\_\_\_\_\_

Username\_\_\_\_\_ Change username\_\_\_\_\_ Superuser\_\_\_\_\_ Superprocess\_\_\_\_\_  
Access Devices\_\_\_\_\_ Sys Mgr\_\_\_\_\_

Username\_\_\_\_\_ Change username\_\_\_\_\_ Superuser\_\_\_\_\_ Superprocess\_\_\_\_\_  
Access Devices\_\_\_\_\_ Sys Mgr\_\_\_\_\_

Username\_\_\_\_\_ Change username\_\_\_\_\_ Superuser\_\_\_\_\_ Superprocess\_\_\_\_\_  
Access Devices\_\_\_\_\_ Sys Mgr\_\_\_\_\_

Username\_\_\_\_\_ Change username\_\_\_\_\_ Superuser\_\_\_\_\_ Superprocess\_\_\_\_\_  
Access Devices\_\_\_\_\_ Sys Mgr\_\_\_\_\_

8b. Do any of these privileged users have network or modem privileges?

If so, write the username and check the privileges.

Username\_\_\_\_\_ Network\_\_\_\_\_ Modem\_\_\_\_\_

Username\_\_\_\_\_ Network\_\_\_\_\_ Modem\_\_\_\_\_

Username\_\_\_\_\_ Network\_\_\_\_\_ Modem\_\_\_\_\_

Username\_\_\_\_\_ Network\_\_\_\_\_ Modem\_\_\_\_\_

Username\_\_\_\_\_ Network\_\_\_\_\_ Modem\_\_\_\_\_

9. Have you changed any of the default ACLs supplied with or created by AOS/VS files? If so, specify the parent directory name and filename.

Parent directory information Name \_\_\_\_\_ ACL \_\_\_\_\_

Filename \_\_\_\_\_ Old ACL \_\_\_\_\_ New ACL \_\_\_\_\_

Reason for change  
\_\_\_\_\_

Parent directory information Name \_\_\_\_\_ ACL \_\_\_\_\_

Filename \_\_\_\_\_ Old ACL \_\_\_\_\_ New ACL \_\_\_\_\_

Reason for change  
\_\_\_\_\_

Parent directory information Name \_\_\_\_\_ ACL \_\_\_\_\_

Filename \_\_\_\_\_ Old ACL \_\_\_\_\_ New ACL \_\_\_\_\_

Reason for change  
\_\_\_\_\_

Figure 16-1. AOS/VS Security Check List (continued)

Parent directory information    Name \_\_\_\_\_    ACL \_\_\_\_\_  
Filename \_\_\_\_\_    Old ACL \_\_\_\_\_    New ACL \_\_\_\_\_  
Reason for Change \_\_\_\_\_

10. At your site, what would be the two most destructive security-related events and their (estimated) dollar values?

Event \_\_\_\_\_ \$ \_\_\_\_\_

Event \_\_\_\_\_ \$ \_\_\_\_\_

11. Does your site have a clearly defined security program (Y/N)? \_\_\_\_\_

- 11a. If there is a security program, do users know why there is one? \_\_\_\_\_

- 11b. If there is a security program, how do users feel about it (check one)?

Like it \_\_\_\_\_    Accept it \_\_\_\_\_    Dislike it \_\_\_\_\_    Hate it \_\_\_\_\_

- 11c. If there is a security program, name major reasons for it (past break-in, general prudence, sensitive data, contract requirements). Write as many as apply.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

12. Does your site run the system log?

Yes, with detail full \_\_\_\_\_    Yes, without detail full \_\_\_\_\_    No \_\_\_\_\_

If no, skip to question 18.

13. How often do you generate reports?

Daily \_\_\_\_\_    Two to five times weekly \_\_\_\_\_    Weekly \_\_\_\_\_    Biweekly \_\_\_\_\_

Monthly \_\_\_\_\_    When it seems appropriate \_\_\_\_\_    Never \_\_\_\_\_

14. If your site generates reports, what kind do you generate?

By username \_\_\_\_\_    By filename \_\_\_\_\_    Failed logons \_\_\_\_\_

Other (specify switches) \_\_\_\_\_

- 14a. Why do you do it this way? \_\_\_\_\_

15. How often are the reports read?

Daily \_\_\_\_\_    Two to five times weekly \_\_\_\_\_    Weekly \_\_\_\_\_    Biweekly \_\_\_\_\_

Monthly \_\_\_\_\_    When it seems appropriate \_\_\_\_\_    Never \_\_\_\_\_

16. How often are the log files dumped and deleted?  
 Daily\_\_\_\_\_ Two to five times weekly\_\_\_\_\_ Weekly\_\_\_\_\_ Biweekly\_\_\_\_\_  
 Monthly\_\_\_\_\_ When it seems appropriate\_\_\_\_\_

17. Where is the log directory (check one)?  
 Root (:)\_\_\_\_\_ Other CPD directory on master LDU \_\_\_\_\_  
 Directory on a nonmaster LDU \_\_\_\_\_

17a. Approximate size by which the log file grows each day, blocks \_\_\_\_\_

18. Are you satisfied — generally — with the level of security maintained at your site (Y or N)?

**Notes:**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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*Figure 16-1. AOS/VS Security Check List (concluded)*

## How to Adapt This Book for Restricted Operators

If your system operators have few or no privileges, there are some parts of this book you may not want them to read. If so, you can remove certain parts of the book and give the operator(s) the rest. Generally, the parts to remove are

|                  |                                                                                                                                      |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Chapters 2 and 3 | If you don't want the operator to bring up the first AOS/VS system.                                                                  |
| Chapter 4        | If you don't want the operator to run VSGEN.                                                                                         |
| Chapter 5        | If you don't want the operator to run PREDITOR or create the multiuser environment.                                                  |
| Chapter 7        | If you don't want the operator to run PREDITOR.                                                                                      |
| Chapter 15       | If you don't want the operator to know about processes or to install new revisions.                                                  |
| Chapter 16       | If you don't want the operator to know about security concepts, and setting the LOCK_CLI password, and some ways to breach security. |

## What Next?

Chapters 1 through 5 of this book describe *bringing up* an AOS/VS system from scratch. Chapters 6 through 14 explain *running* the system; and Chapters 15 and 16 (this one) deal with system management issues.

Thinking about, and achieving, a secure system is complex, because it involves strong — and unpredictable — human feelings and behaviors. This chapter is more of a beginning than an end. It explained degrees of security (closed, medium-security, and open shop), privileges, ACLs, the LOCK\_CLI password, hardware security, user cautions, logging issues, danger signals, and the protection safeguards in MV/Family architecture. Finally, it summarized these issues in a security checklist, and showed how to adapt this book for restricted operators.

At this point, you might want to check out the error chapter or appendixes — or review earlier material.

End of Chapter



# Chapter 17

## Important Errors and Error Messages

Read this chapter

- when you expect a response at your console and nothing happens;
- when an error message appears on your console or a printed file and you don't know how to recover from the error;
- when you see an incomplete POWER UP message or lights blink regularly on your computer's front panel.

While bringing up or running your computer system, errors may occur. This chapter explains the most important of these. Major sections are

- Error Messages
- AOS/VS Numeric Error Codes
- Powerup and Power Supply Codes

### Error Messages

This section describes important error messages you may receive while running your computer system. Most messages are displayed on the system console or the console you're using; a few messages may appear on printed files. Table 17-1 describes the messages, alphabetically. It explains the probable source (cause) of the error and one or more possible solutions.

Common errors that *users* may receive from EXEC or the system are detailed in Chapter 8, Table 8-5. The most important of those messages also appear in Table 17-1.

Error messages from some programs (not the CLI) consist only of a number, without a text explanation. If AOS/VS is up and running, you can use the CLI command MESSAGE to interpret the number. For example,

```
) MESSAGE 244 )      (Get the CLI to interpret the number.)
244 FILE ACCESS DENIED
)
```

If you see a numeric code and AOS/VS is *not* running, see the next major section ("AOS/VS Numeric Error Codes") for the most common error codes and their meanings. These codes are from the system parameter file, PARU.32.SR.



**Table 17-1. Important Errors and What To Do About Them**

| Message                                                      | Source and Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| None. Nothing happens at startup or in response to commands. | At startup. Power is not flowing to CPU, system console, disk unit, or tape unit.                                                                                                                                                                                                                                                                                                                                                                                                         | Power up CPU, system console, disk unit, and tape unit if needed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                                                              | At startup. System console is not on line (ON LINE light off), or brightness is set too dim.                                                                                                                                                                                                                                                                                                                                                                                              | Put it on line (CMD and ON LINE key), or check brightness.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                                              | At startup. You typed the wrong device code; there is no such device.                                                                                                                                                                                                                                                                                                                                                                                                                     | Type the break sequence (CMD and BREAK/ESC keys). Retype the BOOT command.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                                              | At startup. Bootstrap disk or tape unit is not ready or on line.                                                                                                                                                                                                                                                                                                                                                                                                                          | Make the unit(s) ready and/or put on line.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                                              | At startup from tape. Tape unit is set to wrong density, or is not on line, or unit door is open.                                                                                                                                                                                                                                                                                                                                                                                         | Take tape unit off line, change density, put back on line; close unit door (if any); try again.                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                              | At startup from diskette. Diskette is misinserted.                                                                                                                                                                                                                                                                                                                                                                                                                                        | Remove and reinsert diskette, with write-enable notch up and label out (see Figure 2-1).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                                              | At startup. Disk bootstrap is not installed.                                                                                                                                                                                                                                                                                                                                                                                                                                              | Run the Installer (see Chapter 2 or 3) and install the disk bootstrap and the system bootstrap.                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                              | At startup. Input medium (disk or tape) is unreadable. The first blocks of the medium are required to load the program. This could mean a bad tape or disk.                                                                                                                                                                                                                                                                                                                               | Make sure device is ready and/or on line. If so, perhaps the wrong disk or tape is mounted.<br><br>If you are starting from tape (device code 22), file 0 of the tape must contain program TBOOT. If you are starting from disk or diskette (code 27, 24, 33, or 64) the first blocks of the disk must contain a disk bootstrap, installed by the Installer.                                                                                                                                                                                                               |
|                                                              | At startup on an MV/4000 DC, MV/4000 SC, or Data General DS/4000-series system. The IOC emulator is not installed on the hard disk.                                                                                                                                                                                                                                                                                                                                                       | Turn power off and on again. If nothing happens again, get the IOC EMULATOR diskette and install the emulator on the hard disk, as described in Chapter 2, steps 3, 4, 5.                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                              | At startup. Bootstrap jumpers are not installed. On any locked CPU (lock switch), when you turn power on, the CPU tries to boot from the device code selected with hardware jumpers or DIP switch. Usually the jumpers or DIP switch are set to the master disk device code (27, 24, or 33) by the DG engineer who installs the hardware. If the jumpers/DIP switch are not set, or are set to a device that's not on line, the computer can't automatically boot when you turn power on. | Make sure the system console and system disk are ready and on line. After you make sure they're on line, unlock the CPU and turn power off and on. The system console should display <i>BOOT DEVICE</i> or <i>@</i> . If so, this means CPU jumpers or the DIP switch aren't set to a device code. You must specify the code to load from. If the message is <i>BOOT DEVICE</i> , type 27L, 24L, (or other disk code). If the message is <i>@</i> , type 24L, 27L, (or other disk code). This will boot SYSBOOT, which loads micro-code and allows you to bring up AOS/VS. |

(continues)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                                     | Source and Meaning                                                                                                                                                                                                                                                                                           | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| None. Nothing happens at startup or in response to commands.<br>(continued) |                                                                                                                                                                                                                                                                                                              | To make cold starts easier later on, you might want to have a DG engineer set the jumpers/DIP switch to the primary disk device code.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                                                                             | During normal AOS/VS operations (power still on to CPU and system console).                                                                                                                                                                                                                                  | <p>At the system console: Type CTRL-Q to undo any CTRL-S that suspended display. If this works, you've recovered. If it doesn't work, type CTRL-O to undo any CTRL-O. If this works, fine. If it doesn't work, type CTRL-O again and continue to the next recommended action.</p> <p>Type CHAR/OFF/NRM ↵ to undo any CHARACTERISTICS/NRM command that suppressed messages.</p> <p>If the system console is a hard-copy console, check for a fault; turn off and on, and/or replace ribbon if worn out.</p> <p>Check for a high priority process (like a dump) that's using a lot of resources. Try typing CTRL-C CTRL-C on the system console. If the system console echoes ^C^C, AOS/VS is probably okay and the problem is with one or more user processes. Warn users of impending shutdown; then bring the multiuser environment DOWN ↵ and UP ↵.</p> <p>If the system console doesn't react to CTRL-C CTRL-C, the system is deadlocked. Type the break sequence, then RESET ↵ and START 50 ↵. Proceed as described in Chapter 6, "Abnormal Shutdown".</p> |
| ! (exclamation)                                                             | From the SCP debugger.                                                                                                                                                                                                                                                                                       | Press CONSOLE RESET (MV/8000 systems), then type N ↵ and TTY ↵ to the SCP-CLI> prompt when it comes up. On a different machine, if AOS/VS is not running, turn power on off and on again.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| @ (at sign)                                                                 | From microcoded console loader program. This program, which opens communication between CPU and system console, has control. This @ prompt can appear: if you type a break sequence while in the SCP, or when you turn CPU power on with the computer unlocked, or if power-up diagnostics detect a problem. | <p>Turn power off, press LOCK to ON; turn power on; then answer the SYSBOOT questions. If there is no LOCK switch, boot from disk via 24L.</p> <p>If AOS/VS was running when this prompt appeared, try typing P, then CONT ↵. You may need to run FIXUP on the LDU and/or DTOS FRUs on the CPU.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                                                                                               | Source and Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>A disk can only be mirrored with a disk of the same size</i>                                                                       | From the Disk Formatter. Each disk in an LDU image must be the same size as its mirror. You can also get this message if the diagnostic areas differ.                                                                                                                                                                                                                                                                                                                                                                                                                   | Perhaps you made a mistake in typing. If so, respecify the disk unit names. If the diagnostic areas differ, run a Full format on one of the images, making the diagnostic areas the same size.                                                                                                                                                                                                                                                                                                                                                           |
| <b>ABNORMAL SYSTEM SHUTDOWN</b><br><br>sometimes followed by<br><br>-- Run <i>FIXUP</i> on all LDUs ever initialized into this system | <p>From AOS/VS, after you have tried to shut down normally or run ESD.</p> <p>This message means that — for some reason — AOS/VS could not close all files and release nonmaster LDUs (if any were initialized).</p> <p>This problem occurs if you initialize a removable LDU (like a diskette), remove it from its unit without releasing it, then shut down. For example, you typed <b>INIT @DPJ10 J</b> — and, without typing <b>RELEASE ldu-name J</b> — removed the diskette from its slot. Later, you shut down while the diskette remained outside its slot.</p> | <p>Run <b>FIXUP</b> on the system LDU.</p> <p>If the <i>ABNORMAL</i> message is followed by the <i>RUN FIXUP</i> message, you should insert each LDU ever initialized and run <b>FIXUP</b> on it (unless <b>FIXUP</b> says fixing is not necessary). Some of these previously initialized LDUs will not be accessible from AOS/VS unless you fix them.</p>                                                                                                                                                                                               |
| <b>ABORT</b> message                                                                                                                  | <p>From the Disk Formatter on a Partial format, this may mean the disk was never full formatted.</p> <p>From <b>FIXUP</b>, if message is <i>FIXUP CHECKSUM ERROR</i>, this means that <b>FIXUP</b> hasn't been read into memory correctly.</p> <p>From <b>FIXUP</b>, the disk DIB block may be bad.</p> <p>From AOS/VS during initialization. There may be a message or numeric code to explain. If there is only a code, find it in Table 17.2</p> <p>From CLI. A utility program hit a fatal error and couldn't continue. AOS/VS stays up.</p>                        | <p>Make sure the disk is write enabled if this applies; retry the Formatter. A Full format may be needed. If it aborts on a Full format, consult your DG support organization.</p> <p>See <i>FIXUP CHECKSUM ERROR</i> in this table.</p> <p>See <i>CANNOT READ IN THE DIB FOR THE LDU</i> message in this table.</p> <p>If message contains the number 243, you must run <b>FIXUP</b> on the LDU before running anything else.</p> <p>If the message allows you to correct the problem, do so. Otherwise try to find the message text in this table.</p> |
| <b>AIR FLOW ALARM -- CHECK FILTERS</b>                                                                                                | From SCP on system console. Air flow in the MV/8000 cabinet is inadequate. The main CPU keeps running.                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Shut down AOS/VS (if up) immediately; temperature may soon reach a critical point. Correct the problem.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                                                 | Source and Meaning                                                                                                                                                                                                                                                                             | Action                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>AN UNLABELED DISKETTE HAS BEEN INSERTED. DO YOU WANT TO LABEL THIS DISKETTE? [N]</i> | From CLI, on a labeled diskette write. The diskette you inserted is not labeled.                                                                                                                                                                                                               | If you want to label the diskette, type Y ↵. The CLI will then ask for the volume ID you want, and will display a default based on the label you specified for the first diskette. If you thought the diskette was labeled, or think you may have made a mistake and inserted a diskette with valuable data, press ↵. Then remove the diskette and try to find and insert the diskette with the label you expected. |
| <i>AOS/VS cannot run with this instruction set</i>                                      | From SYSBOOT. SYSBOOT has detected that the microcode that's loaded does not match the CPUID.                                                                                                                                                                                                  | Perhaps you loaded the wrong microcode (for example, C/350 microcode on an MV/8000). Reload the microcode and try again.                                                                                                                                                                                                                                                                                            |
| <i>ATTEMPT TO ACCESS PROCESS NOT IN HIERARCHY</i>                                       | From AOS/VS. Either the process doesn't exist or your command can't be executed because your process is not the father of the target process.                                                                                                                                                  | See if the process exists by typing ? ↵. If it does exist, and you still want to execute the command, turn Superprocess on and try again.                                                                                                                                                                                                                                                                           |
| <i>ATTEMPT TO CONNECT A- AND C-TYPE PROCESSES</i>                                       | From remote host system. You're logged on to another system via VTA, and tried to run an anyPID program (VTA would need to connect to a C-type process, which is illegal).<br><br>This error occurs anytime an A-type process tries to connect to a C-type process (using a ?CON system call). | You cannot run this program remotely. You can either go to the remote system, log on as a local user, and retry; or you can try to execute a hybrid or smallPID version of the program.<br><br>If your own process caused the error, you must either configure the program for any PID or have the program try to connect to a B-type or A-type process.                                                            |
| <i>ATTEMPT TO WIRE TOO MANY PAGES</i>                                                   | From the system. A 16-bit process tried to wire pages.                                                                                                                                                                                                                                         | Build a system with variable swap files. In the system parameters section, when VSGEN prompts, <i>Do you wish to use variable swapfiles [N]?</i> , answer Yes, and set the maximum swapfile size and the default swapfile size to 300.                                                                                                                                                                              |
| <i>Bitmap not aligned, should be at n</i>                                               | From PCOPY or MSCOPY, on restore. The bitmap address on the destination LDU is not the same as the address on the LDU that was backed up.                                                                                                                                                      | The bitmap, and certain other disk tables, must have the same size and address as those recorded in the backup. For PCOPY, check this message in Table 10-2; for MSCOPY, check this message in Table 10-3.                                                                                                                                                                                                          |
| <i>BOOT TIMEOUT</i>                                                                     | From SCP EPROM. It couldn't program load from the device specified (or from code in jumpers with CPU locked on power up).                                                                                                                                                                      | If disk or tape is not on line and ready, put it on line. If message recurs, get the MV/n system tape and reload microcode as described at the beginning of Chapter 3. Also see message under None (message about bootstrap jumpers) in this table.                                                                                                                                                                 |
| <i>Both LDU images have inconsistent data — must run a Full format</i>                  | From the Disk Formatter or the Installer. Either program has found that the information on the images is inconsistent.                                                                                                                                                                         | If you specified incorrect images, specify correct ones. Otherwise, you must run a Full format. (A Full format will destroy all data on the disks, so you will have to reload from a backup.)                                                                                                                                                                                                                       |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                                | Source and Meaning                                                                                                                                                                                                                                                                                                                                     | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C...                                                                   | During MV/8000 power up, partial <i>CONSOLE READY</i> message. Problems with one or more SCP or main processor components.                                                                                                                                                                                                                             | Make sure diskette is properly inserted; or perhaps insert another copy of diskette. Turn CPU power off and on again. For interpretation, see Table 17-4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>CALLER NOT PRIVILEGED FOR THIS ACTION</i>                           | From system. Your command requires a privilege or PID that your process lacks. For example, you need to turn on Superuser to read a file, or be PID 2 to turn on SYSLOG or set the system time. Or, you need the CREATE WITHOUT BLOCK privilege to use the PROCESS command without the BLOCK switch.                                                   | If you really want to have the command obeyed, either log on with a privileged profile and turn Superuser on, or go to the system console and become PID 2, which has all privileges.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <i>CANNOT DELETE UNEXPIRED FILE ON LABELED MEDIUM</i>                  | From system, on a write to labeled tape or diskette. The retention date for the fileset (default 90 days, can be selected with DUMP's /RETAIN= switch) has not yet expired.<br><br>For tape, the system will not let you write to the tape set unless you relabel each tape.<br><br>For diskette, the CLI asks if you want it to relabel the diskette. | You can either select another tape or diskette set for the write, or use this set. To use this set, you'll need to relabel each tape or diskette.<br><br>To relabel tapes, use the LABEL utility. Then retry the write.<br><br>For diskettes, if you need only a few, have the CLI relabel them.<br><br>If you need many diskettes, the easiest course is to use auto-labeling. Abort the command (CTRL-C CTRL-A). Type<br><br>OPERATOR OFF )<br>OPERATOR/LABEL ON )<br><br>The CLI will now relabel diskettes without asking for confirmation. Restart the dump. For a dump to either tape or diskette, think about shortening the retention period via the /RETAIN= switch, so this doesn't happen again. |
| <i>CANNOT INIT AN LDU IMAGE THAT WAS PREVIOUSLY BEING SYNCHRONIZED</i> | From SYSBOOT. Someone aborted a command line that contained a MIRROR/WAIT command using this LDU image as an argument, or there was a panic or hardware failure.                                                                                                                                                                                       | Since you cannot initialize the image specified in the INITIALIZE command line, release the LDU containing the other image and reverse the order. Issue the INITIALIZE command, giving the other image as an argument.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <i>CANNOT READ IN THE DIB FOR THE LDU</i>                              | From FIXUP. The DIB (Disk Information Block) is unreadable.                                                                                                                                                                                                                                                                                            | There may be surface or hardware format damage. Rerun FIXUP from the beginning.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                                                                                                                                                                                      | Source and Meaning                                                                                                        | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><i>Cannot write<br/>{ data }<br/>{ label }<br/>record due to write error.</i></p> <p><i>Use a different tape.</i></p> <p><i>Mount reel n of tape file<br/>x.nnn.yymmdd... and<br/>enter tape unit name<br/>[MTB0]</i></p> | <p>From MSCOPY, on a backup. MSCOPY tried to write to the tape 14 times without success. The tape is defective.</p>       | <p>Dismount the tape, discard it, and mount another tape. Then type the unit name and press J (or, for unit MTB0, simply press J). The backup continues.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p><b>CAN'T INITIALIZE<br/>LDU; RUN FIXUP ON<br/>IT</b></p>                                                                                                                                                                  | <p>From system. You can't initialize the LDU because it wasn't closed normally (via the RELEASE command or shutdown).</p> | <p>Start up stand-alone FIXUP via XEQ FIXUP* and run it on the LDU. Then retry the initialize command.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <p><b>CAUTION – USTORE<br/>OR SPAD NOT<br/>LOADED<br/>CORRECTLY</b></p>                                                                                                                                                      | <p>From SCP on power up; microcode or scratchpad memory hasn't been loaded correctly.</p>                                 | <p>First, turn CPU power off, lock the CPU (if possible), and turn power on again. Step through the microcode load. If there are no errors, proceed with normal operations.</p> <p>If the error recurs on an MV/8000 with an SCP diskette, try another SCP diskette. If the error recurs on any other machine, load the SCP-OS from the MV/n system tape (Chapter 3; steps 3, 4, 5, and 6, 7, or 8). If the tape-based SCP-OS and microcode work without errors, use the CLI to load the tape-based .MCF file onto the LDU (Chapter 3, step 53). Keep the MV/n tape handy in case you need it again.</p> <p>If this message recurs after you try the steps above, contact your DG support organization.</p> |
| <p><b>CHECKSUM BAD</b></p>                                                                                                                                                                                                   | <p>From SCP on power up. The SCP operating system may have failed a checksum test.</p>                                    | <p>Follow the steps described in the <b>CAUTION-USTORE...</b> message in this table.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <p><b>CHECKSUM ERROR</b></p>                                                                                                                                                                                                 | <p>From AOS/VS or support program. The tape unit hardware couldn't read your tape.</p>                                    | <p>Retry; if error recurs, try another tape or a different unit (if possible). Sometimes cleaning the tape or tape unit read/write heads with an alcohol-soaked cotton swab will help.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <p><b>CLI OPERATOR<br/>ALREADY EXISTS</b></p>                                                                                                                                                                                | <p>From system. You tried to turn CLI Operator mode on when it was already on.</p>                                        | <p>Proceed with the desired labeled diskette operation.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                     | Source and Meaning                                                                                                                                                                                                                                                                                                                                                                                                                 | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>CONTROL POINT DIRECTORY MAX SIZE EXCEEDED, FILE file</i> | From the system. Your command cannot be completed because the directory <i>file</i> (or a control point directory above <i>file</i> ) has used all disk blocks allowed for it.                                                                                                                                                                                                                                                     | <p>To recover, you must expand the space available to this directory via the SPACE command (e.g., SPACE XDIR 5000 I); or delete some files. If you expand a user directory (:UDD:username) this way, the expansion lasts only until the person logs on again.</p> <p>If the full directory is the system root (:) or any directory of type LDU, you must delete some files, since expanding an LDU requires a full disk format.</p> <p>If system logging caused the error by filling up the directory (via file or link :SYSLOG), rename the current log file according to your log naming convention (if any); then dump and delete the log file before starting logging.</p> |
| <i>CONTROLLER DOES NOT SUPPORT LDU MIRRORING</i>            | From SYSBOOT. In AOS/VS Revision 7.00, logical disk mirroring requires 6236- or 6239-class disks. You tried to mirror an invalid type of disk, or the disk microcode is the wrong revision.                                                                                                                                                                                                                                        | Consider purchasing disks of the right class or install the right revision of microcode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <i>CONTROLLER MICROCODE NEEDS TO BE UPDATED</i>             | From system. Someone tried to initialize a peripheral that has an intelligent controller, but the revision of microcode running in the controller isn't compatible with this revision of AOS/VS.                                                                                                                                                                                                                                   | A new revision of microcode must be installed on all disks connected to this controller. You (or a DG field engineer) can do this using a program named the Peripheral Microcode Installer (model number 30976). This program is supplied on tape with each intelligent disk controller. Running the program is further described in Chapter 15.                                                                                                                                                                                                                                                                                                                               |
| <i>COULDN'T ACCESS MESSAGE FOR CODE</i>                     | From EXEC. The :ERMES message file, from which most programs get the text for messages, has a bad ACL, is missing, or is invalid.                                                                                                                                                                                                                                                                                                  | Make sure the ACL of file :ERMES includes +,RE. If this error recurs, rebuild ERMES as described in Chapter 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>CPUID indicates less than n KB of memory</i>             | From AOS/VS during system initialization. The main processor CPUID indicates too little memory for AOS/VS.                                                                                                                                                                                                                                                                                                                         | Fix the CPUID as described in Chapter 11; then retry.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <i>DATA OVERRUN ERROR</i>                                   | <p>From system. During transit over a console line, characters are being dropped. Causes may be</p> <ul style="list-style-type: none"> <li>Flow control isn't working properly.</li> <li>There's too much system load for all characters to be transmitted.</li> <li>A program is receiving characters without posting a read for them (a user is typing characters but the application program is not ready for them).</li> </ul> | <p>Recover as follows.</p> <ul style="list-style-type: none"> <li>Make sure that output flow control (characteristics IFC and OFC, or VSGEN mnemonic ?MIFC and ?MOFC) are enabled on the console line.</li> <li>Reduce the processing load or have users type slower.</li> <li>Have the program rewritten so that it issues read calls more often — say 5–10 seconds or more often; or have the user wait for the program prompt.</li> </ul>                                                                                                                                                                                                                                   |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                       | Source and Meaning                                                                                                                                                                                                                                                                                                                                                                                    | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Default operating system file does not exist</i>           | From SYSBOOT at startup. SYSBOOT looks for the pathname of the default operating system.                                                                                                                                                                                                                                                                                                              | Perhaps someone deleted the operating system file (usually in :SYSGEN. Either reload the operating system (from file 5 of your system tape or from a system diskette you created), or change the name of the default system to INSTALLED SYSTEM. Then, from the Technical Maintenance Menu, choose option 1 to load and start the starter system. Run VSGEN. Finally, from the Technical Maintenance Menu, make the new tailored system the default system. |
| <i>DIFFERENT TYPE PROCESSES (32/16 BIT) WITHOUT PRIVILEGE</i> | From AOS/VS. The program you tried to run is a 16-bit program — but your user profile doesn't allow you to run 16-bit processes.                                                                                                                                                                                                                                                                      | Run PREDITOR, edit the user profile, and when you get to question <i>Change address space type</i> , type Y ↓. Then log off, log on, and run the program again.                                                                                                                                                                                                                                                                                             |
| <i>DIRECTORY ACCESS DENIED</i>                                | From AOS/VS. You do not have needed access privilege(s) to this file.                                                                                                                                                                                                                                                                                                                                 | Turn Superuser on and retry. You may want to change the file ACL to give your username the needed access so you can access the directory without turning Superuser on. See Chapter 16 or 9, which explain access control.                                                                                                                                                                                                                                   |
| <i>DIRECTORY DELETE ERROR</i>                                 | From the system. The directory you tried to delete has subordinate directories.                                                                                                                                                                                                                                                                                                                       | You may not really want to delete this directory. Check all directories in it by typing<br>) F /TY=DIR /TY=CPD dir:# ↓<br>Then delete selectively. If you really want to delete the whole directory, repeat the delete command with the # template.                                                                                                                                                                                                         |
| <i>DIRECTORY IN USE -- CANNOT DELETE</i>                      | From the system. You cannot delete this directory because it's being used. Perhaps it's your working directory, initial directory, or it's in someone's search list.                                                                                                                                                                                                                                  | If you really want to delete this directory, make sure it isn't your working directory or initial directory; have users remove it from their search lists; try the delete again.                                                                                                                                                                                                                                                                            |
| <i>Disk and file system revision numbers don't match</i>      | From Disk Formatter during Partial format. The disk is not recognizable as part of an LDU. Causes may be<br>1) The disk was never Full formatted (made into an LDU) with the Disk Formatter.<br>2) The disk's Disk Information Block (DIB) was destroyed. This can happen if a disk is written to as a device — (for example, via DUMP /V @DPJ1 MYFILE ↓); hardware failure can also destroy the DIB. | This disk isn't usable as a directory. If you want to use it as a directory, you must run a Disk Formatter Full format on it.<br>You can use the disk as is for storage as a physical device (most useful for diskettes); as, for example, via<br>) DUMP /V @DPJ10 DATA+ ↓. To do this, you need write access to :PER or Superuser on.                                                                                                                      |

(continued)



**Table 17-1. Important Errors and What To Do About Them**

| Message                                               | Source and Meaning                                                                                                                                                                                                                                    | Action                                                                                                                                                                                              |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Disk error, statuses= n, n</i>                     | From FIXUP, PCOPY, the Disk Formatter, or Installer.                                                                                                                                                                                                  | Make sure the disk is write-enabled if this applies. If this is not the problem, see the description under <i>HARD ERROR</i> for more detail on statuses.                                           |
| <i>Disk is in use — FIXUP must be run on this LDU</i> | From SYSBOOT during startup. The LDU was not closed normally by AOS/VS; there may be file inconsistencies on it.                                                                                                                                      | SYSBOOT will make option 7, "Run FIXUP," the default. Press <b>↓</b> and FIXUP will run automatically, using the default script filename if you named one. Otherwise, FIXUP will run interactively. |
| <i>Disk is in use</i>                                 | From PCOPY or any program. The LDU was not released or closed normally by AOS/VS shutdown.                                                                                                                                                            | Run FIXUP (stand-alone or stand-among) on the LDU.                                                                                                                                                  |
| <i>Disk is not mirrored</i>                           | From Fixup. You specified a mirrored LDU but the disks in the LDU are not mirrored.                                                                                                                                                                   | Rerun FIXUP, specifying only one image.                                                                                                                                                             |
| <i>Disk space exhausted</i>                           | From the Installer. You were trying to install a program on a floppy disk and used up all of the available space.                                                                                                                                     | Replan your approach and put fewer files on the disk.                                                                                                                                               |
| <i>Disk was left in inconsistent state</i>            | From the Installer. The image(s) specified is not consistent due to an incomplete mirror synchronization.                                                                                                                                             | Specify a consistent image (the other image).                                                                                                                                                       |
| <i>DPJn is not part of a mirrored set of images</i>   | From FIXUP. One of the images you specified is mirrored but the other is not.                                                                                                                                                                         | Rerun FIXUP, specifying the correct images, or specify only one image.                                                                                                                              |
| <i>Dynamic memory allocation/ deallocation error</i>  | From stand-among PCOPY. Stand-among PCOPY tries to wire pages. This message means that it can't do so. The problem probably involves privileges: to wire pages a process must become resident, which means it needs the <i>Change type</i> privilege. | Run PREDITOR, specify your username, edit the profile, and give yourself the <i>Change type</i> privilege. Then retry PCOPY.                                                                        |
| <i>ERROR... message</i>                               | From SYSBOOT during AOS/VS startup.<br><br>From the CLI or a utility program. The program hit a nonfatal error condition.                                                                                                                             | The message will tell you what's wrong. Correct and retry.<br><br>If the message enables you to recover, do so. Otherwise, find the message text in this table.                                     |
| <i>ERROR n</i>                                        | During power up.                                                                                                                                                                                                                                      | See Table 17-3. Run DTOS FRU tests.                                                                                                                                                                 |
| <i>ERROR:n FILE:path</i>                              | During AOS/VS initialization; this is nonfatal.                                                                                                                                                                                                       | From CLI, type <b>MES n ↓</b> or see Table 17-2. This describes the error.                                                                                                                          |
| <i>EXEC NOT AVAILABLE</i>                             | You tried a Q-series command and EXEC isn't running.                                                                                                                                                                                                  | Bring EXEC UP ↓.                                                                                                                                                                                    |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                  | Source and Meaning                                                                                                                                                                                                                                                     | Action                                                                                                                                                                                                                                                                        |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>EXEC'S PROCESS<br/>SUB-TREE ONLY</i>  | From system. A process that's not a son of EXEC asked for specific service from EXEC. For example, the master CLI process issued a MOUNT command.                                                                                                                      | If you really need this EXEC service, log onto a user console and retry your command. For a MOUNT command, you'll also need to mount tapes and answer EXEC prompts at the <i>system</i> console.                                                                              |
| <i>EXECUTE ACCESS<br/>DENIED</i>         | From CLI. You lack the needed E privilege.                                                                                                                                                                                                                             | See <i>DIRECTORY ACCESS DENIED</i> message.                                                                                                                                                                                                                                   |
| <i>FATAL AOS/VS<br/>ERROR: n</i>         | From AOS/VS. A software or hardware error, <i>n</i> , has prevented AOS/VS from continuing.                                                                                                                                                                            | If you want help from DG with this, do a memory dump (Chapter 6, "Abnormal Shutdown" and consider filing an STR, explained in Chapter 11).<br><br>To skip the memory dump, type the break sequence (CMD and BREAK/ESC keys). Then type START 50 J to run ESD. Restart AOS/VS. |
| <i>FATAL DISK ERROR</i>                  | From FIXUP. FIXUP probably hit a new bad block.                                                                                                                                                                                                                        | See the <i>FATAL DISK ERROR</i> message in the FIXUP table at the end of Chapter 6.                                                                                                                                                                                           |
| <i>FATAL ERROR:<br/>message</i>          | From AOS/VS, during system initialization.                                                                                                                                                                                                                             | If the message is a number, see Table 17-2 for an explanation of the number. If the message is text, try to find it in this table. Then try ESD via RESET J and START 50 J; if ESD fails, run FIXUP.                                                                          |
|                                          | From another program. A serious error condition prevented the program from continuing.                                                                                                                                                                                 | Correct the problem if you can, and retry. See the ABORT message or find the message in this table.                                                                                                                                                                           |
| <i>FILE ACCESS<br/>DENIED</i>            | From CLI. You lack the needed Read or Execute privilege.                                                                                                                                                                                                               | See <i>DIRECTORY ACCESS DENIED</i> message.                                                                                                                                                                                                                                   |
| <i>FILE ALREADY<br/>EXISTS: filename</i> | From system, during load or move command. The file to be loaded or moved into the directory already exists in the working (or specified) directory.                                                                                                                    | To get the most recent version of the file, repeat the command and add the /RECENT switch.<br><br>To load/move the file regardless of creation date (deleting the file in the destination directory), repeat the command with the /DELETE switch.                             |
|                                          | From system. A program needs to create a file, and cannot do so because a file with the same name already exists, with permanence on.                                                                                                                                  | Either remove permanence with the CLI or create/specify a different filename (so the program can create its output file without conflict with the original, permanent file).                                                                                                  |
|                                          | From system. On a labeled tape write, this happens if you omit a tape filename after the tape linkname. For example, the following sequence would cause the error.<br><br>) MOUNT/VOLID=V1 XTAPE PIs J<br><br>... (Operator mounts tape) ...<br><br>) DUMP/V XTAPE + J | For a labeled tape write, think up a tape filename and use it in the command. A sample valid sequence is<br><br>) MOUNT/VOLID=V1 XTAPE PIs J<br><br>...(Operator mounts tape)...<br>) DUMP/V XTAPE:TFILE + J                                                                  |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                        | Source and Meaning                                                                                                                                          | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>FILE ALREADY EXISTS: filename<br/>REPLACE OLD<br/>COPY?</i> | From system, while installing a new revision of AOS/VS.                                                                                                     | Type Y to replace the older version of the file.                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <i>File already open</i>                                       | The file your program tried to open is already open.                                                                                                        | See message under <i>FILE IS OPEN, CAN'T EXCLUSIVELY OPEN</i>                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <i>FILE DELETED...</i>                                         | From FIXUP. FIXUP had to delete the file.                                                                                                                   | If you want the file, restore it from backup media.                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <i>FILE DOES NOT EXIST</i>                                     | From FIXUP or Installer.                                                                                                                                    | Try adding the @ prefix to the devicename or respecify tape file number.                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                | From AOS/VS starter system.                                                                                                                                 | For tape, specify unit @MTC0, or @MTD0, even if the tape unit is another type. The starter system recognizes only MTC0 and MTD0.<br><br>For diskette, retype the labeled diskette pathname. For the first dump file, this is @LFD:VOL1:FIRST_DUMP_FILE; for the second dump file, the pathname is @LFD:VOL1:SECOND_DUMP_FILE; for an update, it is @LFD:VOL1:UPDATE.                                                                                                                      |
|                                                                | From CLI or EXEC. The program can't find the file.                                                                                                          | Correct your search list or type the full file pathname; use FILES and PATH commands to check.                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>FILE INACCESSIBLE; RUN FIXUP ON THE LDU</i>                 | From the system. It found a file open that should have been closed.                                                                                         | FIXUP should be run on this LDU. As soon as is practical, release the LDU (or shut down, if the file is on the master LDU). Then run FIXUP on it.                                                                                                                                                                                                                                                                                                                                         |
| <i>FILE IS EXCLUSIVELY OPENED— CAN'T OPEN filename</i>         | From the CLI, during a command that reads a file (often the DUMP command). A program has the file exclusively opened, which means it can't be opened again. | If you really need to have the file read (for example, to have it backed up), abort the command and shut down the program (like text editor or data management program) normally. Then retry the command. The multiuser environment should always be down <i>before</i> you do system backups.<br><br>If the file is a device, like a tape unit (e.g., @MTB1 or @LMT:xxx), this means someone is using it. Wait until the user's tape I/O is done, or urge him/her to finish; then retry. |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                               | Source and Meaning                                                                                                                                                                                                                                                                                                                                                     | Action                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>File is open, can't exclusively open</i>           | From PCOPY. PCOPY must open an LDU exclusively, and the LDU is already open.                                                                                                                                                                                                                                                                                           | You may have already started to run a copy of PCOPY on this LDU. Check by typing ? l.                                                                                                                                                                                    |
| <i>FILE IS OPEN, CAN'T EXCLUSIVELY OPEN, filename</i> | From system. The program you're running tried to exclusively open a file, but a program already has the file open. This can happen if you try to edit a file that's being printed, since text editors try to exclusively open files.                                                                                                                                   | Type QDISPLAY l to see if this file is being printed. If so, wait for printing to end. If it's not being printed, perhaps it's being dumped or moved. Wait a few moments and try again.                                                                                  |
| <i>FILE RENAMED ...</i>                               | From FIXUP. FIXUP had to rename the file.                                                                                                                                                                                                                                                                                                                              | See this message in the FIXUP error table (end of Chapter 6) for action.                                                                                                                                                                                                 |
| <i>File set ID does not match ... ID</i>              | From PCOPY, on a load. The tape/diskette volume is wrong, or the LDU you're restoring is wrong.                                                                                                                                                                                                                                                                        | Find the PCOPY error message in the Backup chapter, Table 10-2, for details.                                                                                                                                                                                             |
| <i>FIXUP CHECKSUM ERROR ...</i>                       | The FIXUP program or a script file hasn't been read into memory correctly, or the disk file has been corrupted.                                                                                                                                                                                                                                                        | Reload microcode by turning CPU power off, locking the CPU (if possible), then turning power on. Restart. Skip the script file (if any) and run an interactive session. If the error recurs, load FIXUP from an AOS/VS system tape, file 1, or AOS/VS diskette number 1. |
| <i>FIXUP does not exist</i>                           | From SYSBOOT at startup (if FIXUP had to be run) or whenever you tried to run FIXUP from SYSBOOT's Technical Maintenance Menu. FIXUP is not in the root (:).                                                                                                                                                                                                           | Reload FIXUP from file 1 of the AOS/VS system tape or from the first AOS/VS system diskette, and try again.                                                                                                                                                              |
| <i>FIXUP recommended on this LDU to reclaim space</i> | From SYSBOOT at startup or from AOS/VS when you delete a file, initialize or release an LDU, or shut down the system (in which case the message applies to the master LDU only). A file was deleted but the system was unable to reclaim disk space. It's a good idea, then, to run FIXUP. When FIXUP asks, "May I fix it?", answer Yes. This will restore disk space. | At startup, choose option 7, "Run FIXUP," from SYSBOOT's Technical Maintenance Menu or think about running FIXUP when there is time.                                                                                                                                     |
| <i>FRAMING ERROR</i>                                  | From system, may be displayed by EXEC or other console-managing program. An incomplete character was sent. Causes may be an open line (with no console at its end), a faulty connection, or hardware problems in the console                                                                                                                                           | Check the console and connection. If the console has been disconnected/removed, run without it until someone reconnects it. If the connection is faulty, try to reseat the cable. If reseating doesn't help, contact your DG support organization.                       |
| <i>From Disk bootstrap: message</i>                   | The message may give the cause; e.g., SYSBOOT not installed.                                                                                                                                                                                                                                                                                                           | Install a system bootstrap via the Installer if this is the problem, and retry. Else note the error code in the Peripherals book.                                                                                                                                        |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                                                                                                                                                                                | Source and Meaning                                                                                                                                                                                                                                                                                       | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>From Pid n : (process)</i>                                                                                                                                                                                          | Console message from another process; e.g., EXEC.                                                                                                                                                                                                                                                        | If process name is EXEC, see message in this table or in Table 8-4. If the name belongs to another process, see book(s) that describe the other process.                                                                                                                                                                                                                                                                                                                                                                            |
| <i>From system: message</i>                                                                                                                                                                                            | AOS/VS detected a serious error.                                                                                                                                                                                                                                                                         | Find the message in this table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Hard disk error while writing to the LDU</i>                                                                                                                                                                        | From SYSBOOT. SYSBOOT tries to write to the disk but can not because the disk is not write enabled.                                                                                                                                                                                                      | Write enable the disk and start over again.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <p><i>Hard error: device d, unit u, retries=r</i></p> <p><i>statuses:field,field</i></p> <p>fields are</p> <p>[DIA=mmmmmm,]<br/>[DIB=nnnnnn,]<br/>[DIC=oooooo,]<br/>[CB error=x,]</p> <p>[address=addr<br/>unit=u]</p> | <p>From system. During I/O with a device, the system found invalid or inconsistent data. The system retried the I/O 16 (octal) times without success; the error condition remained.</p> <p>All hard errors are noted in the error log. You can get a report by typing</p> <p>) X REPORT :ERROR_LOG )</p> | <p>The cause may be obvious: a disk has gone off line, been turned off, or been write-disabled (if possible). If the cause is obvious, fix it: put the unit back on line, turn it on, or write-enable it. Run ESD or FIXUP if needed. For more detail, read on.</p>                                                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                                        | <p>If the unit is a model 6236 or 6239 (DPJ) disk, the status display has DIC and CB ERROR fields. It ends with an ADDRESS field or a UNIT field.</p>                                                                                                                                                    | <p>With a model 6236 or 6239 disk, if the status display ends with the field ADDRESS, this probably means the disk has developed a new bad block. Run a Disk Formatter Partial format, with read-only analysis, on the LDU. If the Formatter finds a reasonable number of new bad blocks (say 10 or fewer), tell the Formatter to update the bad block table. Run FIXUP if the Formatter tells you <i>MUST RUN FIXUP</i>.</p> <p>If, with a model 6236 or 6239 disk, the last field is UNIT, call your DG support organization.</p> |
|                                                                                                                                                                                                                        | <p>If the unit is a DPF-type disk (model 606n, 616n, 6122, 6214), the status display ends with DIA and DIB fields.</p>                                                                                                                                                                                   | <p>With a DPF-type disk, check the DIB value.</p> <p>If the DIB value ends with 00 (nnnn00), then check the DIA value. If the DIA value is an odd number (and the DIB value ends with 00), this probably means the disk has developed a new bad block. Run a Disk Formatter Partial format, with read-only analysis, on the LDU. If the Formatter finds a reasonable number of new bad blocks (say 10 or fewer), tell the Formatter to update the bad block table. Run FIXUP if the Formatter tells you <i>MUST RUN FIXUP</i>.</p>  |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                | Source and Meaning                                                                                                                                                                                                          | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>HARD error:<br/>device...</i><br>(continued)        | DPF-type disk<br>(continued)                                                                                                                                                                                                | If, with a DPF-type disk, the DIB value does <i>not</i> end in 00, call your DG support organization.                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                        | For a tape unit, the status display includes field DIA and, on MTB and MTD units, field DIC.                                                                                                                                | For a tape unit, check the DIA value, fourth digit (DIA = mmmXmm). If the fourth digit X is 4 or 6, this means a bad tape. A bad tape error may be caused by dirty or worn tape or read/write heads. If it occurred on read, the unit might be incompatible with the unit that wrote the tape.<br><br>Try another tape or unit; or try cleaning unit heads with an alcohol-soaked cotton swab.<br><br>If the first digit of the DIA value is 1 (DIA = 1mmmm), call your DG support organization. |
|                                                        | For a diskette unit, the diskette may be badly seated; or it may write-protected; or it may not have been hardware formatted for DG drives.                                                                                 | For diskette, remove the diskette from the unit and remove the write-enable tape (if any). Reinsert the diskette (shown in Chapter 2, Figure 2-1).<br><br>If the error recurs, the diskette may not be hardware formatted (can be done via DG Customer Diagnostics). Or, the diskette may be unusable.                                                                                                                                                                                           |
|                                                        | A hard error occurs on a device that isn't a disk, diskette, or tape unit.                                                                                                                                                  | For a hard error on a nonmagnetic device, call your DG support organization, and try to run without the device until it is fixed.                                                                                                                                                                                                                                                                                                                                                                |
| <i>HARD ERROR WHILE WRITING TO SYSTEM OVERLAY AREA</i> | The system cannot write to the first disk in the master LDU.                                                                                                                                                                | Perhaps the disk is not write-enabled. If so, write-enable it and restart AOS/VS.                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>HARD INTERRUPT FROM</i> board                       | From SCP. A CPU hardware problem has halted the main CPU. AOS/VS, if it was up, is frozen.                                                                                                                                  | Record the whole message and contact your DG support organization.                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <i>ILLEGAL OPTION REQUESTED</i>                        | From AOS/VS. This reports an error returned by a JP-series hardware instruction. The error, which can occur after the CLI command JPINITIALIZE or JPRELEASE, indicates a wrong use of an instruction; and should not occur. | See the <i>MV/20000 Principles of Operations</i> manual for more on "options."                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>INCOMPLETE MIRRORED LDU SPECIFIED</i>               | From SYSBOOT. You used the CLI INITIALIZE command to start mirroring, but specified only one LDU image.                                                                                                                     | Type the command again, but specify two images using the format INITIALIZE unitname!unitname or use the command INITIALIZE /NOMIRROR if one image is not available.                                                                                                                                                                                                                                                                                                                              |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                  | Source and Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Action                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Inconsistent LDU</i>                                  | From SYSBOOT (1) when you try to initialize an LDU; or (2) during startup. In (1), the disk is not recognizable as part of an LDU, possibly because the disk was never Full formatted (made into an LDU) with the Disk Formatter or because the disk's Disk Information Block (DIB) was destroyed. (This can happen if you write to the disk as a device (for example, via <b>DUMP/V @DPJ1 MYFILE</b> ; or because of a hardware failure. In (2), the last disk unit you specified holds a disk that isn't part of the LDU. | For (1), you <i>can</i> use the disk for storage <i>or</i> as an LDU, but not both. Decide which you want to choose. To use the disk as an LDU, you must run a Disk Formatter Full format on it. For (2), mount the correct disk and specify the correct disk.                                  |
| <i>Inconsistent LDU revision, must run a Full format</i> | From the Disk Formatter. Disks in the specified LDU have different revision numbers.                                                                                                                                                                                                                                                                                                                                                                                                                                        | You must run a Full format. If the error occurs during a Partial format, you need only run a Full format on the image being introduced.                                                                                                                                                         |
| <i>Inconsistent mirrored LDU</i>                         | From the Disk Formatter or the Installer. The LDU you specified has inconsistent information in the Disk Information Block (DIB).                                                                                                                                                                                                                                                                                                                                                                                           | Respecify the LDU.                                                                                                                                                                                                                                                                              |
| <i>Incorrect disk format revision number...</i>          | From FIXUP. The disk you tried to run FIXUP on is not recognizable as an LDU. Perhaps it's a disk(ette) that was never Full formatted, or a disk(ette) whose directory structure was overwritten. In any case, it cannot be used as an LDU.                                                                                                                                                                                                                                                                                 | Continue with normal processing. You cannot (and need not) fix this disk.<br><br>If you were using the disk as a physical device (e.g., via <b>DUMP</b> or <b>LOAD</b> ), reissue the original command.<br><br>To use the disk as a directory, you must run a Disk Formatter Full format on it. |
| <b>INCORRECT FILE SECTION NUMBER</b>                     | From system, on load from labeled tape. The file section number of this volume is wrong. It is probably the wrong volume.<br><br>From PCOPY. This volume doesn't belong to the fileset.                                                                                                                                                                                                                                                                                                                                     | Dismount the tape; find the correct volume, mount it, and continue.<br><br>Dismount the tape or diskette; find the correct volume and respecify unit and volume ID if asked.                                                                                                                    |
| <b>INCORRECT LABELED TAPE FILE</b> message               | From system, usually on load, but can appear on dump. File ID data on the HDR2 label (near the beginning of the volume) is inconsistent or invalid.                                                                                                                                                                                                                                                                                                                                                                         | See <b>INCORRECT LABELED TAPE VOLUME MOUNTED</b> , below.                                                                                                                                                                                                                                       |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                                              | Source and Meaning                                                                                                                                                                                                                                                                                                | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>INCORRECT<br/>LABELED TAPE<br/>BLOCK COUNT</i>                                    | From system, on load. The number of blocks actually read from the tape doesn't match the number recorded in the end of volume label. The load is not complete and may be invalid.                                                                                                                                 | If there are other error messages, this is probably the wrong reel. Try to find and use a more recent version of this labeled tape file. If you <i>must</i> load this tape file, try restarting it from the beginning; maybe this time all blocks will be read.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>INCORRECT<br/>LABELED TAPE<br/>SEQUENCE<br/>NUMBER</i>                            | From system, on load. The tape belongs to this tape fileset, but was mounted out of sequence. For example, in a 3-volume fileset, you mounted volume 3 after volume 1.                                                                                                                                            | Find the correct tape from the tape fileset, mount it, and tell EXEC or the prompting program that it's mounted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <i>INCORRECT<br/>LABELED TAPE<br/>VOLUME MOUNTED</i>                                 | From EXEC, detected by system. When the system tried to write to or read from the tape, it detected the wrong tape volume (not the one specified by the mount originator with the /VOLID= switch).<br><br>The tape I/O operation can't continue; you must either change the tape, refuse the request, or relabel. | On a dump, you have the following choices.<br><br>1) Find and mount the correct volume. To do this, dismount the wrong volume, find and mount the correct volume, and type <b>CX MOUNTED</b> .<br><br>2) Reissue the MOUNT command or have the user reissue it. Do this if the mount originator specified the wrong volume ID. To do it, type <b>CX REFUSED</b> . and reissue the MOUNT command. Mount the correct tape (unless it's already mounted) and type <b>CX MOUNTED</b> .<br><br>3) Relabel this tape, and all other tapes needed. To do this, use the LABEL program to assign the desired labels to the tape(s). Then mount the correct tape and type <b>CX MOUNTED</b> .<br><br>On a labeled tape load, you must choose 1 — unless the mount originator specified the wrong volume ID, in which case choose 2. |
| <i>Incorrect<br/>{ fileset<br/>tape label fileset }<br/>tape label</i>               | From MSCOPY on restore. The volume ID on the tape is inconsistent with other volumes or the backup history file.                                                                                                                                                                                                  | Don't continue. Check MSCOPY error messages in the Backup chapter, Table 10-3, for the specific message.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <i>Incorrect volume ID<br/>Tape volume ID = id</i>                                   | From PCOPY on restore. The volume ID you specified does not match the ID on the tape/diskette mounted.                                                                                                                                                                                                            | Find this message in PCOPY error messages, in the Backup chapter, Table 10-2, for details.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>Incorrect volume<br/>sequence number<br/>Expecting reel n<br/>Received reel m</i> | From PCOPY. The volume on the unit you specified is out of order.                                                                                                                                                                                                                                                 | Put the correct volume on a unit and/or respecify the unit and volume ID.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

(continued)



**Table 17-1. Important Errors and What To Do About Them**

| Message                                    | Source and Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>INDECIPHERABLE<br/>DUMP FORMAT</i>      | <p>From system, after CLI LOAD or LOAD_II command. The cause may be</p> <ol style="list-style-type: none"> <li>1) This is an unlabeled tape and you tried to treat it as labeled; for example</li> </ol> <p>) LOAD/V TAPE:FILE )</p> <ol style="list-style-type: none"> <li>2) The file was not dumped to the tape (it may have been written with COPY or by a user program.</li> </ol> <ol style="list-style-type: none"> <li>3) The file was dumped with a nondefault buffer size (DUMP default is 2048 bytes), and you didn't specify the correct buffer size in the LOAD command.</li> </ol> <ol style="list-style-type: none"> <li>4) The tape is the second or subsequent volume (not the first volume) in a multivolume fileset.</li> </ol> | <p>Decide on the cause and correct it.</p> <ol style="list-style-type: none"> <li>1) Find the correct tape or try to load it as file number 1 (this won't work across multiple volumes).</li> </ol> <ol style="list-style-type: none"> <li>2) Try</li> </ol> <p>) COPY/V filename @unit:filenumber )</p> <p>Then check the contents of the filename.</p> <ol style="list-style-type: none"> <li>3) Check with</li> </ol> <p>LOAD/N/BUFF=n @unit:filenumber</p> <p>(n is usually 4096 or 8192; for example,</p> <p>) LOAD/N/BUFF=8192 @MTB0:0 )</p> <p>If this works, you've solved the problem. Interrupt with CTRL-C CTRL-A. Then try a LOAD command with this buffer size, and omit the /N switch.</p> <ol style="list-style-type: none"> <li>4) Using paper labels on tape reels, find and mount the first volume in the fileset; retry.</li> </ol> |
| <i>INFINITE xxxx<br/>FAULT</i>             | <p>From the SCP system. A hardware protection or page fault occurred while the CPU was processing such a fault.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>AOS/VS is frozen. Consult your DG support organization.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <i>INITIALIZATION<br/>PRIVILEGE DENIED</i> | <p>From system. To initialize an LDU, a user user needs:</p> <ol style="list-style-type: none"> <li>1) Write or Append access to the working directory (to release an LDU, a user needs Write access).</li> <li>2) Execute access to the device entry file in the peripherals directory (:PER).</li> <li>3) Owner access to the LDU (set with Disk Formatter).</li> </ol>                                                                                                                                                                                                                                                                                                                                                                          | <p>You can give the user the needed privileges (or give yourself the needed privileges), via the ACL command and/or the Disk Formatter; or you can turn on Superuser and initialize the LDU.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <i>INSTALLER<br/>ABORTED!</i>              | <p>From the Installer, this means a fatal error.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>Perhaps you specified the wrong file to the Installer or the disk is write-protected, if this applies. Try to rerun the Installer. If you see <i>MUST FIX FIXUP</i>, run FIXUP; then rerun the Installer. For more detail, see the error messages in Chapter 13, "The Installer".</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                                                                                            | Source and Meaning                                                                                                                                                                                                                                                                                                                                                                                          | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>INSUFFICIENT ROOM IN DIRECTORY</i>                                                                                              | From the CLI when moving files with UDAs into a directory, or running FCU on files already in a directory.                                                                                                                                                                                                                                                                                                  | UDAs and other file-related information are stored in the directory, not beneath it. There is a (very large) limit to the amount of information a directory can hold, and, on very rare occasions, you can exceed this limit when moving files with UDAs into a directory, <i>even though there is still room in the directory for storing files without UDAs</i> . Try reorganizing your directory structure to have more directories with fewer files in any one directory. |
| <i>INTERNAL CONSISTENCY ERROR IN EXEC.</i><br><br>... message ...<br><br><i>HAVE EVERYONE LOG OFF AND THEN TERMINATE THIS EXEC</i> | From EXEC. EXEC has problems. It creates a memory image file in its original directory (:UTIL); the filename template is EXEC.+ .MDM. If you submit an STR to DG, include this file.<br><br>If the message includes <i>NEGATIVE TIME ENCOUNTERED</i> , this means the system clock was set back while EXEC was running. Doing this is illegal; there is no fault with EXEC.                                 | Send warning messages to all users; CX DISABLE all consoles. When users are ready, type DOWN ↵ or TERM OP:EXEC ↵. Then try UP ↵ again.                                                                                                                                                                                                                                                                                                                                        |
| <i>Internal problems while merging bad block tables</i>                                                                            | From the Disk Formatter. The Disk Formatter encountered a problem it could not deal with while merging bad block information for a mirror.                                                                                                                                                                                                                                                                  | Report the problem to Data General.                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>Invalid DIB info, must run Full format</i>                                                                                      | From the Disk Formatter. The disk isn't an LDU. It was never Full formatted or its format has been destroyed.                                                                                                                                                                                                                                                                                               | You need to Full format the disk.                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <i>Invalid Remote Username-Password Pair -- FILE :NET:pathname</i>                                                                 | From the system. Your remote username/password pair on the remote system differs from the local system, or you do not have the <i>Access local resources from remote machines</i> privilege. The username and password must be the same on both systems for the network and CEO to work. Also, for a CEO user, there must be a CEO profile with a user ID identical to the AOS/VS username on both systems. | To fix it, someone on the remote system (or on your system) must change the username and/or password so that they match on both (or all) systems, or give the <i>Access local resources from remote machines</i> privilege on the remote system.                                                                                                                                                                                                                              |
| <i>Invalid username-password pair</i>                                                                                              | From the system. If you see this message while trying to log on to a remote system, it means that there is no profile with the username and password that you typed — or — there is such a profile but it doesn't specify the required privilege for network operations. You can also get this message during a local logon.                                                                                | Someone on the remote system must create the profile. The profile must include the privilege <i>Use virtual console</i> if the user will log on across a network, or the <i>Modem</i> privilege if the user will dial up.                                                                                                                                                                                                                                                     |
| <i>I/O PORT PARITY ERROR</i>                                                                                                       | From SCP on power up. The SCP is having problems communicating with the system cache.                                                                                                                                                                                                                                                                                                                       | Follow the steps described under the <i>CAUTION-USTORE...</i> message in this table.                                                                                                                                                                                                                                                                                                                                                                                          |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                    | Source and Meaning                                                                                                                                                                                                                             | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>JP ALREADY INITIALIZED</i>              | From AOS/VS. Someone (or the UP macro) issued a JPINITIALIZE command to a job processor that's already initialized.                                                                                                                            | If you typed the wrong name, try again — and/or correct the command in the UP macro. If the job processor name was correct, it's already initialized; skip the JPINITIALIZE command.                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>JP FAILED</i>                           | From AOS/VS. A JP-series hardware instruction failed. The error can occur after the CLI command JPINITIALIZE, and means that the job processor is faulty and can't run.                                                                        | Call your DG support organization. For more detail on the error, see the <i>MV/20000 Principles of Operations</i> manual. (This error reports a hardware status code of 4 in AC1.)                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>JP IS IN A BAD STATE</i>                | From AOS/VS, from the CLI command JPINITIALIZE. AOS/VS has not initialized the job processor, yet it's running.                                                                                                                                | Perhaps the job processor is running a different operating system: diagnostics or FRU-ADES. AOS/VS can't initialize the job processor until it's halted. You may want to use the SCP to halt and/or reset the job processor; then try the initialize command again. Or, if the job processor is running diagnostics, wait until they finish. (Generally, it's risky to run AOS/VS in one job processor and a different operating system in another.)<br><br>If you determine that nothing should be running in the job processor, you may want to call your DG support organization. |
| <i>JP NOT INITIALIZED</i>                  | From AOS/VS. You issued a CLI JPRELEASE command to a job processor that wasn't initialized.                                                                                                                                                    | If you made a typing error, retry; otherwise, proceed with the next operation planned.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <i>JP NOT RUNNING</i>                      | From AOS/VS. A JP-series hardware instruction returned an error. This error, which can occur after the CLI command JPINITIALIZE, means that the job processor is not running, although AOS/VS tried to start it.                               | The job processor may be faulty; you may want to run diagnostics and/or contact your DG support organization.<br><br>For more detail on the error, see the <i>MV/20000 Principles of Operations</i> manual. (The error returns a hardware status code of 7 in AC1.)                                                                                                                                                                                                                                                                                                                  |
| <i>JP NOT STOPPED</i>                      | From AOS/VS. A JP-series hardware instruction returned this error, which can occur after the CLI command JPRELEASE. It means that the processor is still running after AOS/VS tried to release it. Normal shutdown may not be possible.        | Try normal shutdown. If this isn't possible, you must force shutdown.<br><br>For more detail on the error, see the <i>MV/20000 Principles of Operations</i> manual. (The error returns a hardware status code of 1 in AC1.)                                                                                                                                                                                                                                                                                                                                                          |
| <i>JP RUNNING ONE OR MORE SYSTEM TASKS</i> | From AOS/VS. You tried to release (JPRELEASE) the mother job processor, without which AOS/VS can't run.                                                                                                                                        | If you made a typing error, retry. Otherwise, if you need to release this job processor, you must shut down AOS/VS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <i>LCS ERROR</i>                           | From AOS/VS. A JP-series hardware instruction returned this error. The error, which can occur after the CLI command JPINITIALIZE, occurred when AOS/VS tried to load microcode (it uses the LCS instruction). The job processor may be faulty. | For more detail on the LCS instruction, see the <i>MV/20000 Principles of Operations</i> manual. (The error returns a hardware status code of 3 in AC1.)                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <i>LDU DOES NOT EXIST</i>                  | From SYSBOOT. The LDU specified with the MIRROR command does not exist.                                                                                                                                                                        | Check the command line.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| <b>Message</b>                                                                          | <b>Source and Meaning</b>                                                                                                                                 | <b>Action</b>                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>LDU FORMAT MISMATCH - NOT A VALID MIRROR</i>                                         | From SYSBOOT. The bad block table entries or the sizes or addresses of the remap areas on the two images differ.                                          | You must run a Disk Formatter Partial format on the disk and make the values match.                                                                                                                                                                                                                           |
| <i>LDU IMAGE 'LDU unique ID' OF THE LDU NAMED 'name' HAS BEEN REMOVED BY THE SYSTEM</i> | From SYSBOOT. The system has removed one of the LDU images because of a hardware error.                                                                   | Fix the problem. Then, start mirroring again with the CLI command MIRROR/SYNC.                                                                                                                                                                                                                                |
| <i>LDU IN USE; CAN NOT RELEASE</i>                                                      | From AOS/VS. It thinks someone is using the LDU. Perhaps a user with a directory there is logged on, or the directory is in an active user's search list. | Check users and get them to log off as needed; then retry the RELEASE command. If the message recurs, perhaps a batch or print job requires files on the LDU. Check with QDISPLAY. If system shutdown can't close the LDU, the shutdown will be abnormal (explained in the <i>ABNORMAL SHUTDOWN</i> message). |
| <i>LDU IS NOT MIRRORRED</i>                                                             | From SYSBOOT. You used the CLI INITIALIZE command to initialize a synchronized mirror, but the LDU is not part of a mirror.                               | Check the command line.                                                                                                                                                                                                                                                                                       |
| <i>LDU NAME MISMATCH - NOT A VALID MIRROR</i>                                           | From SYSBOOT. You used the CLI INITIALIZE or MIRROR command to start mirroring, but the two LDUs have different names.                                    | Check the command line or run a Disk Formatter Partial format on each LDU and make the names the same.                                                                                                                                                                                                        |
| <i>LDU RELEASED; MUST HAVE FIXUP RUN ON IT</i>                                          | From AOS/VS. A file on the LDU just released could not be closed.                                                                                         | Run FIXUP on the LDU.                                                                                                                                                                                                                                                                                         |
| <i>LDU sequence number mismatch - not a valid mirror</i>                                | From FIXUP. You specified two or more multiple-disk LDUs, but then typed the corresponding disk units in each LDU in an inconsistent order.               | Rerun FIXUP, specifying the disk units in the right order.                                                                                                                                                                                                                                                    |
| <i>LDU SIZE MISMATCH - NOT A VALID MIRROR</i>                                           | From SYSBOOT. You used the CLI INITIALIZE or MIRROR command to start mirroring, but the two LDUs differ in size.                                          | Make sure the disks are the same size. If they are, check to see if the size of the diagnostic area on each disk is the same. If not, run the Disk Formatter Full format on the second disk and make these values (and the sizes) the same.                                                                   |
| <i>LDU UNIQUE IDS ARE NOT UNIQUE - NOT A VALID MIRROR</i>                               | From SYSBOOT. You used the CLI INITIALIZE or MIRROR command to start mirroring, but the LDU unique IDs are the same (they must be different).             | Run a Disk Formatter Partial format on either disk and make the LDU unique IDs different. Suggestion: make the LDU unique ID the same as the disk unit name (for example, DPJ1).                                                                                                                              |
| <i>LDU WAS RELEASED DURING SYNCHRONIZATION - LDU IS NOT SYNCHRONIZED</i>                | From SYSBOOT. Someone released an LDU image before a MIRROR/WAIT command had completed.                                                                   | Issue the command INITIALIZE/NOMIRROR, giving as an argument the name of the preferred mirror. Then, issue the command MIRROR/SYNC, giving the other image as an argument.                                                                                                                                    |
| <i>@LPx COOPERATIVE TERMINATED</i>                                                      | From EXEC. EXEC's cooperative printer manager process has terminated. The printer is unusable via Q-series commands.                                      | Unless you stopped the printer, see if it is on line. If not, use EXEC commands to start and continue it (see UP.CLI macro for syntax).                                                                                                                                                                       |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                     | Source and Meaning                                                                                     | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>@LPx PHYSICAL UNIT OFF-LINE</i>                          | From EXEC. The printer is not on line. EXEC printer process (XLPT) terminates.                         | Put printer on line and use EXEC commands to start and continue it (see UP.CLI macro for syntax.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <i>M...</i>                                                 | From EPROM in the CPU during power up; partial <i>MV/4000 READY</i> message.                           | See Table 17-3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>Master LDU mirror is not synchronized</i>                | From SYSBOOT at startup.                                                                               | If you want, you can force resynchronization by using the <b>MIRROR/SYNC</b> command, giving the other image as an argument.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>Microcode file does not exist</i>                        | From SYSBOOT when you specified a new microcode file.                                                  | You probably typed the microcode filename incorrectly or the microcode file is not on the disk. Retype the filename. If that does not work, load the new microcode file from the media and try again. For more information, see Chapter 6, Table 6-2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>MICROCODE IS INCOMPATIBLE WITH CURRENT SYSTEM</i>        | From AOS/VS. The microcode file specified for a CPU is invalid.                                        | You must specify a different microcode file or change the default microcode filename. See the message <i>MICROCODE REVISION FOR THIS CPU MUST BE n OR GREATER</i> for more information.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>MICROCODE REVISION FOR THIS CPU MUST BE n OR GREATER</i> | From AOS/VS. The revision of microcode in your CPU is obsolete. AOS/VS cannot run with this microcode. | <p>On an MV/8000, obtain an MV/8000 diskette with revision <i>n</i> (<i>n</i> in message) or greater microcode; insert it in the diskette unit; and turn power off and on again to initialize the SCP-OS. Then boot AOS/VS, and continue.</p> <p>On other machines, try the following steps. Get an MV/<i>n</i> system tape or diskette with a revision of at least <i>n</i> (preferably the latest revision).</p> <p>Then unlock the CPU (if possible), turn CPU power off and on, and mount the MV/<i>n</i> system tape or "AOS FMT" diskette on unit 0 on the first controller.</p> <p>Execute steps 2 through 8 in Chapter 3 or the steps beginning with 3 and 4 in Chapter 2. Then start the AOS/VS system that didn't come up earlier, and type</p> <pre>) SUPERUSER ON; DIR : ) *) LOAD/V/R @MTx0:1 ) (or @DPJ10 ) MVn.MCF *) REWIND @MTx0 )</pre> <p>Then store the MV/<i>n</i> tape or diskette and continue with AOS/VS as usual.</p> <p>On any computer, by loading each new CPU microcode rev as you receive it (Chapter 15), you can avoid this problem.</p> |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| <b>Message</b>                                                                  | <b>Source and Meaning</b>                                                                                                                                              | <b>Action</b>                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Mirror should be specified</i>                                               | From FIXUP. In a multi-disk LDU configuration, you specified a mirrored pair for the <i>Disk unit name</i> prompt but not for a subsequent prompt.                     | Specify both images of the mirror.                                                                                                                                                                                                                                |
| <i>Mirror should not be specified</i>                                           | From FIXUP. In a multi-disk LDU configuration, you specified a single image for the <i>Disk unit name</i> prompt but the specified two images for a subsequent prompt. | Specify only one image.                                                                                                                                                                                                                                           |
| <i>Mirror synchronization was in progress - FIXUP cannot run on LDU-id</i>      | From FIXUP. You attempted to run FIXUP, but one image was in the process of being synchronized at the time of the failure.                                             | Specify the other image of the mirror.                                                                                                                                                                                                                            |
| <i>Mirror synchronization was in progress - FIXUP cannot run on these disks</i> | From FIXUP. You attempted to run FIXUP, and both images have the synchronization-in-progress bit set.                                                                  | Run a Disk Formatter Full format to reclaim the disks. (This error is highly unlikely.)                                                                                                                                                                           |
| <i>Mirrored LDU is not synchronized</i>                                         | From FIXUP. FIXUP will fix the files on the preferred image.                                                                                                           | None necessary.                                                                                                                                                                                                                                                   |
| <i>MIRRORED LDU IS NOT SYNCHRONIZED</i>                                         | From SYSBOOT. You used the CLI INITIALIZE command to start mirroring, but one of the images is less recent than the other.                                             | If you don't know which is more recent, you can run FIXUP. Then, use the CLI command INITIALIZE/NOMIRROR, giving the name of the more recent image as the argument. Finally, use the CLI command MIRROR/SYNC, giving the name of the other image as the argument. |
| <i>MIRRORED LDU IS OUT OF PHASE</i>                                             | From SYSBOOT. You used the CLI MIRROR command to start mirroring, but the LDU image is more recent than the initialized LDU image.                                     | If this is what you want to do, use the command MIRROR/FORCESYNC.                                                                                                                                                                                                 |
| <i>MIRRORED LDU SYNCHRONIZATION FAILED</i>                                      | From SYSBOOT. An error condition occurred before a MIRROR/WAIT completed.                                                                                              | Fix the problem and start over.                                                                                                                                                                                                                                   |
| <i>MORE THAN 255 PROCESSES</i>                                                  | From AOS/VS. A process tried to create another process when the maximum number of processes was running. The default maximum is 255 processes.                         | If you need to run more processes, set up for big PIDs as described in Chapter 15.                                                                                                                                                                                |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                          | Source and Meaning                                                                                                                                                                                                         | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>NETWORK NOT AVAILABLE</i>     | From AOS/VS. Either the network isn't up or the command may require the File Transfer Agent (/FTA switch on the MOVE command).                                                                                             | If you used the MOVE command, retry with the /FTA switch; otherwise, check for network processes (X25, etc.) and bring up the network (macro UP.NET-WORK.CLI).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>NO JP STATE BLOCK DEFINED</i> | From AOS/VS. A JP-series hardware instruction returns this error. The error, which can occur after the CLI commands JPINITIALIZE or JPRELEASE, indicates the wrong definition of a job processor, and should not occur.    | For more on job processor state blocks, see the <i>MV/20000 Principles of Operations</i> manual.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>NO OPERATOR AVAILABLE</i>     | From the CLI. Your command requires an operator, but there is no operator (human or CLI) available.                                                                                                                        | <p>Type OPERATOR ON J and retry the command that caused the error.</p> <p>If typing OPERATOR ON J eliminates the error, this means you tried to use labeled diskettes (pathname @LFD:valid:filename), without turning CLI operator mode on. Now that you've turned operator mode on, you can proceed with the labeled diskette access.</p> <p>If you want to have the CLI label many diskettes, turn operator off and turn it on again with the /LABEL switch. Using the CLI command OPERATOR is described in the Backup chapter.</p> <p>If turning CLI OPERATOR on doesn't eliminate the error, this means that some operation requires a person to be on duty at the system console. To tell the system that a person is available, use the EXEC command OPERATOR. Type</p> <p>) CX OPERATOR ON J</p> <p>on the system console. Then — from a user console — reissue the command that provoked the error. Someone must be present at the system console to mount tapes, etc., for this command to work.</p> |
| <i>NO SUCH ARGUMENT</i>          | From system. The program requires an argument (like the filename) that you omitted.                                                                                                                                        | Check the required format (using the CLI manual or this one) if needed. Rerun the program, specifying additional argument(s).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>NON-EXISTENT JP</i>           | From AOS/VS. A JP-series hardware instruction returned this error. The error, which can occur after the CLI commands JPINITIALIZE or JPRELEASE, means that the hardware doesn't recognize the job processor you specified. | If you made a typing error, retry. For more detail, see the <i>MV/20000 Principles of Operations</i> manual. (The error returns a hardware status code of 2 in AC1.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

(continues)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                    | Source and Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>NOT A COMMAND OR MACRO</i>              | From CLI. Your command line starts with a keyword unknown to the CLI — and, the CLI can't find a file whose name matches the keyword (a macro).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p>If you made a typing error, reissue the command.</p> <p>If you think your keyword is a valid command, type <b>HELP *COMMANDS</b> for a list of CLI commands.</p> <p>If you think a macro with this name exists, check your directory (type <b>DIR</b>) and/or search list (type <b>SEARCHLIST</b>). Change directory or search list to include the pertinent directory; then retype the command line.</p>                                                                                                                                                                                            |
| <i>Not a valid mirror</i>                  | From FIXUP. You specified a mirror for FIXUP to fix, but FIXUP has determined that the images are not normally mirrored.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Specify the correct set of images.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <i>NOT ENOUGH MEMORY, RESTARTING CLI</i>   | <p>From CLI. Execution of your command or macro requires too much CLI memory (stack) space. The current CLI terminates, chaining to a new CLI. The new CLI retains the search list and working directory of the terminated one, but its other environment settings revert to those of your original user CLI.</p> <p>This error can occur if</p> <ol style="list-style-type: none"> <li>1) The CLI tries to execute a nonmacro file as if it were a macro. This can happen if you mean to type — but omit — a CLI command in front of a filename. For example, you typed <b>MYFILE</b> instead of <b>F/AS MYFILE</b>.</li> <li>2) A CLI macro requires too much memory. This can happen if a macro calls itself from any point except its end.</li> <li>3) A template and/or list of pathnames is too complex — may occur in a <b>DUMP</b>, <b>LOAD</b>, or <b>FILESTATUS</b> command.</li> </ol> | <p>Decide on the cause — 1, 2, or 3, and correct as follows.</p> <ol style="list-style-type: none"> <li>1) Reissue the command line, but include the command.</li> <li>2) Rewrite your macro so it calls itself from a point closer to its end. (Every time a macro calls itself, all characters between the call and the end of the macro are stored in CLI memory. If the macro calls itself too often from anywhere but its end, it will exhaust the CLI's memory allotment.)</li> <li>3) Reduce the complexity of templates and/or the number of pathname arguments in the command line.</li> </ol> |
| <i>OVER TEMP ALARM – SYSTEM GOING DOWN</i> | From SCP. The temperature in the CPU cabinet has reached a critical point; the SCP is cutting CPU power to prevent damage.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Check for the problem (clogged filters, faulty fans, etc.); try to fix and reboot. FIXUP will be needed on all initialized LDUs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <i>P...</i>                                | From EPROM in the CPU on power up; partial <b>POWER UP TESTING</b> message.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | See Table 17-3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <i>PARITY ERROR</i>                        | From system, about console line (not tape or disk), when parity checking is enabled. Character was not transmitted properly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Unless this recurs, ignore it. If it recurs, make sure cable connections are tight.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

(continued)



**Table 17-1. Important Errors and What To Do About Them**

| Message                                                                                                         | Source and Meaning                                                                                                                                                                                                                                                                             | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>PHYSICAL UNIT FAILURE, FILE file-name</i>                                                                    | From CLI, or AOS/VS utility. A hard error has occurred on the device that holds filename.                                                                                                                                                                                                      | See the first <i>HARD ERROR</i> message in this table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>PHYSICAL UNIT OFF LINE</i>                                                                                   | From AOS/VS. The tape or diskette unit you specified isn't on-line.                                                                                                                                                                                                                            | For tape, check the ON LINE status light (if any) and use the ON LINE switch if needed. On a diskette, make sure a diskette is inserted correctly (with the write notch up, and paper label toward you).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>PHYSICAL WRITE LOCK, FILE @MTxn</i>                                                                          | From system. The tape reel or cartridge on unit <i>n</i> is write-protected.                                                                                                                                                                                                                   | Check the paper label (if any) on the tape reel. If, after checking, you still want to write to the tape, insert a write-enable ring or write enable the cartridge; then retry the command.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>PID IS OUT OF RANGE FOR THIS PROCESS</i>                                                                     | From system. An A-type process received a message that included a PID larger than 255. Odds are that the A-type program had issued an ?IREC or other interprocess communication call; perhaps the father of this process is a C-type process and sent its A-type son a message with a big PID. | <p>Type CHECKTERMS J to see any process termination message; perhaps the message will indicate what happened. Use ?.CLI or PED to check processes that may have tried to communicate with the A-type process.</p> <p>The best way to prevent recurrence of this error is to make the smallPID program compatible with big PIDs. Then change its PID-size type to hybrid with the SPRED editor. Doing this is described in Chapter 15 in the section "Running More than 255 Processes on Your System".</p> <p>If you can't make the smallPID program big-PID compatible, make sure it is executed by, and communicates with, only B-type and A-type processes (which all have PIDs less than 256).</p> |
| <i>PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED.</i><br><i>UNIT [default]</i><br><i>VOLUME ID [default]</i> | From system, on labeled diskette access. The CLI is ready to read or write a labeled diskette.                                                                                                                                                                                                 | <p>If you've already inserted the diskette you want in the unit, and the unit and volume ID are correct, press J.</p> <p>To specify a unit other than the default, type N J and then the unit name (like @DPJ11).</p> <p>To specify a different volume ID, abort the command with CTRL-C CTRL-A and restart.</p> <p>Any diskette you use for data storage should have a paper label with volume ID, date, and so on.</p>                                                                                                                                                                                                                                                                              |
| <i>PLEASE INSERT NEXT DISKETTE.</i><br><i>UNIT [default]</i><br><i>VOLUME ID [default]</i>                      | From system, on labeled diskette access. The CLI is ready to read or write the next diskette in the sequence.                                                                                                                                                                                  | <p>Remove any diskette from the unit. If you are loading from diskette, find and insert the next diskette.</p> <p>If you are dumping to diskette, make sure the volume ID and date are written on the diskette's paper label (felt-tipped pen!). Then insert the next diskette and press J.</p>                                                                                                                                                                                                                                                                                                                                                                                                       |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                            | Source and Meaning                                                                                                                                                                                                                                                          | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>PLEASE REMOVE THE DISKETTE</i>                                  | From system, at the end of labeled diskette operation.                                                                                                                                                                                                                      | Your labeled diskette dump or load operation is complete (unless you aborted it). Remove the diskette from the unit and store it. If you aborted the operation and want to restart, restart.                                                                                                                                                                                                                                                                                                                                                                              |
| <i>POWER BACK TO NORMAL</i>                                        | From SCP. Full power has returned after a drop or outage.                                                                                                                                                                                                                   | AOS/VS enters its power fail recovery routine (Chapter 6). With full backup, continue normal processing. With partial backup, run ESD and restart AOS/VS.                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>POWER GOING DOWN</i>                                            | From SCP. Power brownout; power has dropped below the minimum allowed value. The SCP is cutting power to prevent damage.                                                                                                                                                    | AOS/VS automatically enters its power failure routine (Chapter 6). There's nothing you can do.                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>PRIVILEGE HELD EXCLUSIVELY BY ANOTHER PROCESS</i>               | From AOS/VS. The program you ran, or tried to run, tried to turn on System Manager privilege while another process had the privilege turned on exclusively. (A program can turn System Manager on nonexclusively — allowing other programs to turn it on — or exclusively.) | Use PED with the System Manager switch to check for other processes that might have System Manager privilege turned on exclusively. Among AOS/VS programs, the optional Class Allocation and Scheduling Package (CLASP) does turn System Manager on exclusively, unless CLASP is run with the /VIEW_ONLY switch. If CLASP is not the cause, check other programs.                                                                                                                                                                                                         |
| <i>PROFILE NOT FOUND</i>                                           | From EXEC. Someone typed a Q-series command (like QPRINT or QBATCH) yet lacks a user profile.                                                                                                                                                                               | Even the system operator needs a profile to issue Q-series commands. Check for a profile with PREDITOR, creating one if needed (Chapter 5 or 7).                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <i>READ ACCESS DENIED</i>                                          | From CLI. You lack the needed Read access privilege.                                                                                                                                                                                                                        | See <i>DIRECTORY ACCESS DENIED</i> message.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <i>RECORD LENGTH EXCEEDS BLOCK LENGTH</i>                          | From system, on labeled tape read or write. The block size (buffer size) is smaller than the record size. The default buffer size for DUMP is 2048 bytes; the backup macros shipped with AOS/VS use a buffer size of 8192 bytes.                                            | You might try specifying a bigger buffer size (use an even multiple of 2048 bytes).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <i>Respecify tape units starting at reel n<br/>Tape unit name?</i> | From PCOPY. You mounted the wrong tape. PCOPY gives you this chance to recover.                                                                                                                                                                                             | On a dump, decide if you want to retain data on this tape. To retain it, dismount the tape, mount another, and type the unit name and specify the volume ID.<br><br>If you're willing to write to the tape, you can have PCOPY relabel it — but this will be needed for all volumes in the set. To do it, type the unit name and specify the volume ID. When PCOPY asks about labeling tapes, say Y ). PCOPY will label the tape and the dump will continue.<br><br>For a load operation, you must find the correct tape, mount it, and type the unit name and volume ID. |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                                                                                                                                                                                | Source and Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>"?SEND" DESTINATION DEVICE HELD BY "^S"</i>                                                                                                                                                                         | From system. You sent a message to a process, but the recipient has suspended console output by pressing CTRL-S.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | The user won't receive any SEND messages until he/she presses CTRL-Q. You can either give message verbally or keep sending until the error message doesn't appear.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>SBUS message</i>                                                                                                                                                                                                    | From SCP. There are problems with the S-BUS, which connects the SCP to the main CPU. SCP log entries from this point may not be reliable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Record the message. Soon, you should shut down AOS/VS and run DTOS FRUs (Chapter 11), if possible.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>SCP OPERATION HAS DEGRADED, CPU EXCEPTION CODE 115</i>                                                                                                                                                              | From AOS/VS. The SCP is not responding to AOS/VS requests (over device code 45).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | On the front panel, press console reset (not system reset), and continue running. If you see a <i>CHECKSUM ERROR</i> from the SCP, shut down AOS/VS, and turn power off and on again to reload the SCP operating system. Then restart AOS/VS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>Script file ...</i>                                                                                                                                                                                                 | From FIXUP. There's a problem with the script file you specified.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Generally, you can handle this by running an interactive FIXUP session. For specifics, see Table 6-3, near the end of Chapter 6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <p><i>Soft error: device d, unit u, retries=r</i></p> <p><i>statuses:field,field</i></p> <p>fields are</p> <p>[DIA=mmmmmm,]<br/>[DIB=nnnnnn,]<br/>[DIC=oooooo,]<br/>[CB ERROR=x,]</p> <p>[address=addr<br/>unit=u]</p> | <p>From system. A soft error occurred. During I/O with a device, AOS/VS found invalid or inconsistent data. After <i>r</i> retries, it found the data valid (the problem went away).</p> <p>A soft error usually means a problem with magnetic media, not with controller or unit hardware. The error field(s) displayed depend on the device; if you care about details, see the error field description in the first <i>HARD ERROR</i> message.</p> <p>Soft errors are noted in the error log (unless someone excluded them with the SYSLOG /NOSOFTTAPEERRORS switch). You can get an error report by typing</p> <p>) X REPORT :ERROR__LOG )</p> | <p>If the device is a disk (not diskette), plan to run a Disk Formatter Partial format soon on the LDU. If a soft error <i>recurs</i> on the same disk unit, you should take action: release the offending LDU (or shut down if it is the master LDU). Run a Disk Formatter Partial format, with read-only analysis, to isolate any new bad blocks. Run FIXUP if the Formatter says <i>MUST RUN FIXUP</i>.</p> <p>If the device is a tape or diskette, some soft errors while writing are normal, depending on the quality of tape or diskette.</p> <p>Recurring soft errors may mean dirty read/write heads (try cleaning them) or poor quality tape or diskette.</p> <p>Recurring soft errors can also mean that improper storage is degrading the medium (suggestions for storage are given in Chapter 10).</p> <p>Lastly, recurring soft errors on tape or diskette may indicate mechanical wear in the unit itself.</p> |
| <i>Specified file does not exist</i>                                                                                                                                                                                   | From SYSBOOT during startup. SYSBOOT tried to run a program but it was not there.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Retype the pathname. Pathname may be a system or a program, depending on what program you were trying to run. If retyping doesn't work, try reloading the file.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>SWITCH VALUE FORMAT ERROR</i>                                                                                                                                                                                       | <p>From system. You mistyped a switch value. Perhaps you accidentally inserted a space — for example,</p> <p>) MOUNT /VOL = □VOL1 XTAPE ).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Retype the command, using a valid switch value.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                                                             | Source and Meaning                                                                                                                                                                          | Action                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>SYNCHRONIZATION OF LDU IMAGE 'LDU unique ID' OF THE LDU NAMED 'name' FAILED</i>                  | From SYSBOOT. Someone aborted a command line that contained a MIRROR/WAIT command, or there was a problem with the hardware.                                                                | If there was a hardware problem, fix it. In all cases, use the CLI command MIRROR/SYNC, giving the name of the other image as an argument.                                                                                                                                                                                                                             |
| <i>System Bootstrap not installed</i>                                                               | From the disk bootstrap on startup. The system bootstrap is necessary for booting (loading and running) other stand-alone programs, like FIXUP or the operating system.                     | Install the system bootstrap. See Chapter 2 or 3.                                                                                                                                                                                                                                                                                                                      |
| <i>SYSTEM BOOTSTRAP TOO LARGE</i>                                                                   | From the Installer. The tape file whose number you specified is too big for its reserved area on the LDU. This probably means you specified the wrong tape file or used the wrong diskette. | If you get a <i>MUST RUN FIXUP</i> message, run FIXUP on the LDU. Rerun the Installer and type the correct file number (4 for system bootstrap, 5 for the AOS/VS system) or use diskette 2 for the system bootstrap and diskette 3 for the AOS/VS system. Make sure the tape/ diskette is an AOS/VS system tape/diskette (created as shown near the end of Chapter 4). |
| <i>System file is too large to load</i>                                                             | From SYSBOOT. There is not enough room in SYSBOOT's address space to load the system.                                                                                                       | Your computer's main memory appears not to meet the Minimum Equipment Configuration (MEC) for a DG license. Call your Data General representative.                                                                                                                                                                                                                     |
| <i>SYSTEM PATCH AREA CONTAINS NO PATCHES</i>                                                        | From AOS/VS. Patches were not applied to this AOS/VS system; thus it may not work perfectly. This message will appear at startup until the system is patched.                               | Get the latest AOS/VS update tape or diskette and apply patches to the system (and other system programs) as described in Chapter 4.                                                                                                                                                                                                                                   |
| <i>Tape has not exceeded retention period</i><br>.<br>.<br>.<br><i>Select action ...</i>            | From MSCOPY, on backup. The retention period set when MSCOPY wrote to the tape (default 90 days from backup) hasn't expired. MSCOPY can't write to the tape unless MSCOPY relabels it.      | If you decide you want to write to this tape set, type RELABEL J. You'll need to type this for each volume in the set.<br><br>To retain data on the tape set, dismount the tape, and find and mount a tape that's not unexpired. Press J.                                                                                                                              |
| <i>Tape has not reached its expiration date.</i><br><br><i>Do you want to override it (Y or N)?</i> | From PCOPY, on backup. The problem is the same as with MSCOPY. See <i>Tape has not exceeded its retention period</i> , above.                                                               | Read the message above and decide what you want to do.<br><br>To relabel the tape, type Y J. To retain it, type N J.                                                                                                                                                                                                                                                   |
| <i>Tape reel is out of sequence</i>                                                                 | From MSCOPY, on restore. This tape is from the right backup, but mounted in the wrong order.                                                                                                | Find the correct tape from the tape set, mount it, and press J.                                                                                                                                                                                                                                                                                                        |
| <i>TARGET PROGRAM CANNOT BE CHAINED TO BY B- OR C-TYPE PROCESS</i>                                  | From system. A C-type process tried to chain to a smallPID or hybrid program. This is illegal.                                                                                              | Perhaps you can use a different chaining process. For example, if you tried to chain from a CLI, run a C-type CLI. Creating such a CLI is described in Chapter 15, under "Running an AnyPID CLI".                                                                                                                                                                      |
| <i>TARGET PROGRAM CANNOT BE RINGLOADED BY B- OR C-TYPE PROCESS</i>                                  | From system. A C-type process tried to ring load a smallPID or hybrid program; or a B-type process tried to ring load a smallPID program.                                                   | Either the ring-loading process must be more restricted (e.g., an A-type process), or the program to be ring loaded must be more versatile (e.g., a hybrid program). The latter is preferable; you might want to configure the target program for any PID size, described in Chapter 15.                                                                               |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| Message                                                                                                                                                                                                        | Source and Meaning                                                                                                                                                                                                | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><i>THE LABEL ON THIS DISKETTE IS NOT THE LABEL REQUESTED.</i><br/> <i>INSERTED: xxx</i><br/> <i>REQUESTED: yyy</i></p> <p>sometimes followed by</p> <p><i>DO YOU WANT TO RELABEL THIS DISKETTE? [N]</i></p> | <p>From the CLI, on labeled diskette access. The diskette you inserted does not have the label expected. On a dump, it asks if you want to relabel the diskette.</p>                                              | <p>On a dump, if you think you may have made a mistake and inserted a diskette that holds valuable data, press <b>↓</b>; then find and insert the correct diskette.</p> <p>Relabeling a diskette destroys all information on this and subsequent diskettes, if it is part of a sequence. If you want to have the CLI relabel the diskette, with the volume ID shown in xxx, type <b>Y ↓</b>.</p> <p>On a load, it asks you to insert the next diskette. Find the correct diskette, insert this in place of the current one; then press <b>↓</b>.</p> |
| <p><i>The LDU is not mirrored as stated in script file</i></p>                                                                                                                                                 | <p>From FIXUP. You ran FIXUP using a script file for input, but the disk is not mirrored.</p>                                                                                                                     | <p>Either build a new script file, or run FIXUP interactively.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <p><i>The LDU selected for fixing differs from preferred image</i></p>                                                                                                                                         | <p>From FIXUP. You ran FIXUP using a script file for input. FIXUP aborted because the LDU selected in the script file is less recent than the LDU FIXUP has determined needs fixing.</p>                          | <p>Rerun FIXUP interactively, specifying the other image.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <p><i>THERE HAS BEEN A POWER FAILURE. ... NOW RESTARTING DEVICE n UNIT n</i></p>                                                                                                                               | <p>From AOS/VS auto-restart routine. AC power failed, but the backup battery maintained power to the CPU. The restart routine tries to restart all disks, and restores AOS/VS status as of the power failure.</p> | <p>If AOS/VS cannot restart a device, it tells you so. If the device is a disk or diskette, run FIXUP on it; for a different device, you may need to shut down and reboot AOS/VS. Regardless, any tape write to an MTB or MTD unit must be restarted, and printers must be put on line.</p>                                                                                                                                                                                                                                                          |
| <p><i>This LDU is not in use, fixing is not necessary.</i></p> <p><i>Do you want to cancel this request [n]</i></p>                                                                                            | <p>From FIXUP. The LDU was closed normally by AOS/VS, thus running FIXUP is not mandatory.</p>                                                                                                                    | <p>You can skip FIXUP by typing <b>Y ↓</b>. But you must run FIXUP anyway if any of the following is true.</p> <ol style="list-style-type: none"> <li>1) You ran a Disk Formatter Partial format on this LDU and the Formatter found new, allocated bad blocks (it said <i>MUST RUN FIXUP</i>); or</li> <li>2) The system displayed <i>FIXUP RECOMMENDED</i> when you brought up AOS/VS or initialized the LDU.</li> </ol> <p>Also, you should run FIXUP if you suspect errors on the LDU.</p>                                                       |
| <p><i>Too many bad blocks for a mirrored disk</i></p>                                                                                                                                                          | <p>From the Disk Formatter. The bad block tables on a mirrored disk must be equivalent. The Disk Formatter has found more than 126. bad blocks, too many to permit mirroring.</p>                                 | <p>You should have a DG representative hardware format DPJ (6236-class) disks to <i>remove</i> bad blocks.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                       |

(continued)

**Table 17-1. Important Errors and What To Do About Them**

| <b>Message</b>                                            | <b>Source and Meaning</b>                                                                                                                                                                                                                                                                                                                                                                       | <b>Action</b>                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>UNKNOWN ERROR CODE n</i>                               | From any AOS/VS program.                                                                                                                                                                                                                                                                                                                                                                        | If you think <i>n</i> is a valid error code, the system ERMES file may need rebuilding.                                                                                                                                                                                                                               |
| <i>Unrecognized CPU model ID</i>                          | From SYSBOOT at startup. SYSBOOT can't read the CPU ID.                                                                                                                                                                                                                                                                                                                                         | Call your Data General representative.                                                                                                                                                                                                                                                                                |
| <i>USER SPECIFIED FORM DOES NOT MATCH FORM IN PRINTER</i> | From XLPT process, appears on printed file. A user tried to print a file with UDA specs (created by FCU) that exceed a limit (like LPP or CPL) specified for the printer.                                                                                                                                                                                                                       | For the file to be printed, one of the following things must happen.<br><br>1) The offending spec in the UDA must be reduced (perhaps by the user) to match the default form limit; or<br><br>2) You can pause the printer and specify a form that allows the user's spec (use EXEC's FORMS or DEFAULTFORMS command). |
| <i>VOLID TOO LONG OR NULL</i>                             | From LABEL program. The volume ID must be from 1 through 6 characters long.                                                                                                                                                                                                                                                                                                                     | Run LABEL again, specifying a valid volid.                                                                                                                                                                                                                                                                            |
| <i>WARNING: message</i>                                   | From the CLI or EXEC. The program was not able to execute part of the command. The program continues running.                                                                                                                                                                                                                                                                                   | If the message enables you to solve the problem, do so. Otherwise, find the message text in this table.                                                                                                                                                                                                               |
| <i>Warning — disk is normally mirrored</i>                | From FIXUP. You specified only one image of a mirrored LDU. In order to determine which image is <i>preferred</i> , FIXUP needs to know about both images.                                                                                                                                                                                                                                      | Continue if you know the image you have specified is more recent. Or rerun FIXUP and specify both images.                                                                                                                                                                                                             |
| <i>WRITE ACCESS DENIED</i>                                | From the CLI. You lack the needed Write access privilege.                                                                                                                                                                                                                                                                                                                                       | See <i>DIRECTORY ACCESS DENIED</i> message.                                                                                                                                                                                                                                                                           |
| <i>ZERO LENGTH FILENAME SPECIFIED, FILE pathname</i>      | Your command line specified a filename of zero length. This can occur if you insert a space in a pathname; for example, <b>TYPE MYDIR: MYFILE</b> would cause this error.<br><br>On a read from a labeled tape, this error can be caused if you omit the tape filename; for example<br><br><b>) MOUNT/VOLID=V1 XTape Pls</b><br><br>...(Operator mounts tape)...<br><br><b>) LOAD/V XTape +</b> | Retype the command to eliminate the space.<br><br>For a read from labeled tape, specify the filename that's on the tape; for example,<br><br><b>) LOAD/V XTape:TFILE +</b>                                                                                                                                            |

(concluded)

## AOS/VS Numeric Error Codes

While you are bringing up AOS/VS, or running the stand-alone Disk Formatter, error messages may appear as numeric codes, without text explanation. This happens because the active program doesn't have access to the ERMES message file.

Should it happen, you can find the number, and its meaning, in Table 17-2. For a complete list of AOS/VS numeric codes, print file :UTIL:PARU.32.SR.

**Table 17-2. AOS/VS Numeric Error Codes**

| <b>Numeric<br/>Error Code</b> | <b>Text</b>                                    |
|-------------------------------|------------------------------------------------|
| 5                             | INSUFFICIENT MEMORY IS AVAILABLE               |
| 15                            | DATA CHANNEL MAP IS FULL                       |
| 21                            | FILE SPACE EXHAUSTED                           |
| 23                            | DIRECTORY DOES NOT EXIST                       |
| 24                            | ILLEGAL FILENAME CHARACTER                     |
| 25                            | FILE DOES NOT EXIST                            |
| 26                            | FILE NAME ALREADY EXISTS                       |
| 30                            | END OF FILE                                    |
| 32                            | WRITE ACCESS DENIED                            |
| 33                            | READ ACCESS DENIED                             |
| 43                            | SWAP FILE SPACE EXHAUSTED                      |
| 44                            | DEVICE ALREADY IN SYSTEM                       |
| 45                            | ILLEGAL DEVICE CODE                            |
| 51                            | NO PID AVAILABLE FOR THIS PROCESS              |
| 63                            | DEVICE ALREADY IN USE                          |
| 70                            | PARITY ERROR                                   |
| 71                            | RESIDENT PROCESS TRIED TO CREATE SON AND BLOCK |
| 72                            | NOT A DIRECTORY                                |
| 74                            | TOO MANY SUBORDINATE (son) PROCESSES           |
| 75                            | FILE READ ERROR                                |
| 76                            | DEVICE TIMEOUT                                 |
| 102                           | CALLER NOT PRIVILEGED FOR THIS ACTION          |
| 107                           | ATTEMPT TO ACCESS PROCESS NOT IN HIERARCHY     |
| 110                           | ATTEMPT TO BLOCK UNBLOCKABLE PROCESS           |
| 112                           | ATTEMPT TO START MULTIPLE AGENTS               |
| 113                           | CHANNEL IN USE                                 |
| 114                           | NOT ENOUGH CONTIGUOUS DISK BLOCKS              |
| 115                           | STACK OVERFLOW                                 |
| 116                           | INCONSISTENT BIT MAP DATA                      |

(continues)

**Table 17-2. AOS/VS Numeric Error Codes**

| <b>Numeric Error Code</b> | <b>Text</b>                                              |
|---------------------------|----------------------------------------------------------|
| 121                       | PHYSICAL UNIT FAILURE (hard error)                       |
| 122                       | PHYSICAL WRITE LOCK                                      |
| 123                       | PHYSICAL UNIT OFF-LINE                                   |
| 126                       | DISK AND FILE SYSTEM REVISION NUMBERS DON'T MATCH        |
| 127                       | INCONSISTENT DEVICE INFORMATION BLOCK (DIB) DATA         |
| 130                       | INCONSISTENT LOGICAL DISK                                |
| 131                       | INCOMPLETE LOGICAL DISK                                  |
| 134                       | LDU IN USE, CANNOT RELEASE                               |
| 141                       | TOO MANY OR TOO FEW ARGUMENTS TO PMGR                    |
| 147                       | ILLEGAL CHANNEL                                          |
| 167                       | ILLEGAL ACL                                              |
| 172                       | FPU HARDWARE NOT INSTALLED                               |
| 175                       | DISCONNECT ERROR ON MODEM                                |
| 177                       | SYSTEM NOT INSTALLED                                     |
| 200                       | MAXIMUM DIRECTORY TREE DEPTH EXCEEDED                    |
| 202                       | RESOURCE DEADLOCK                                        |
| 203                       | FILE IS OPEN, CAN'T EXCLUSIVELY OPEN                     |
| 204                       | FILE IS EXCLUSIVELY OPENED, CAN'T OPEN                   |
| 205                       | INITIALIZATION PRIVILEGE DENIED                          |
| 237                       | CONTROL POINT DIRECTORY MAX SIZE EXCEEDED                |
| 240                       | SYSTEM OR BOOTSTRAP DISK NOT PART OF MASTER LOGICAL DISK |
| 241                       | UNIVERSAL SYSTEM, YOU CAN'T DO THAT                      |
| 242                       | EXECUTE ACCESS DENIED                                    |
| 243                       | CAN'T INITIALIZE LDU; RUN FIXUP ON IT                    |
| 244                       | FILE ACCESS DENIED                                       |
| 245                       | DIRECTORY ACCESS DENIED                                  |
| 253                       | RESOURCE LOAD OR RELEASE FAILURE                         |
| 254                       | ZERO LENGTH FILENAME SPECIFIED                           |

(concluded)



## Powerup and Power Supply Fault Codes

Powerup and power supply fault codes reflect problems with hardware. In this section, we differentiate between them, suggest what you can do if you get one of them, and refer you to tables here and in other documentation in case you want to know more.

*Powerup* fault codes indicate faulty CPU components, as detected by EPROM code when you turn power on. After you see a powerup fault code, you may want to run DTOS FRU tests or MV/ADES tests to confirm the faulty component.

A powerup fault code is a partial powerup message (with one or more characters missing) or a message that indicates that powerup testing failed. The powerup messages are

**\*\*POWER UP TESTING COMPLETED\*\*** on MV/20000 Model 2, MV/20000 Model 1, MV/20000, MV/10000 SX, MV/10000, MV/8000 II, MV/8000 C, and MV/6000 systems;

or

**\*\*POWER UP TESTING FAILED** on MV/20000 Model 2, MV/2000 Model 1, and MV/20000 systems;

or

**\*\*CONSOLE READY\*\*** on MV/8000 systems;

or

**MV4000 READY** on MV/4000, MV/4000 DC, MV/4000 SC, and Data General DS/4000-series systems

*Power supply* fault codes indicate serious error conditions like brownouts or short circuits in the supply. These errors are detected (usually after powerup) by the MV/20000, MV/10000 or MV/4000 power supply. The codes appear in the LED diagnostic window (MV/20000 Family computers) or CPU front panel lights, not on the system console.

On any system, aside from running FRU tests or MV/ADES tests, there is little you can do. Generally, write down the messages or record the lights that lit, and then shut down. When you call your DG support organization, give this information, which may be useful for them when they decide what material to bring to your site.

Table 17-3 refers you to hardware manuals or tables in this manual for powerup and power-supply fault codes for all MV/Family computers.

**Table 17-3. Powerup and Power-Supply Error Codes Documentation**

| Computer               | Manual or Table                                                                                                                                                                          |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MV/20000               | <i>Starting the ECLIPSE MV/20000™ Series Computer Systems</i>                                                                                                                            |
| MV/10000               | <i>ECLIPSE MV/10000™ System Control Processor User's Manual</i>                                                                                                                          |
| MV/8000                | Table 17-4 (MV/8000 powerup faults)                                                                                                                                                      |
| MV/8000 II             | Tables 17-6 (powerup faults) and 17-7 (power supply faults)                                                                                                                              |
| MV/8000 C              | Tables 17-6 (powerup faults) and 17-8 (power supply faults)                                                                                                                              |
| MV/6000                | Table 17-5 (MV/6000 powerup faults)                                                                                                                                                      |
| MV/4000                | <i>Data General 4000-Class System Control Programs Operator's Reference</i>                                                                                                              |
| MV/2000 DC and DS/7500 | <i>Setting Up and Starting Your System: ECLIPSE MV/2000™ DC and DS/7500 Series Systems or Starting and Running AOS/VS on ECLIPSE MV/2000™ DC and Data General DS/7000-Series Systems</i> |
| DS/7700                | <i>Setting Up and Starting Your System: DS/7700 Series Systems or Starting and Running AOS/VS on ECLIPSE MV/2000™ DC and Data General DS/7000-Series Systems</i>                         |

Table 17-4 shows the MV/8000 powerup faults.

**Table 17-4. MV/8000 Powerup Faults (Partial Console Ready Message)**

| Message           | Faulty Component(s)                                                                             |
|-------------------|-------------------------------------------------------------------------------------------------|
| (none)            | SCP (MBC CPU and/or TTO circuit boards).                                                        |
| **_**             | SCP (MBC CPU circuit board).                                                                    |
| **C_**            | SCP (MBC TTO circuit board).                                                                    |
| **CO_**           | CC circuit board.                                                                               |
| **CON_**          | Microsequencer or CC circuit board — in order of probability.                                   |
| **CONS_**         | CC circuit board.                                                                               |
| **CONSO_**        | Power supply.                                                                                   |
| **CONSOL_**       | Power supply (the temperature is too high and the SCP won't allow it to operate).               |
| **CONSOLE_**      | Power supply (air flow is restricted, and the SCP won't allow it to operate).                   |
| **CONSOLE R_**    | SCP (MBC RAM circuit board).                                                                    |
| **CONSOLE RE_**   | CC circuit board, ATU circuit board, or Microsequencer circuit board — in order of probability. |
| **CONSOLE REA_**  | Microsequencer circuit board.                                                                   |
| **CONSOLE READ_** | SCP (diskette controller board).                                                                |

Table 17-5 shows the MV/6000 powerup faults.

**Table 17-5. MV/6000 Powerup Faults (Partial Powerup Message)**

| Message                          | Missing Letters | Faulty Component(s), in Order of Probability                       |
|----------------------------------|-----------------|--------------------------------------------------------------------|
| (none)                           | All             | SCP.                                                               |
| ** _ **                          | P               | SCP.                                                               |
| ** P_ **                         | O               | SCP.                                                               |
| ** PO _ **                       | W               | SCP.                                                               |
| ** POW _ **                      | E               | SCP, Microsequencer, or Bank Controller.                           |
| ** POWE_ **                      | R               | SCP.                                                               |
| ** POWER _ **                    | U               | SCP.                                                               |
| ** POWER U_ **                   | P               |                                                                    |
| ** POWER UP_ **                  | T               | Microsequencer, SCP, or ATU.                                       |
| ** POWER UP T_ **                | E               | Microsequencer or SCP.                                             |
| ** POWER UP TE_ **               | S               | ALU, Microsequencer or SCP.                                        |
| ** POWER UP TES_ **              | T               | System Cache, Instruction Processor, or ATU.                       |
| ** POWER UP TEST_ **             | I               | System Cache, SCP, or I/O Controller (IOC).                        |
| ** POWER UP TESTI_ **            | N               | ATU or ALU-1.                                                      |
| ** POWER UP TESTIN_ **           | G               |                                                                    |
| ** POWER UP TESTING_ **          | C               | System Cache, ALU-1, or ATU.                                       |
| ** POWER UP TESTING C_ **        | O               | System Cache, Bank Controller, or Memory Module 0.                 |
| ** POWER UP TESTING CO_ **       | M               | System Cache, SCP, or I/O Controller (IOC).                        |
| ** POWER UP TESTING COM_ **      | P               | Instruction Processor (IP) or ALU-1.                               |
| ** POWER UP TESTING COMP_ **     | L               | Host board. To identify the board, run DTOS FRUs as in Chapter 11. |
| ** POWER UP TESTING COMPL_ **    | E               | Reserved.                                                          |
| ** POWER UP TESTING COMPLE_ **   | T               | Reserved.                                                          |
| ** POWER UP TESTING COMPLET_ **  | E               | Reserved.                                                          |
| ** POWER UP TESTING COMPLETE_ ** | D               | Reserved.                                                          |

Table 17-6 shows MV/8000 II and MV/8000 C powerup faults.

**Table 17-6. MV/8000 II and MV/8000 C Powerup Faults (Partial Powerup Message)**

| Message                          | Missing Letters | Faulty Component(s), in Order of Probability                       |
|----------------------------------|-----------------|--------------------------------------------------------------------|
| <i>(none)</i>                    | All             | SCP.                                                               |
| ** _ **                          | P               | SCP.                                                               |
| ** P_ **                         | O               | SCP.                                                               |
| ** PO _ **                       | W               | SCP.                                                               |
| ** POW _ **                      | E               | SCP, Microsequencer, or Bank Controller.                           |
| ** POWE _ **                     | R               | SCP.                                                               |
| ** POWER _ **                    | U               | SCP.                                                               |
| ** POWER U_ **                   | P               |                                                                    |
| ** POWER UP_ **                  | T               | Microsequencer, SCP, or ATU.                                       |
| ** POWER UP T_ **                | E               | Microsequencer or SCP.                                             |
| ** POWER UP TE_ **               | S               | ALU, Microsequencer or SCP.                                        |
| ** POWER UP TES_ **              | T               | System Cache, Instruction Processor, or ATU.                       |
| ** POWER UP TEST_ **             | I               | System Cache, SCP, or I/O Controller (IOC).                        |
| ** POWER UP TESTI_ **            | N               | ATU or ALU-1.                                                      |
| ** POWER UP TESTIN_ **           | G               |                                                                    |
| ** POWER UP TESTING_ **          | C               | System Cache, ALU-1, or ATU.                                       |
| ** POWER UP TESTING C_ **        | O               | System Cache, Bank Controller, or Memory Module 0.                 |
| ** POWER UP TESTING CO_ **       | M               | System Cache, SCP, or I/O Controller (IOC).                        |
| ** POWER UP TESTING COM_ **      | P               | Instruction Processor (IP) or ALU-1.                               |
| ** POWER UP TESTING COMP_ **     | L               | Host board. To identify the board, run DTOS FRUs as in Chapter 11. |
| ** POWER UP TESTING COMPL_ **    | E               | Reserved.                                                          |
| ** POWER UP TESTING COMPLE_ **   | T               | Reserved.                                                          |
| ** POWER UP TESTING COMPLET_ **  | E               | Reserved.                                                          |
| ** POWER UP TESTING COMPLETE_ ** | D               | Reserved.                                                          |

## **Power Supply Faults — MV/8000 II Computers**

The MV/8000 II power supply can detect certain kinds of error conditions, like overtemperature, undervoltage, and fan failure (on a fan failure it cuts power automatically if the failure lasts 15 seconds).

Fault codes are displayed in the rightmost seven lights (lights 0-6), when the computer STATUS switch is in the POWER SUPPLY position.

When you turn CPU power on with the STATUS switch at POWER SUPPLY, all these lights should glow for a few seconds. This is a lamp test.

After powerup, when the STATUS switch is at POWER SUPPLY, the code of the last fault (if any) will be displayed in the rightmost seven lights. Regardless of the STATUS switch position, the code is saved until another fault occurs, AC power goes down, or you turn power off. The fault code may indicate a current fault, or an earlier fault that was cleared without affecting system operation. For example, if the blower slows briefly, then returns to normal, the fault code will be saved (and displayed with STATUS at POWER SUPPLY) until another fault occurs, AC power is lost, or someone turns AC power off.

If, with STATUS at POWER SUPPLY, the rightmost seven lights are all unlit, there has been no fault since powerup.

The rightmost three lights indicate a fault "category." The four lights to the left of these give specifics within the category. Table 17-7 explains MV/8000 II fault codes. The tables give specifics only when specific information would help general users.

When you discover a power supply fault, note and record the code promptly, before turning power off. The code can help you (and your DG support organization) decide what hardware (if any) needs attention.

**Table 17-7. MV/8000 II Power Supply Fault Codes**

| Fault Category<br>(Lights 4,5,6) |                 |                 | Fault Specifics (Lights 0,1,2,3) and Meaning                         |          |          |          |                                    |                                                                                                                                                                                   |
|----------------------------------|-----------------|-----------------|----------------------------------------------------------------------|----------|----------|----------|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>4</b><br>OFF                  | <b>5</b><br>OFF | <b>6</b><br>ON  | Environment fault. The type depends on panel lights 0-3, as follows. |          |          |          |                                    |                                                                                                                                                                                   |
|                                  |                 |                 | <b>0</b>                                                             | <b>1</b> | <b>2</b> | <b>3</b> | <b>Seven-Light<br/>Code(octal)</b> | <b>Meaning of Code</b>                                                                                                                                                            |
|                                  |                 |                 | OFF                                                                  | OFF      | OFF      | ON       | 0 2                                | VNR (ac line input) voltage too low (brownout condition).                                                                                                                         |
|                                  |                 |                 | OFF                                                                  | OFF      | ON       | OFF      | 021                                | VNR voltage too high.                                                                                                                                                             |
|                                  |                 |                 | OFF                                                                  | OFF      | ON       | ON       | 031                                | Overtemperature in power supply.                                                                                                                                                  |
|                                  |                 |                 | OFF                                                                  | ON       | OFF      | OFF      | 041                                | Overtemperature (in room, if CPU has sensor option).                                                                                                                              |
| <b>4</b><br>OFF                  | <b>5</b><br>ON  | <b>6</b><br>OFF | <b>0</b>                                                             | <b>1</b> | <b>2</b> | <b>3</b> | <b>Seven-Light<br/>Code(octal)</b> | <b>Meaning of Code</b>                                                                                                                                                            |
|                                  |                 |                 | OFF                                                                  | OFF      | OFF      | OFF      | 002                                | Fan (blower) failure. The power supply shuts down.                                                                                                                                |
| <b>4</b><br>OFF                  | <b>5</b><br>ON  | <b>6</b><br>ON  | <b>0</b>                                                             | <b>1</b> | <b>2</b> | <b>3</b> | <b>Seven-Light<br/>Code(octal)</b> | <b>Meaning of Code</b>                                                                                                                                                            |
|                                  |                 |                 | OFF                                                                  | OFF      | OFF      | ON       | 013                                | Battery backup fault. There is a problem with the battery or its hardware.                                                                                                        |
| <b>4</b><br>ON                   | <b>5</b><br>OFF | <b>6</b><br>OFF | <b>0</b>                                                             | <b>1</b> | <b>2</b> | <b>3</b> | <b>Seven-Light<br/>Code(octal)</b> | <b>Meaning of Code</b>                                                                                                                                                            |
|                                  |                 |                 | any                                                                  | any      | any      | OFF      | xx4                                | This fault category indicates an undervoltage condition in the power supply. The cause may be a broken supply or short circuit. The supply shuts down.                            |
|                                  |                 |                 | OFF                                                                  | OFF      | OFF      | ON       | 014                                | At least one (but not all) power supplies have an undervoltage fault (the supplies are not sharing). The supply does not shut down. Shut down AOS/VS (if up); turn CPU power off. |

(continues)

**Table 17-7. MV/8000 II Power Supply Fault Codes**

| 4    | 5    | 6    | 0                                                                                                                                                                | 1   | 2   | 3   | Seven-Light Code(octal) | Meaning of Code                                                                                                                                                                         |
|------|------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ON   | OFF  | ON   | any                                                                                                                                                              | any | any | any | xx5                     | This fault category indicates overvoltage. Output voltages are above safe limits. The power supply shuts down immediately, and stays down until someone presses power off and on again. |
| 4    | 5    | 6    | 0                                                                                                                                                                | 1   | 2   | 3   | Seven-Light Code(octal) | Meaning of Code                                                                                                                                                                         |
| ON   | ON   | OFF  | any                                                                                                                                                              | any | any | any | xx6                     | This fault category indicates overcurrent. There is an overload or short circuit. The power supply shuts down.                                                                          |
| 4 ON | 5 ON | 6 ON | UPSC (Universal power supply controller) fault on powerup. If these lights stay on, or glow when you press STATUS to POWER SUPPLY, the specifics are as follows. |     |     |     |                         |                                                                                                                                                                                         |
|      |      |      | 0                                                                                                                                                                | 1   | 2   | 3   | Seven-Light Code(octal) | Meaning of Code                                                                                                                                                                         |
|      |      |      | OFF                                                                                                                                                              | OFF | OFF | OFF | 007                     | The USPC self-test found a checksum error in EPROM code. It hangs without powering up.                                                                                                  |
|      |      |      | ON                                                                                                                                                               | ON  | ON  | ON  | 177                     | AC line voltage is too low (power up during brownout). When ac voltage reaches normal, the powerup sequence will resume.                                                                |

(concluded)

## MV/8000 C Power Supply Fault Codes

On an MV/8000 C computer front panel, there are three lights: PWR (power), BATT (battery), and RUN. Normally, when the POWER switch is ON, one or more of these glows steadily, as follows:

- PWR light      lit when DC power is normal; off when power is off or the computer is under partial battery backup.
- BATT light     lit when computer has transferred from normal power to backup battery (full or partial backup).
- RUN light      lit when the computer is executing instructions (AOS/VS, DTOS, etc.); off when the computer is halted.

When the computer is running AOS/VS on normal power, the PWR and RUN lights are lit. When the POWER switch is OFF, all lights are off.

When one or more lights *blinks*, at about one cycle per second, this indicates a power system or fan fault. The lights will continue blinking until someone turns the POWER switch to OFF or until AC power goes down. In some cases, the power supply will cut power to the entire CPU in 15 seconds to prevent damage.

If you see one or more panel lights blink, note and record the code promptly, in case AC power goes down. The code can help you (and your DG support organization) decide what hardware (if any) needs attention.

The meaning of the blinking lights is shown in Table 17-8.

**Table 17-8. MV/8000 C Power Supply Faults (Blinking Lights)**

| <b>Blinking Light(s)</b>   | <b>Meaning</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RUN only  [001]            | Environment fault. This may be either of the following: <ul style="list-style-type: none"> <li>· AC line input voltage either too high or too low (brownout condition).</li> <li>· Overtemperature, within power supply or externally (surrounding temperature too high).</li> </ul>                                                                                                                                                                                                                                |
| BATT only  [010]           | Fan failure. One or more cooling fans is not working. The supply shuts down.                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| RUN and BATT  [011]        | VNR or battery backup hardware fault. There is a problem with the battery or its hardware.                                                                                                                                                                                                                                                                                                                                                                                                                          |
| PWR only  [100]            | Power supply fault. An undervoltage condition exists. This may result from a broken supply or a short circuit. The supply shuts down.                                                                                                                                                                                                                                                                                                                                                                               |
| PWR and RUN  [101]         | Overvoltage fault. Output voltages are above safe operating limits. The power supply shuts down immediately. It stays down until someone presses the power switch OFF and ON again.                                                                                                                                                                                                                                                                                                                                 |
| PWR and BATT  [110]        | Overcurrent fault. There is a current overload or short circuit. The power supply shuts down.                                                                                                                                                                                                                                                                                                                                                                                                                       |
| PWR, BATT, RUN (all) [111] | UPSC (Universal power supply) fault on powerup. Normally, as part of the powerup test, all lights glow for about a second. If either of the following occurs, there is a problem: <ul style="list-style-type: none"> <li>· If the lights blink, the UPSC sel-test found a checksum error in EPROM code). It hangs without powering up.</li> <li>· If the lamps do "not" blink, AC line voltage is too low (powerup during a brownout). When AC voltage reaches normal, the powerup sequence will resume.</li> </ul> |

## What Next?

If you have read to this point, you've acquired a sound basic sense of how to create and run a DG AOS/VS system.

You might want to check the appendixes or glossary — or simply run your AOS/VS system.

## End of Chapter





# Appendix A

## Peripheral Device Names and Types

This appendix gives some background; then it describes all peripheral devices (their AOS/VS controller and unit names, and their device codes), that are supported by a standard tailored AOS/VS system. AOS/VS utilities, like the Disk Formatter and FIXUP, support many of these devices. You can get more details on DG hardware from your Data General representative.

Table A-1 describes peripheral devices by AOS/VS controller name, alphabetically. Table A-2 describes all *disk* types and models supported by AOS/VS, and their unit names. Table A-3 lists DG device codes, and the device mnemonics and types associated with these codes.

Note that the disk names recognized by MV/ADES or DTOS hardware diagnostics differ from the AOS/VS names. Usually, hardware diagnostics access all disks on one controller as a single device. For the device names, consult the product documentation or your DG support organization.

### Some Background

When you generate a tailored AOS/VS system, software drivers for the device controllers you specify become *part* of the system.

When you bring up the tailored system, it creates the peripherals directory (:PER, shorthand @) and writes entries for all the devices into this directory. Users can then access devices via the @ prefix. When you shut the system down, it deletes the peripherals directory. So, each tailored AOS/VS system always has its own tailored peripherals directory as it runs.

AOS/VS can support devices other than those you specify at VSGEN; but someone must code drivers for these devices, and the drivers must be identified at runtime via ?IDEF system calls.

### Devices and Controllers

Each I/O device is run by a *controller* board, generally within the computer chassis. The controller may support one or more devices. For example, some DPF controllers can support up to four devices (units); and an MTB controller can support up to eight units. The controller is connected to a device code. Through the device code connection, AOS/VS accesses the controller and — through it — the unit.

**Table A-1. Devices by AOS/VS Name**

| AOS/VS Name      | Device and Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| @CON0            | The system console, a CRT or hardcopy console connected to its own controller and the SCP.                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| @CON2, @CON3,... | User consoles, connected to an ATI or one or more IAC, MCP1, or CPI/24 console-handling devices. A remote user console can run via modem to an ATI, IAC, or DRT device. An @CON- can also be a DASHER LP2 or TP2 printer.                                                                                                                                                                                                                                                                                                              |
| @CRA, @CRA1      | First and second card reader controllers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| @DKB, @DKB1      | First and second fixed-head disk controllers. Each controller can run up to four units.                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| @DPx, @DPx1      | First and second moving-head disk controllers. AOS/VS supports up to eight of each type of controller (DPx, ...DPx7). The x is a letter that signifies the type of disk; it is shown in Table B-2. The units on each controller are numbered 0 through 3 (if the controller supports four) or 0 and 1 (if the controller supports two). So, unit names on the first controller can be @DPx0,@DPx1,...@DPx7. On the second controller they can be @DPx10,@DPx11,...@DPx17; on the third they can be @DPx20,@DPx21,...@DPx27, and so on. |
| @LPB, @LPB1      | First and second data channel line printer controllers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| @LPD, @LPD1      | First and second DASHER LP2 line printer controllers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| @LPE, @LPE1      | First and second laser document printer controllers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| @LPJ             | Another tape controller.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| @MCAR,@MCAT      | First multiprocessor communications adapter (MCA) controllers. The receiver and transmitter each has its own device code.                                                                                                                                                                                                                                                                                                                                                                                                              |
| @MCAR1,@MCAT1    | Second MCA controllers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| @MTB, @MTB1      | First and second dual-density (800/1600 bpi) model 6026 tape controllers. Each controller can support up to eight units. An MTB unit has a DENSITY rocker switch on its front panel. The units are numbered 0 through 7, so the unit names on the first controller are @MTB0,@MTB1,...@MTB7; on the second controller they are @MTB10,@MTB11,...@MTB17.                                                                                                                                                                                |

(continues)

**Table A-1. Devices by AOS/VS Name**

| AOS/VS Name                     | Device and Description                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| @MTC, @MTC1                     | First and second <i>streaming</i> tape controllers. Model 5125 uses reels side by side, at a density of 1600 bpi. A controller can support up to four units, named MTC0, MTC1, MTC2, MTC3. Models 6231 and 6311 use cartridges, at 6400 bpi, and can support one unit per controller (MTC0). Model 6311 is for MV/4000 DC, MV/400 SC, and DS/4000-series only.              |
| @MTD, @MTD1                     | First and second 1600/6250 bpi tape controllers. The model number is 4307 (switches at top) or 6300 (touch-sensitive switch panel). A controller can handle up to four units. On the first controller, the names are MTD0, MTD1, ... , MTD3. On the second controller, names are MTD10, MTD11, ... , MTD13.                                                                 |
| @MTJ, @MTJ1                     | First and second <i>streaming</i> tape controllers. Models 6340 and 6341 use reels side by side, at a density of 1600 or 6250 bpi. Models 6351 and 6352 use cartridges, at a density of 6400 bpi. A controller can handle up to four units. On the first controller, the names are MTJ0, MTJ1, ..., MTJ7. On the second controller, the names are MTJ10, MTJ11, ..., MTJ13. |
| @PLA, @PLA1<br>@SLN0, @SLN1,... | First and second digital plotter controllers.<br><br>Synchronous communications lines (e.g., for DG/SNA or a XODIAC network) connected to the first DCU (DCU0) or ISC. (People don't use the name @DCU0; the software does this for them.)                                                                                                                                  |
| @VCON0,<br>@VCON1,.             | Virtual consoles (allowed by DG's XODIAC Networking VTA agent). These are connected to an MCA (local) or DCU, ISC, or NBA (remote); XODIAC manages the interfaces.                                                                                                                                                                                                          |

(concluded)

**Table A-2. AOS/VS Disk Unit Names and Device Codes**

| <b>Disk Unit Description, Model and Capacity in Megabytes (Mbytes)</b>                                                                                                                                                                                                                                                                           | <b>Default Device Code of Controller</b> | <b>Disk Number on Controller</b>                   | <b>Disk Unit Name (under AOS/VS, use leading @)</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|----------------------------------------------------|-----------------------------------------------------|
| <p>Separate, freestanding disk unit, with multiple-platter removable disk packs.</p> <p>Removable pack:<br/> Model 6067 = 50 Mbytes<br/> Model 5061 = 73 Mbytes<br/> Model 6060 = 96 Mbytes<br/> Model 6061 = 192 Mbytes<br/> Model 6122 = 277 Mbytes</p> <p>Nonremovable pack:<br/> Model 6214 = 602 Mbytes (only two units per controller)</p> | 27                                       | first (0)<br>second (1)<br>third (2)<br>fourth (3) | DPF0<br>DPF1<br>DPF2<br>DPF3                        |
|                                                                                                                                                                                                                                                                                                                                                  | 67                                       | first (0)<br>second (1)<br>third (2)<br>fourth (3) | DPF10<br>DPF11<br>DPF12<br>DPF13                    |
|                                                                                                                                                                                                                                                                                                                                                  | *                                        | first (0)<br>second (1)<br>third (2)<br>fourth (3) | DPF20<br>DPF21<br>DPF22<br>DPF23                    |
|                                                                                                                                                                                                                                                                                                                                                  | *                                        | first (0)<br>second (1)<br>third (2)<br>fourth (3) | DPF30<br>DPF31<br>DPF32<br>DPF33                    |
| <p>Sealed disk unit, has nonremovable disks, rack mounted, switches press for on/off.</p> <p>Model 6160 = 73 Mbytes<br/> Model 6161 = 147 Mbytes</p>                                                                                                                                                                                             | 27                                       | first (0)<br>second (1)                            | DPF0<br>DPF1                                        |
|                                                                                                                                                                                                                                                                                                                                                  | 67                                       | first (0)<br>second (1)                            | DPF10<br>DPF11                                      |
|                                                                                                                                                                                                                                                                                                                                                  | *                                        | first (0)<br>second (1)                            | DPF20<br>DPF21                                      |
|                                                                                                                                                                                                                                                                                                                                                  | *                                        | first (0)<br>second (1)                            | DPF30<br>DPF31                                      |
| <p>Sealed disk unit, has nonremovable disks, rack mounted, power switch on upper right. It has a LED display to show unit number and status. A controller can run four units. Up to three units fit in a cabinet.</p> <p>Model 6236 = 354 Mbytes<br/> Model 6237 = three 6236 units in one cabinet on one controller.</p>                        | 24                                       | first (0)<br>second (1)<br>third (2)<br>fourth (3) | DPJ0<br>DPJ1<br>DPJ2<br>DPJ3                        |
|                                                                                                                                                                                                                                                                                                                                                  | 64                                       | first (0)<br>second(1)<br>third (2)<br>fourth (3)  | DPJ10<br>DPJ11<br>DPJ12<br>DPJ13                    |
|                                                                                                                                                                                                                                                                                                                                                  | *                                        | first (0)<br>second (1)<br>third (2)<br>fourth (3) | DPJ20<br>DPJ21<br>DPJ22<br>DPJ23                    |

(continues)

- \* There is no default device code for the third, fourth, or subsequent disk controllers. These device codes are chosen at installation.

**Table A-2. AOS/VS Disk Unit Names and Device Codes**

| <b>Disk Unit Description, Model and Capacity in Megabytes (Mbytes)</b>                                                                                                                                                                                                                                                                                         | <b>Default Device Code of Controller</b> | <b>Disk Number on Controller</b>                             | <b>Disk Unit Name (Under AOS/VS, Use Leading @)</b> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------|
| <p>Model 6239 = 592 Mbytes<br/>Model 6240 = three 6239 units in one cabinet on one controller.</p> <p>Model 6290 = two 6239 units in one cabinet on one controller.</p> <p>Model 6350 = three 6240 units bolted together.</p>                                                                                                                                  |                                          | <p>first (0)<br/>second (1)<br/>third (2)<br/>fourth (3)</p> | <p>DPJ30<br/>DPJ31<br/>DPJ32<br/>DPJ33</p>          |
| Sealed, moving-head disk, rack mounted. Model 6234 = 50 Mbytes                                                                                                                                                                                                                                                                                                 | 33                                       | only                                                         | DPI0                                                |
|                                                                                                                                                                                                                                                                                                                                                                | 73                                       | only                                                         | DPI10                                               |
| <p>5-1/4 inch disk unit and controller, included in cabinet of a MV/4000 DC, MV/4000 SC, or Data General DS/4000-series system. It has no separate model number. Capacity = 39 Mbytes.</p> <p>Add-on 5-1/4 inch disk unit, available for above machines.</p> <p>Model 6310 = 39 Mbytes.</p> <p>Model 6328 = 71 Mbytes.</p> <p>Model 6329 = 120 Mbytes.</p>     | 24                                       | first (1)                                                    | DPJ0                                                |
|                                                                                                                                                                                                                                                                                                                                                                | 24                                       | second (1)                                                   | DPJ1                                                |
| 5-1/4 inch diskette unit and controller, included in cabinet of a MV/4000 DC, MV/4000 SC, or Data General DS/4000-series system. It has no separate model number. Capacity = 0.737 Mbyte (737,000 bytes).                                                                                                                                                      | 64                                       | first (1)                                                    | DPJ10                                               |
| <p>Add-on 5-1/4 inch diskette unit, available for above machines.</p> <p>Model 6309 = 0.737 Mbyte (737,000 bytes)</p>                                                                                                                                                                                                                                          | 64                                       | second (1)                                                   | DPJ11                                               |
| <p>Sealed, moving-head disk. There can also be a 1.26-Mbyte diskette on this controller. If so, a toggle switch under the front panel makes the disk unit 0 and diskette unit 1, and vice-versa.</p> <p>6227 = 15 Mbytes<br/>6225 = 5 Mbytes<br/>6098 = 12.3 Mbytes + diskette<br/>6099 = 12.3 Mbytes<br/>6100 = 25 Mbytes + diskette<br/>6103 = 25 Mbytes</p> | 33                                       | only                                                         | Disk DPI0<br>(with diskette, DPI0 or DPI1)          |
|                                                                                                                                                                                                                                                                                                                                                                | 73                                       | only                                                         | Disk DPI10<br>(with diskette, DPI10 or DPI11)       |

(continued)

**Table A-2. AOS/VS Disk Unit Names and Device Codes**

| <b>Disk Unit Description, Model and Capacity in Megabytes (Mbytes)</b>                                                                                                                                                                    | <b>Default Device Code of Controller</b> | <b>Disk Number on Controller</b>                 | <b>Disk Unit Name (Under AOS/VS, Use Leading @)</b>                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sealed disk unit, nonremovable disk, rack mounted. When power is on, unit number shows in neon through small plastic window. This is a fixed-head disk.<br><br>Model 6063 = 1 Mbyte<br>Model 6064/5 = 2 Mbytes<br>Model 6066 = 2 6064/5s. | 26                                       | 0<br>1<br>2<br>3                                 | DKB0<br>DKB1<br>DKB2<br>DKB3                                                                                                                                                 |
|                                                                                                                                                                                                                                           | 66                                       | 0<br>1<br>2<br>3                                 | DKB10<br>DKB11<br>DKB12<br>DKB13                                                                                                                                             |
| A minidiskette (5-1/4 inch) unit with one or two slots, used in DESKTOP GENERATION and other systems. Model 4514=0.368 Mbyte (368,000 bytes).                                                                                             | 20                                       | first                                            | DPM0, DPM1                                                                                                                                                                   |
|                                                                                                                                                                                                                                           | 60                                       | second                                           | DPM10, DPM11                                                                                                                                                                 |
| A diskette unit with one or two slots. The only switch is the power switch.<br><br>Model 6097 = 1.26 Mbytes                                                                                                                               | 33                                       | first                                            | Left: DPI0; right: DPI1                                                                                                                                                      |
|                                                                                                                                                                                                                                           | 73                                       | second                                           | Left: DPI10; right: DPI11                                                                                                                                                    |
| A disk unit with two switches and a wheel to select unit number. It has two disks; the top is removable, the bottom is nonremovable.<br><br>Model 6070 = 10 Mbytes/disk                                                                   | 33                                       | 0 on dial<br>1 on dial<br>2 on dial<br>3 on dial | Removable: DPG0;<br>nonremovable: DPG4<br>Removable: DPG1;<br>nonremovable: DPG5<br>Removable: DPG2;<br>nonremovable: DPG6<br>Removable: DPG3;<br>nonremovable: DPG7         |
|                                                                                                                                                                                                                                           | 73                                       | 0 on dial<br>1 on dial<br>2 on dial<br>3 on dial | Removable: DPG10;<br>nonremovable: DPG14<br>Removable: DPG11;<br>nonremovable: DPG15<br>Removable: DPG12;<br>nonremovable: DPG16<br>Removable: DPG13;<br>nonremovable: DPG17 |

(continued)

**Table A-2. AOS/VS Disk Unit Names and Device Codes**

| <b>Disk Unit Description, Model and Capacity in Megabytes (Mbytes)</b>                                                                                       | <b>Default Device Code of Controller</b> | <b>Disk Number on Controller</b>                                    | <b>Disk Unit Name (under AOS/VS, use leading @)</b>                                                                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>A disk unit that looks just like the previous one. But it has half the capacity and supports 0.3 Mbyte diskettes.</p> <p>Model 6045** = 5 Mbytes/disk</p> | 33                                       | <p>0 on dial</p> <p>1 on dial</p> <p>2 on dial</p> <p>3 on dial</p> | <p>Removable: DPD0;<br/>nonremovable: DPD4</p> <p>Removable: DPD1;<br/>nonremovable: DPD5</p> <p>Removable: DPD2;<br/>nonremovable: DPD6</p> <p>Removable: DPD3;<br/>nonremovable: DPD7</p>         |
|                                                                                                                                                              | 73                                       | <p>0 on dial</p> <p>1 on dial</p> <p>2 on dial</p> <p>3 on dial</p> | <p>Removable: DPD10;<br/>nonremovable: DPD14</p> <p>Removable: DPD11;<br/>nonremovable: DPD15</p> <p>Removable: DPD12;<br/>nonremovable: DPD16</p> <p>Removable: DPD13;<br/>nonremovable: DPD17</p> |
| <p>A diskette unit with one or two slots; each slot has a thumbwheel to select unit number.</p> <p>Model 6030 = 0.3 Mbyte.</p>                               | 33                                       | n on dial                                                           | DPDn                                                                                                                                                                                                |
|                                                                                                                                                              | 73                                       | n on dial                                                           | DPD1n                                                                                                                                                                                               |

(concluded)

\*\* A model 6045 controller can run both 6045 disk units and 6030 diskette units. The hard disk unit numbers leave room for diskette unit names; for example, if you dial 0 on the hard disk thumbwheel, the removable disk is unit 0 and the nonremovable disk unit 4; you can dial 1, 2, or 3 on the diskette units.



**Table A-3. DG Standard I/O Device Codes**

| Device Code | Hardware Mnemonic | Device Name                                                                                    |
|-------------|-------------------|------------------------------------------------------------------------------------------------|
| 00          | ---               | Power fail/auto restart.                                                                       |
| 01          | WCS               | Writable control store (WCS), CPU.                                                             |
| 02          | ERCC              | Error checking and correction (ERCC).                                                          |
| 03          | BMAP              | ECLIPSE memory allocation and protection (MAP).                                                |
| 04          | UPSC              | Universal Power Supply Controller.                                                             |
| 05          | BMC               | Burst Multiplexor Channel.                                                                     |
| 06          | MCAT              | First multiprocessor communications adapter (MCA) transmitter.                                 |
| 07          | MCAR              | First MCA receiver.                                                                            |
| 10          | TTI               | System console input (keyboard).                                                               |
| 11          | TTO               | System console output (screen or printer).                                                     |
| 12          | ---               | Mouse.                                                                                         |
| 14          | RTC               | Real-time clock.                                                                               |
| 15          | PLT               | First incremental plotter.                                                                     |
| 16          | CDR               | First card reader.                                                                             |
| 17          | LPT               | First line printer.                                                                            |
| 22          | MTA               | First magnetic tape controller.                                                                |
| 23          | MTJ               | First MTJ-type magnetic tape controller (AOS/VS mnemonic).                                     |
| 24          | DPJ               | First DPJ-type moving-head disk controller (AOS/VS mnemonic).                                  |
| 25          | ---               | First ISC or MCP1 synchronous line controller.                                                 |
| 26          | DKB               | First fixed-head disk controller.                                                              |
| 27          | DPF               | First DPF-type moving-head disk controller (AOS/VS mnemonic).                                  |
| 33          | DKP               | First moving-head disk controller.                                                             |
| 34          | MUX               | First communications system controller (used by ATI or DRT).                                   |
| 40          | SDCU0             | First Data Control Unit (DCU) or Intelligent Synchronous Controller (ISC) (synchronous lines). |
| 43          | PIT               | Programmable Interval Timer.                                                                   |
| 44          | SLM               | Synchronous Line Multiplexor                                                                   |
| 45          | ---               | SCP notifies AOS/VS to log an event in SYSLOG.                                                 |
| 46          | MCAT1             | Second MCA transmitter or LAN transmitter.                                                     |
| 47          | MCAR1             | Second MCA receiver or LAN receiver.                                                           |
| 50          |                   | Second IAC or MCP1 async controller.                                                           |
| 51          |                   | Third IAC or MCP1 async controller.                                                            |
| 52          |                   | Fourth IAC or MCP1 async controller.                                                           |
| 54          | RTC1              | Second real-time clock.                                                                        |
| 55          | PLT1              | Second incremental plotter.                                                                    |
| 56          | CDR1              | Second card reader.                                                                            |

(continues)

**Table A-3. DG Standard I/O Device Codes**

| <b>Device Code</b> | <b>Hardware Mnemonic</b> | <b>Device Name</b>                                                                                             |
|--------------------|--------------------------|----------------------------------------------------------------------------------------------------------------|
| 57                 | LPT1                     | Second line printer.                                                                                           |
| 62                 | MTA1                     | Second magnetic tape controller (first type MTD controller).                                                   |
| 63                 | MTJ1                     | Second MTJ-type magnetic tape controller (AOS/VS mnemonic).                                                    |
| 64                 | DPJ1                     | Second DPJ-type moving-head disk controller (AOS/VS mnemonic).                                                 |
| 65                 | IOP                      | First Intelligent Asynchronous Controller (IAC), MCP1 (async controller), or IOP (Controller board in an ATI). |
| 66                 | DKB1                     | Second fixed-head disk controller.                                                                             |
| 67                 | DPF1                     | Second DPF-type moving-head disk controller.                                                                   |
| 73                 | DKP1                     | Second nonDPF-type disk controller.                                                                            |
| 74                 | FPU1                     | Single-precision floating-point unit.                                                                          |
| 75                 | FPU2                     | Double-precision floating-point unit.                                                                          |
| 76                 | FPU                      | Floating-point unit Controller.                                                                                |
| 77                 | CPU                      | Central processor and console functions.                                                                       |

(concluded)

End of Appendix



# Appendix B

## EXEC Command Summary

This appendix summarizes all EXEC commands, alphabetically, in Table B-1. You can abbreviate any EXEC command to its shortest identifiable string. An EXEC Command summary card is shipped with this book.

Start each EXEC command with CONTROL @EXEC or CX (CX.CLI is a macro).

**Table B-1. EXEC Commands, Alphabetically**

| EXEC Command  | What It Does                                                                                                                                  | Example                                                                   |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| ALIGN         | Stops or continues line printer. Use it for aligning paper.                                                                                   | ) CX ALIGN @LPB ↓<br>) CX ALIGN/CONT @LPB ↓                               |
| BINARY        | Enables binary mode (for word processor printing) on a device.                                                                                | ) CX PAUSE @CON25 ↓<br>) CX BINARY @CON25 CLEANUP ↓<br>) CX CONT @CON25 ↓ |
| BRIEF         | Makes batch or spool messages brief.                                                                                                          | ) CX BRIEF @LPB ↓                                                         |
| CANCEL        | Cancels a batch or printing request that is enqueued but not yet active. Use FLUSH for an active request.                                     | ) CX CANCEL 445 ↓                                                         |
| CLOSE         | Closes a queue to user requests.                                                                                                              | ) CX CLOSE PLT ↓                                                          |
| CONSOLESTATUS | Displays console-user status.                                                                                                                 | ) CX CONSOLES @CON8 ↓                                                     |
| CONTINUE      | Continues (resumes processing in) a batch stream (1-4) or device (@LPB). Use after PAUSE.                                                     | ) CX CONTINUE 2 ↓<br>) CX @LPB ↓                                          |
| CPL           | Changes the maximum number of printed characters per line.                                                                                    | ) CX PAUSE @LPB ↓<br>) CX CPL @LPB 85 ↓                                   |
| CREATE        | Creates a device queue.                                                                                                                       | ) CX CREATE PRINT QFILE ↓                                                 |
| DEFAULTFORMS  | Sets new printer CPL and LPP parameters.                                                                                                      | ) CX DEFAULT @LPB FFILE ↓                                                 |
| DELETE        | Deletes a device queue.                                                                                                                       | ) CX DELETE QFILE ↓                                                       |
| DISABLE       | Disables one or more user consoles for user logon. Use it when you plan to shut down or to free an EXEC-owned console for another DG product. | ) CX DISABLE @CON8 ↓                                                      |
| DISMOUNTED    | Tells EXEC that you have physically dismounted a tape from a unit.                                                                            | <b>**UNIT DISMOUNT**</b><br>.<br>) CX DISMOUNTED ↓                        |
| ELONGATE      | Turns LP2/TP2 elongated printing on or off.                                                                                                   | ) CX PAUSE @CON25 ↓<br>) CX ELONGATE @CON25 ↓<br>) CX CONT @CON25 ↓       |

(continues)

**Table B-1. EXEC Commands, Alphabetically**

| EXEC Command | What It Does                                                                                                                                                                    | Example                                                             |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| ENABLE       | Enables a user console for user logon under EXEC; primarily used within UP.CLI macro.                                                                                           | ) CX ENABLE @CON45 )<br>) CX ENABLE/TRIES=3& )<br>& ) /STOP @CON8 ) |
| EVEN         | Turns even pagination off or on for a printer.                                                                                                                                  | ) CX EVEN @LPB1 OFF )                                               |
| FLUSH        | Flushes (kills) the job that a batch stream or device is processing.                                                                                                            | ) CX FLUSH 3 )<br>) CX FLUSH @LPB )                                 |
| FORMS        | Allows you to specify a file to be used for special form printing; e.g., bills.                                                                                                 | ) CX PAUSE @LPB )<br>) CX FORMS BILLS @LPB )<br>) CX CONT @LPB )    |
| HEADERS      | Changes the number of header pages printed on a device.                                                                                                                         | ) CX HEADERS @LPB 2 )                                               |
| HOLD         | Holds (suspends) a batch or spool request.                                                                                                                                      | ) CX HOLD 4394 )                                                    |
| LIMIT        | Enforces user- or operator-defined limits on CPU time or printed pages.                                                                                                         | ) CX LIMIT 2 1:30 )<br>) CX LIMIT @LPB 25 )                         |
| LOGGING      | Turns EXEC logging on or off.                                                                                                                                                   | ) CX LOGGING/START XLOG )                                           |
| LPP          | Changes the maximum number of printed lines per page.                                                                                                                           | ) CX PAUSE @LPB )<br>) CX LPP @LPB 60 )<br>) CX CONT @LPB )         |
| MESSAGE      | Writes a text message to EXEC's log file.                                                                                                                                       | ) CX MESSAGE 4 STREAMS )                                            |
| MOUNTED      | In response to user mount request, tells EXEC that a tape is physically mounted on a tape unit.                                                                                 | <b>**UNIT MOUNT**</b><br>) CX MOUNTED @MTB1 )                       |
| MOUNTSTATUS  | Displays mount request status.                                                                                                                                                  | ) CX MOUNTSTAT )                                                    |
| OPEN         | Opens a device queue to user requests.                                                                                                                                          | ) CX OPEN MYQUEUE )                                                 |
| OPERATOR     | Tells EXEC that an operator is on or off duty.                                                                                                                                  | ) CX OPERATOR ON )<br>) CX OPERATOR OFF )                           |
| PAUSE        | Pauses a batch stream or device in an orderly way, after the current request is done. Prepares for normal shutdown or change in device specifications. To resume, use CONTINUE. | ) CX PAUSE )<br>) CX PAUSE @LPB )                                   |
| PREMOUNT     | Tells EXEC that a person has physically mounted a labeled tape before a MOUNT request for it occurred.                                                                          | ) CX PREMOUNT @MTB2 & )<br>& ) VOL1 SAM )                           |
| PROMPTS      | Removes or adds time of day from EXEC message display.                                                                                                                          | ) CX PROMPTS OFF )                                                  |

(continued)

**Table B-1. EXEC Commands, Alphabetically**

| EXEC Command | What It Does                                                                                                                        | Example                                               |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| PRIORITY     | Sets a new system priority and/or process type for batch streams or co-operative processes (XLPT).                                  | ) CX PRIORITY 3 1 )                                   |
| PURGE        | Deletes entries in a stopped device queue.                                                                                          | ) CX PURGE PLT )                                      |
| QPRIORITY    | Sets a new range of batch/print priorities that will be accepted by a batch stream or device.                                       | ) CX QPRIORITY 3 1 26 )<br>) CX QPRIORITY @LPB 1 99 ) |
| REFUSED      | Refuses a user mount request.                                                                                                       | ) CX REFUSED )                                        |
| RESTART      | Restarts a printing request.                                                                                                        | ) CX RESTART @LPB )                                   |
| SILENCE      | Silences EXEC; suppresses all batch or device messages to the system console and EXEC log file. Useful on hardcopy system consoles. | ) CX SILENCE )<br>) CX SILENCE @LPB )                 |
| SPOOLSTATUS  | Displays queue-device association and status.                                                                                       | ) CX SPOOLS @LPB )                                    |
| START        | Associates a queue with a device. CX CONTINUE then activates the device.                                                            | ) CX START LPT @LPB )<br>) CX CONT @LPB )             |
| STATUS       | Gives information about batch streams or devices. The CLI command QDISPLAY/V is also handy for this.                                | ) CX STATUS )<br>) CX STAT @LPB )                     |
| STOP         | Stops a device or dissociates a queue. To resume, use CX START.                                                                     | ) CX STOP @LPB )                                      |
| TERMINATE    | Terminates the user process associated with a console, or terminates an EXEC cooperative process.                                   | ) CX TERMINATE @CON5 )                                |
| TRAILERS     | Changes number of printed trailer pages.                                                                                            | ) CX TRAILERS @LPB 1 )                                |
| UNHOLD       | Negates HOLD command.                                                                                                               | ) CX UNHOLD 4394 )                                    |
| UNITSTATUS   | Describes the mount status of tape units.                                                                                           | ) CX UNITSTATUS )                                     |
| UNLIMIT      | Negates LIMIT command.                                                                                                              | ) CX UNLIMIT 2 )<br>) CX UNLIMIT @LPB )               |
| UNSILENCE    | Negates SILENCE command.                                                                                                            | ) CX UNSILENCE )<br>) CX UNSILENCE @LPB )             |
| VERBOSE      | Makes batch/spool messages verbose.                                                                                                 | ) CX VERBOSE 4 )                                      |
| XBIAS        | Sets a new EXEC small job versus large job bias factor, for a batch stream or device.                                               | ) CX XBIAS 1 -100 )<br>) CX XBIAS @LPB 100 )          |
| XHELP        | Describes all EXEC commands or a specified command (omit the leading CX).                                                           | ) XHELP )<br>) XHELP ALIGN )                          |

(concluded)

End of Appendix



# Appendix C

## Files Shipped with AOS/VS

This appendix lists and describes files that are part of AOS/VS Revision 7.00, in Table C-1. Nearly all these files are shipped on AOS/VS release medium — tape or diskettes. Patch files, which have filenames in the form 7.00\_program-name\_PATCHES, are shipped on AOS/VS update media.

The current microcode file for your machine, whose filename has the form MVn/FP/.MCF, is shipped with the computer on the MV/Family system medium (not with AOS/VS).

Table C-1 lists files alphabetically by filename, followed by the home directory name and a brief description. Unless noted otherwise, files are included on the AOS/VS release tape. For brevity, some filenames are templates to indicate more than one file. The normal template rules apply (\* means one character, + means any number of characters, and so on).

General filename suffix rules also apply: a .CLI suffix indicates a CLI macro; an .OL suffix an overlay file; a .PR suffix a program file; and an .ST suffix a symbol table (needed for patching the program, if needed, automatically).



**Table C-1. Files Shipped with AOS/VS**

| Name of File              | Home Directory | Description                                                                                                                     |
|---------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------|
| 069_000031_**             | :UTIL          | Documentation changes for <i>Learning to Use Your AOS/VS System</i> .                                                           |
| 093_000122_**             | :UTIL          | Documentation changes for <i>Command Line Interpreter (CLI) User's Manual (AOS and AOS/VS)</i> .                                |
| 093_000241_**             | :UTIL          | Documentation changes for <i>System Call Dictionary (AOS/VS and AOS/DVS)</i> .                                                  |
| 093_000242_**             | :UTIL          | Documentation changes for <i>AOS/VS Macroassembler (MASM) Reference Manual</i> .                                                |
| 093_000243_**             | :UTIL          | Documentation changes for <i>How to Generate and Run AOS/VS</i> (this manual).                                                  |
| 093_000245_**             | :UTIL          | Documentation changes for <i>AOS/VS Link and Library File Editor (LFE) User's Manual</i> .                                      |
| 093_000246_**             | :UTIL          | Documentation changes for <i>AOS/VS Debugger and File Editor User's Manual</i> .                                                |
| 093_000335_**             | :UTIL          | Documentation changes for <i>AOS/VS System Concepts</i> .                                                                       |
| 7.00_+_PATCHES            | :PATCH         | Program patch files (shipped with AOS/VS updates).                                                                              |
| 7.00_STARTUP.CLI          | :              | Macro that warns users of AOS/VS Rev. 5.00 of changes to make to accommodate big PIDs.                                          |
| AGENT.PR and AGENT.ST     | :(root)        | Agent program, provides user interface to AOS/VS system calls.                                                                  |
| ALPHARS.PR and ALPHARS.ST | :(root)        | Operating system to run in MIOC controller, used on MV/4000 DC, MV/4000 SC, and Data General DS/4000 systems. Loaded by AOS/VS. |
| AOSVS.PANICS.SR           | :UTIL          | Explanation of AOS/VS panic codes (displayed with <i>FATAL AOS/VS ERROR</i> message).                                           |
| AOSVS_UPDATE_NOTICE       | :PATCH         | Instructions for installing this AOS/VS update (shipped with AOS/VS updates).                                                   |
| BRAN.PR and BRAN.ST       | :UTIL          | Break file analyzer, useful for problem diagnosis by system programmers.                                                        |
| BSCGEN.PR and BSCGEN.ST   | :SYSGEN        | Bisynchronous line system generation program, used in addition to VSGEN if you need support for bisync lines.                   |

(continues)

**Table C-1. Files Shipped with AOS/VS**

| <b>Name of File</b>             | <b>Home Directory</b> | <b>Description</b>                                                                                                                              |
|---------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| CHECK_SPACE.CLI                 | :UTIL                 | CLI macro to monitor disk space remaining in the system log directory.                                                                          |
| CLEAR                           | : (root)              | File to clear a laser document printer.                                                                                                         |
| CLEAR_SCREEN.CLI                | :UTIL                 | Macro that displays a form feed, used by other macros.                                                                                          |
| CLIBT.LB                        | :SYSGEN               | System-generation library VSGEN uses to build the special CLI used for initial loading.                                                         |
| CLI.CMD.+                       | :HELP                 | CLI command Help files (approximately 100); they provide the text for HELP/V command displays.                                                  |
| CLI.OL, CLI.PR, and CLI.ST      | : (root)              | The CLI — user interface to AOS/VS.                                                                                                             |
| CLI.PSM.+                       | :HELP                 | CLI pseudo-macro Help files (approximately 55). They provide the text for HELP !pseudo-macro-name displays.                                     |
| CLI.TPC.+                       | :HELP                 | CLI topic Help files (46 with AOS/VS; other software has additional topic Help files). They provide the text for HELP and HELP *topic displays. |
| CLREERMES.OB                    | :UTIL                 | Error message text for programming languages in the Common Language Runtime Environment (CLRE).                                                 |
| CONTEST.+ .PR and CONTEST.+ .ST | :UTIL                 | CONTEST program to test system hardware and software (9 program and symbol table files).                                                        |
| CONTEST.CLEAN.CLI               | :UTIL                 | Macro to delete temporary files created by CONTEST.                                                                                             |
| CONTEST.CLI                     | :UTIL                 | Macro to execute CONTEST program test suite.                                                                                                    |
| CONTEST.ERRORS.CLI              | :UTIL                 | Macro to display errors detected by CONTEST.                                                                                                    |
| CONVERT.PR and CONVERT.ST       | :UTIL                 | Program to convert an RDOS object file to an AOS/VS or AOS object file.                                                                         |
| CPIRS.PR and CPIRS.ST           | : (root)              | Operating system to run in a CPI/24 (Computer-PBX Interface) asynchronous line controller. Loaded by AOS/VS PMGR.                               |

(continued)

**Table C-1. Files Shipped with AOS/VS**

| <b>Name of File</b>                     | <b>Home Directory</b> | <b>Description</b>                                                                                                                            |
|-----------------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| DCTLIB.LB                               | :SYSGEN               | System-generation library of routines to create device driver control tables.                                                                 |
| DEBUG4. +                               | :HELP                 | Help files for assembly-language debugger (28 files).                                                                                         |
| DEFAULT.SPEC                            | :SYSGEN               | File with default specs for BSCGEN.PR.                                                                                                        |
| DEVLIB.LB                               | :SYSGEN               | System generation library of routines to create device drivers.                                                                               |
| DFMTR and DFMTR.ST                      | : (root)              | Stand-alone Disk Formatter, to create or modify a logical disk unit (LDU).                                                                    |
| DFMTR.PR and DFMTR.ST                   | :UTIL                 | Stand-among Disk Formatter, to create or modify an LDU. Runs under AOS/VS.                                                                    |
| DGLERMES.OB                             | :UTIL                 | Message text for DG/L language runtime errors.                                                                                                |
| DISCO.PR and DISCO.ST                   | :UTIL                 | DISCO disk-load monitor program.                                                                                                              |
| DISPLAY.OL, DISPLAY.PR, and DISPLAY.ST  | :UTIL                 | DISPLAY program, to display contents of any file (program file, magnetic tape file, and so on).                                               |
| DOWN.CLI                                | :UTIL                 | Macro to bring down multiuser environment.                                                                                                    |
| DUMP_II.CLI, DUMP_II.PR, and DUMP_II.ST | :UTIL                 | DUMP_II macro and program for fast file backup.                                                                                               |
| DUMP_II_LOAD_II_ERMES.OB                | :UTIL                 | Error message text for DUMP_II and LOAD_II programs.                                                                                          |
| DUMPLIB.LB                              | :SYSGEN               | System-generation library of routines to create a memory dump driver.                                                                         |
| EBID.SR                                 | :UTIL                 | ECLIPSE basic instruction definitions, used to create macroassembler permanent symbol file.                                                   |
| ECID.SR                                 | :UTIL                 | ECLIPSE commercial instruction definitions, used to create macroassembler permanent symbol file.                                              |
| EMASM.CLI                               | :UTIL                 | Macro to assemble an error message object file (-ERMES.OB); for AOS/VS programs, these files are shipped ready-made.                          |
| ERMES                                   | : (root)              | Error message file. As shipped, it includes error text for all AOS/VS programs, DG/L, FORTRAN 77, PL/I, and assembly language runtime errors. |

(continued)

**Table C-1. Files Shipped with AOS/VS**

| <b>Name of File</b>           | <b>Home Directory</b> | <b>Description</b>                                                                                                                  |
|-------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| ERMES.SR                      | :UTIL                 | Source file that explains format of ERMES error messages in AOS/VS.                                                                 |
| EXEC. +                       | :HELP                 | Help files for EXEC; they provide the text for XHELP commands (about 50 files supplied).                                            |
| EXEC.OL, EXEC.PR, and EXEC.ST | :UTIL                 | EXEC program, that manages user logon and logoff, batch, spooling, and labeled tape mounts for users.                               |
| EXECVS.PR and EXECVS.ST       | :UTIL                 | EXEC program that runs in ring 6 (loaded by EXEC.PR).                                                                               |
| F77ERMES.OB                   | :UTIL                 | Message text for FORTRAN 77 runtime errors.                                                                                         |
| FCU.PR and FCU.ST             | :UTIL                 | Forms control utility, creates special form printing settings.                                                                      |
| FED. +                        | :HELP                 | Help files for assembly language disk file editor (16 files).                                                                       |
| FED.PR and FED.ST             | :UTIL                 | Disk file editor, used for changing disk location contents (needed for patching).                                                   |
| FF.CLI                        | :UTIL                 | Macro that prints a form feed (blank sheet).                                                                                        |
| FILCOM.PR and FILCOM.ST       | :UTIL                 | Program to compare binary files and display differences (a better comparison program for program source and text files is SCOM.PR). |
| FIXUP and FIXUP.ST            | : (root)              | Stand-alone disk fixer, corrects LDU inconsistencies after an abnormal shutdown.                                                    |
| FIXUP.PR and FIXUP.ST         | :UTIL                 | Stand-among disk fixer, corrects LDU inconsistencies after an abnormal shutdown; runs under AOS/VS.                                 |
| FULL_BACKUP.CLI               | :UTIL                 | Macro to execute full backup of user files and non-AOS/VS files — to diskettes.                                                     |
| FULL_DUMP.CLI                 | :UTIL                 | Macro to execute full backup of user files and non-AOS/VS files — to labeled magnetic tape.                                         |
| GSMGR.PR and GSMGR.ST         | : (root)              | Global sync-line manager program; run it if your system will use sync lines.                                                        |
| HELPV.CLI                     | :UTIL                 | Macro to display Help messages a screenful at a time.                                                                               |
| HELPV1.CLI                    | :UTIL                 | Macro needed by HELPV.CLI.                                                                                                          |

(continued)

**Table C-1. Files Shipped with AOS/VS**

| <b>Name of File</b>                    | <b>Home Directory</b> | <b>Description</b>                                                                                                              |
|----------------------------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------|
| HISTO.DOC, HISTO.PR, and HISTO.ST      | :UTIL                 | Histogram generator documentation and program.                                                                                  |
| HISTOREPORT.PR and HISTOREPORT.ST      | :UTIL                 | Histogram report generator (works on files created by HISTO.PR).                                                                |
| IACRS.PR and IACRS.ST                  | : (root)              | Operating system to run in an IAC asynchronous line controller. Loaded by AOS/VS PMGR.                                          |
| INC_BACKUP.CLI                         | :UTIL                 | Macro to execute incremental backup of user files to diskettes. Used between full backups done with FULL_BACKUP.CLI.            |
| INC_DUMP.CLI                           | :UTIL                 | Macro to execute incremental backup of user files to labeled mag tape. Used between full backups done with FULL_DUMP.CLI.       |
| INSTL and INSTL.ST                     | : (root)              | Stand-alone Installer program, to install a disk and system bootstrap and, optionally, a system on an LDU.                      |
| INSTL.PR and INSTL.ST                  | :UTIL                 | Stand-among Installer program, to install a disk and system bootstrap and, optionally, a system on an LDU; runs under AOS/VS.   |
| IOPRS.PR and IOPRS.ST                  | : (root)              | Operating system to run in a ATI's IOP (this device controls asynchronous lines on an original MV/8000). Loaded by AOS/VS PMGR. |
| LABEL.PR and LABEL.ST                  | :UTIL                 | Tape labeling program; creates a labeled tape.                                                                                  |
| LANG_RTERMES.OB                        | :UTIL                 | Message text for DG runtime language errors.                                                                                    |
| LFCOPY.PR and LFCOPY.ST                | :UTIL                 | Labeled floppy copy program, copies a memory dump that was done to diskettes. Intended for DG personnel.                        |
| LFE.PR and LFE.ST                      | :UTIL                 | Library file editor program, builds libraries from program routines.                                                            |
| LIB1.LB, LIB2.LB, LIB3.LB, and LIB4.LB | :SYSGEN               | System-generation libraries, used to build operating systems.                                                                   |
| LINK.PR and LINK.ST                    | :UTIL                 | Linker program, creates executable program files from object files.                                                             |
| LINK_ERMES.CLI                         | :UTIL                 | Macro to create new error message file (ERMES).                                                                                 |

(continued)

**Table C-1. Files Shipped with AOS/VS**

| Name of File                                        | Home Directory | Description                                                                                                            |
|-----------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------|
| LINKERMES.OB                                        | :UTIL          | Error message text for Link program errors.                                                                            |
| LOAD_II.CLI, LOAD_II.PR, and LOAD_II.ST             | :UTIL          | LOAD_II macro and program for fast loads from dump files.                                                              |
| LOAD_II.PR                                          | : (root)       | LOAD_II program (duplicated in root directory for faster initial loads on systems that have cartridge tape).           |
| LOCK_CLI.OL, LOCK_CLI.PR, LOCK_CLI.ST               | :(root)        | A CLI that can be locked in a harmless state, designed to safeguard system console.                                    |
| LOGCALLS.DOC, LOGCALLS.PR, and LOGCALLS.ST          | :UTIL          | System call logger documentation and program.                                                                          |
| LPMGR.PR and LPMGR.ST                               | : (root)       | Peripheral manager (PMGR) program that runs consoles for users; the system loads it at startup into ring 3.            |
| MASM.PR, MASM.PS, and MASM.ST                       | :UTIL          | Macroassembler program and permanent symbol file (MASM.PS).                                                            |
| MASM16.PR, MASM16.PS, and MASM.ST                   | :UTIL          | Macroassembler program for 16-bit programs and permanent symbol file (MASM16.PS).                                      |
| MASERMES.OB                                         | :UTIL          | Error message text for macroassembler errors.                                                                          |
| MASMXR.PR and MASMXR.ST                             | :UTIL          | Macroassembler cross-reference generator.                                                                              |
| MIRRORINFO.PR and MIRRORINFO.ST                     | :UTIL          | Logical disk mirroring information utility.                                                                            |
| MKABS.PR and MKABS.ST                               | :UTIL          | Program to copy an RDOS Save file (program file) onto an absolute binary file.                                         |
| MSCOPY.CLI, MSCOPY.BTSFPLK, MSCOPY.PR and MSCOPY.ST | :UTIL          | MSCOPY modified sector disk backup program files — CLI macro, error message file, program file, and symbol table file. |
| MSCOPY.COMMAND_HELP                                 | :HELP          | Help file displayed while executing MSCOPY.                                                                            |
| MV-0000-.MCF                                        | : (root)       | Microcode file for your system, shipped on MV/Family system media.                                                     |
| MV4000DC_IAC.CSF and MV4000DC_IAC.SSF               | :SYSGEN        | VSGEN spec file for a MV/4000 DC computer equipped with an IAC.                                                        |
| MV4000DC_MCP1.CSF and MV4000DC_MCP1.SSF             | :SYSGEN        | VSGEN spec file for a MV/4000 DC computer equipped with an MCP1.                                                       |

(continued)

**Table C-1. Files Shipped with AOS/VS**

| <b>Name of File</b>                         | <b>Home Directory</b> | <b>Description</b>                                                                                                                  |
|---------------------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| MV4000SC.CSF and MV4000SC.SSF               | :SYSGEN               | VSGEN spec file for an MV/4000 SC computer.                                                                                         |
| OP_TEMP.CLI                                 | : (root)              | Macro to set up Operator profile, needed to build initial system over XODIAC network (4000-class integrated systems only).          |
| OP_TEMP_PROF                                | : (root)              | Operator profile used by OP_TEMP.CLI.                                                                                               |
| PARU.16.SR                                  | :UTIL                 | User parameter definitions for 16-bit macroassembler.                                                                               |
| PARU.32.SR                                  | :UTIL                 | User parameter definitions for 32-bit macroassembler.                                                                               |
| PARU_LONG.SR                                | :UTIL                 | User parameter definitions for system calls used in 32-bit high-level language programs.                                            |
| PATCH.PR and PATCH.ST                       | :UTIL                 | Patch program to install patches supplied in :PATCH (auto-patch macros use it).                                                     |
| PCOPY and PCOPY.ST                          | : (root)              | Stand-alone PCOPY physical copy program, backs up and restores LDUs.                                                                |
| PCOPY.PR and PCOPY.ST                       | :UTIL                 | Stand-alone PCOPY program, backs up and restores LDUs; runs under AOS/VS.                                                           |
| PED.CLI, PED.PR, and PED.ST                 | :UTIL                 | Process environment display (PED) macro and program.                                                                                |
| PIDCALL_CHECK.CLI                           | :UTIL                 | Macro that checks a program for system calls that may require some change and recompiling in order for the program to run big PIDs. |
| PIDCALL_CHECK16.FED and PIDCALL_CHECK32.FED | :UTIL                 | FED input files used by PIDCALL_CHECK.CLI.                                                                                          |
| PIDSIZE.CLI                                 | :UTIL                 | Macro that checks a program's PID-size type.                                                                                        |
| PL1ERMES.OB                                 | :UTIL                 | Message text for PL/I runtime errors.                                                                                               |
| PL1ERMES16.OB                               | :UTIL                 | Message text for 16-bit PL/I runtime errors.                                                                                        |
| PLNERMES.OB                                 | :UTIL                 | Message text for PL/Nichols runtime errors (this is a custom DG version of PL/I).                                                   |
| PMGR.PR and PMGR.ST                         | : (root)              | Peripheral manager (PMGR) program that runs in ring 7; loaded by system at startup.                                                 |
| POSS.CLI and POSS1.CLI                      | :UTIL                 | Macros needed by HELP.V.CLI.                                                                                                        |

(continued)

**Table C-1. Files Shipped with AOS/VS**

| <b>Name of File</b>           | <b>Home Directory</b> | <b>Description</b>                                                                                                  |
|-------------------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------|
| PREDITOR.PR and PREDITOR.ST   | :UTIL                 | PREDITOR user profile editor program to create profiles and assign privileges.                                      |
| QCMP.PR and QCMP.ST           | :UTIL                 | Queue compression program.                                                                                          |
| RDOS.OL, RDOS.PR, and RDOS.ST | :UTIL                 | RDOS-to-AOS and AOS/VS conversion program; converts RDOS files, tapes, and disks to AOS[/VS] format and vice versa. |
| RELEASE.7.00                  | :UTIL                 | AOS/VS Release Notice, describes features and cautions not explained in AOS/VS manuals.                             |
| REPORT.PR and REPORT.ST       | :UTIL                 | Program to generate reports from system log files and error log files.                                              |
| RESOLVE.LB                    | :SYSGEN               | System-generation library to avoid Link errors for devices you omit at VSGEN.                                       |
| RESTORE.CLI                   | :UTIL                 | Macro to restore data backed up by FULL_BACKUP.CLI and INC_BACKUP.CLI (diskettes only).                             |
| RESTORE_TAPE.CLI              | :UTIL                 | Macro to restore data backed up by FULL_DUMP.CLI and INC_DUMP.CLI (labeled mag tape only).                          |
| SCOM.PR and SCOM.ST           | :UTIL                 | Program to compare program source or text files and display differences.                                            |
| SED.+                         | :HELP                 | Help files for SED text editor. They contain the text for <b>HELP</b> commands in SED (there are 40 files).         |
| SED.PR and SED.ST             | :UTIL                 | SED text editor program.                                                                                            |
| SEDERMES.OB                   | :UTIL                 | Error message text for SED text editor.                                                                             |
| SKIPS.SR                      | :UTIL                 | File that defines some handy assembly language macros for skips and graphics instructions.                          |
| SLDCU.PR                      | : (root)              | Operating system to run in a DCU sync line controller. Loaded by GSMGR program.                                     |
| SLISC.PR                      | : (root)              | Operating system to run in an ISC sync line controller. Loaded by GSMGR program.                                    |
| SPEED.PR and SPEED.ST         | :UTIL                 | SPEED text editor program.                                                                                          |

(continued)



**Table C-1. Files Shipped with AOS/VS**

| <b>Name of File</b>                            | <b>Home Directory</b> | <b>Description</b>                                                                                                               |
|------------------------------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------|
| SPEEDERMES.OB                                  | :UTIL                 | Error message text for SPEED program errors.                                                                                     |
| SPRED.PR and SPRED.ST                          | :UTIL                 | Symbolic Preamble Editor program, to edit program preambles and specify things like the number of pages to load on a page fault. |
| STACKER.PR and STACKER.ST                      | :UTIL                 | Stacker program that EXEC uses to handle punched card images.                                                                    |
| SYS.PR and SYS.ST                              | :SYSGEN               | AOS/VS starter system.                                                                                                           |
| SYSBOOT and SYSBOOT.ST                         | :(root)               | SYSBOOT bootstrap program that loads microcode (if needed) and starts up AOS/VS.                                                 |
| YSERMES.OB                                     | :UTIL                 | Error message text for general system runtime errors.                                                                            |
| SYSID.16.SR                                    | :UTIL                 | Definition file for 16-bit system calls.                                                                                         |
| SYSID.32.SR                                    | :UTIL                 | Definition file for 32-bit system calls.                                                                                         |
| SYS_REV                                        | :SYSGEN               | File with current AOS/VS revision number.                                                                                        |
| SYSTAPE.CLI                                    | :SYSGEN               | Macro to create a tailored system tape.                                                                                          |
| TBOOT                                          | :(root)               | Tape bootstrap program; when copied to file 0 of a tape, allows people to bootstrap from it.                                     |
| UP.CLI                                         | :UTIL                 | Macro to bring EXEC and the multiuser environment up.                                                                            |
| URT16.LB                                       | :UTIL                 | User runtime library for 16-bit programs; contains essential runtime code for 16-bit user programs.                              |
| URT32.LB                                       | :UTIL                 | User runtime library for 32-bit programs; contains essential runtime code for 32-bit user programs.                              |
| VSGEN.+                                        | :HELP                 | Help files for VSGEN commands (14 files).                                                                                        |
| VSGEN.DATA, VSGEN.PR, VSGEN.QUES, and VSGEN.ST | :SYSGEN               | VSGEN data, program, and question files.                                                                                         |
| XERMES.OB                                      | :UTIL                 | Error message file with text for EXEC errors.                                                                                    |

(continued)

**Table C-1. Files Shipped with AOS/VS**

| <b>Name of File</b>                 | <b>Home Directory</b> | <b>Description</b>                                                                    |
|-------------------------------------|-----------------------|---------------------------------------------------------------------------------------|
| XHELP.CLI                           | :UTIL                 | Macro to display EXEC Help messages.                                                  |
| XLPT.PR and XLPT.ST                 | :UTIL                 | XLPT program, works with EXEC to manage printers and other spooled devices.           |
| XPLT.PR and XPLT.ST                 | :UTIL                 | XPLT program, works with EXEC to manage plotters.                                     |
| XYZZY.PS                            | :SYSGEN               | AOS/VS permanent symbol file, needed for macroassembly during system builds.          |
| XYZZY1.SR, XYZZY2.SR, and XYZZY3.SR | :SYSGEN               | AOS/VS symbol definition files, may be needed for macroassembly during system builds. |
| XYZZYERMES.OB                       | :UTIL                 | Message file with text for AOS/VS errors.                                             |
| ZERMES.OB                           | :UTIL                 | Message file with text for CLI error messages.                                        |

(concluded)

End of Appendix



# Appendix D

## Bringing Up AOS/VS on a Blank Disk — Data General DS/7700, DS/7500, and ECLIPSE MV/2000 DC Computers

Data General DS/7000-series and ECLIPSE MV/2000 DC systems usually ship with a special, friendly model of AOS/VS already installed on disk. A system with this model of AOS/VS arrives ready to run. It has a menu-driven system management interface (called the SMI) that runs at startup instead of the CLI; it has a stand-alone program (called Starter) to help with operations like formatting disks; and it has an on-line system management tutorial. Aside from these differences, friendly AOS/VS is identical to standard AOS/VS. Managing a system using the friendly model of AOS/VS is explained in *Starting and Running AOS/VS on ECLIPSE MV/2000 DC and Data General DS/7000-Series Systems*.

It's *possible*, however, to acquire standard AOS/VS on a DS/7000-series or MV/2000 DC system. To bring up standard AOS/VS on one of these systems — starting with a blank disk — read this appendix.

This appendix explains the steps needed to bring up AOS/VS on a blank disk, before you run the VSGEN program to generate your first tailored AOS/VS system. It applies to DS/7000-series and MV/2000 DC systems only. For other MV/Family computers, see Chapter 2 or 3.

The major sections in this appendix are

- About Your Media
- Powering Up
- Running the Disk Formatter
- Installing Powerup Diagnostics
- Installing and Bringing Up the AOS/VS Starter System from Diskettes
- Installing and Bringing Up the AOS/VS Starter System from Tape
- Step Summary

### About Your Media

All DS/7000-series and MV/2000 DC computer systems include at least one diskette unit or tape unit. Some systems have both. If you have both, use tape whenever possible.

### Diskette-Only Systems

If your hardware doesn't include a tape unit, all components you need to build AOS/VS were supplied on diskettes, in the following groups:

- Powerup diagnostics and computer microcode, on two or three diskettes. (The third diskette has microcode in UNIX dump format. Ignore this UNIX diskette.)

The first diskette holds essential powerup routines. Its paper label includes the words MASTER DISKETTE and SYSTEM MEDIA. It's the SYSTEM MEDIA diskette.

The second diskette holds the microcode file for your computer in a form AOS/VS can read. The paper label includes the words MASTER DISKETTE, followed by your computer name and .MCF (for example, DS7700.MCF or MV2000.MCF) and AOS DUMP FORMAT. This is the .MCF DUMP FORMAT diskette.

- AOS/VS system programs, the latest revision, on 16 or so diskettes;
- An AOS/VS update (updates for programs in the latest revision), on one or more diskettes. You get the update diskette(s) only if an update has occurred since the last AOS/VS revision;
- DG/VIEW windowing management program, on one or more diskettes, on DS/7000-series systems only.

## Systems with Tape

If you have a tape unit, you may receive powerup diagnostics on tape or diskette. In most cases, you'll receive AOS/VS software programs on tape. The tapes are as follows:

- Essential powerup diagnostics are on one tape. The paper label includes your computer name and the words **SYSTEM MEDIA**. This is the **SYSTEM MEDIA** tape. Note that, for DS/7700 systems with tape, the powerup diagnostics are supplied on a **SYSTEM MEDIA** diskette, described in the previous section.
- AOS/VS programs and files are on one tape. The paper label on the AOS/VS tape includes the words "AOS/VS n".
- AOS/VS update, if any, on one tape. The paper labels on AOS/VS update tapes have "UD" and "AOS/VS n" printed on them.
- DG/VIEW windowing management program, on one tape, on DS/7000-series systems only.

Software products other than AOS/VS, like CEO or FORTRAN 77, must wait until you have AOS/VS up and running.

After checking your media as explained above, proceed.

## Powering Up

The following numbered steps lead you through the entire "from blank disk" procedure. The steps cover both tape and diskettes; you'll skip the ones that don't apply.

1. The steps assume that computer power is off. If it's on, turn it off.
2. Turn on the system console. The switch is an on/off rocker behind the console. The console may display a test message and beep. If there is an **ON LINE** light on the keyboard, it should glow. (If the light doesn't glow, press the **CMD** key, hold **CMD** down, and press the **ON LINE** key. The **ON LINE** light should glow.)
3. If your keyboard has an **ALPHA LOCK** key (next to the space bar), press it to make the **ALPHA LOCK** light glow. **ALPHA LOCK** is needed because one program you'll use doesn't accept lowercase letters.
4. If you have a tape unit that's separate from the computer cabinet, turn it on. (To use such a unit, you must turn it on before turning computer power on.)
5. If you received system media on tape, mount the **SYSTEM MEDIA** tape on unit 0. Make sure this unit is online (if this applies). Skip to step 7.
6. If you received system media on diskette, find the diskette labeled **SYSTEM MEDIA**. Insert it in unit 0 as follows. If you have two diskette units, the one on the right is unit 0.
  - 6a. Turn the latch beside the slot to the vertical position.
  - 6b. Remove the diskette from its outer envelope. Don't try to remove the inner envelope — the diskette must remain in this.

- 6c. Hold the diskette by the edges and examine it. One side has a paper label and the other is blank. On each side, the envelope is cut away to expose part of the diskette surface. Just a reminder — *don't touch the diskette surface*. The oil on your finger could make that part of the diskette unreadable. One edge of the diskette has a small notch (about  $1/4 \times 1/4$  inch). This is the *write-enable* notch. When this notch is uncovered, data can be written to the diskette.
- 6d. Hold the diskette with the write-enable notch up and your fingers on the label. Slide it into the unit slot as shown in Figure D-1. The diskette should slide in smoothly and come to a firm stop.

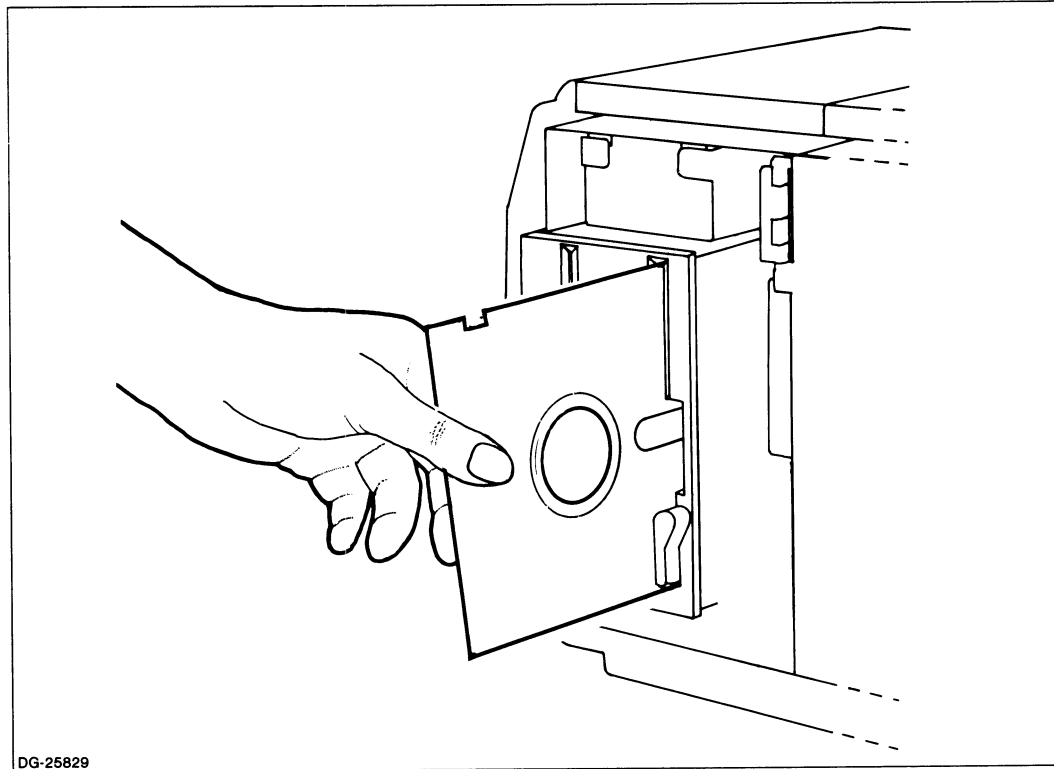


Figure D-1. Inserting a Diskette

- 6e. Turn the latch beside the slot to the horizontal position. This locks the diskette in the unit.
7. Turn computer power on using the power switch on the cabinet. The power light in (or above) the switch should glow. The computer runs powerup tests and indicates the results as follows. The tests take 1 to 2 minutes.

On an MV/2000 DC system, these tests involve displays (like the following) on the system console

*TESTING...*

(printed circuit board name)

*ABCDEFGHIJKLMNOPQRSTUVWXYZ01234567890, PASSED*

On a DS/7500, depending on options, there may be no display on the system console; if you see the Automatic Program Load menu explained next, the system has passed powerup tests. On a DS/7700, the powerup tests display a status code in the digital display; if the code is "b" or "d", the system has passed. A DS/7700 might also display messages on the system console.

(If your system doesn't pass powerup diagnostic tests, you may have inserted the tape or diskette wrong. Return to step 5 (tape) or 6 (diskette) to retry. If the problem recurs, the hardware or cables may not have been properly connected. Check the connections; and check the status code in the *Setting Up and Starting Your System* manual.)

Then, code in the computer's EPROM memory displays the Automatic Program Load Menu:

*nn/nn/nn nn:nn:nn*

*Automatic Program Load Menu*

*1 Continue immediately with preset values*

*2 Change preset values*

*...*

*The default device is DISK*

*...*

*Enter choice [1]:*

- 7a. Glance at the date and time (upper right). If the display begins with letters *DD/MM/YY* or is otherwise wrong, make a mental note that it's wrong.

8. Now, you must change a preset value. Type 2 ↵. The computer displays

*Change Preset Values Menu*

*1 Continue the powerup*

*2 Change the system date or time*

*3 Start from a different device*

*4 Change the default device*

*5 Change the time-out delay*

*6 Enter the SCP CLI*

*...*

9. The date or time that were displayed on the Automatic Program Load Menu are based on the hardware *time-of-boot* clock (called the *boot clock* here). The boot clock settings are passed to AOS/VS at startup; AOS/VS then uses them to set the system real-time clock. The boot clock is a convenience — supplying the date and time to AOS/VS automatically — but it's not essential. You can set the boot clock via the Change Preset Values Menu or via AOS/VS CLI commands.

If the displayed date and time were correct, skip to step 10. If they were displayed as *DD/MM/YY HH:MM:SS*, this means the boot clock isn't operating — the cause may be that the clock lost power. (A replaceable battery supplies power to the boot clock while computer power is turned off. The battery is not rechargable and its life is limited. You can replace the battery yourself as described in the *Setting up and Starting Your System* manual.) In any case, if the date/time appeared as *DD/MM/YY...* or were wrong, set them as follows.

- 9a. Type 2 ↵

*Date [xx]*

- 9b. Type the correct date — numbers for day and year, three letters for the month. Or, to keep the current date, press ↵. For example, to specify July 23, 1986:

*Date [xx] 23-JUL-86 ↵*

*Time [xx]*

- 9c. Type the correct time, using a 24-hour clock. Or, to keep the current time, press **↓**. For example, to specify 2:15 p.m.:
- Time [HH:MM:SS]: 14:15:00 ↓*
- Offset to GMT [+00:00]:*
- 9d. “Offset to GMT” (Greenwich Mean Time) has meaning only if your system will communicate with another computer system in a different time zone. You can always set this later, if needed. It’s further described in Chapter 6. For now, skip the issue by pressing **↓**.
- The Change Preset Values Menu returns.
10. You want the SCP CLI, so type **6 ↓**.
- Enter choice: 6 ↓*
- ...*
- SCP-CLI>*
- The SCP CLI, which allows you to start other programs, has control (as you can tell by the prompt).
11. Remove the SYSTEM MEDIA diskette or tape from unit 0. For diskette, return the diskette to its outer envelope.
12. Insert the correct AOS/VS diskette or tape. If you received AOS/VS on diskettes, insert AOS/VS diskette number 1 in unit 0 (as shown in Figure D-1). If you received AOS/VS on tape, mount the AOS/VS tape in the unit and put the unit on line.
13. You’ve finished the powerup process and can run the Disk Formatter.

## Running the Disk Formatter

The Disk Formatter makes physical disks into logical disk units (LDUs). It does this by writing identifiers so that AOS/VS will know what disk and LDU it is accessing. The Formatter can also check the disk surface for *bad blocks* (flawed areas that won’t hold information).

Running the Disk Formatter is relatively easy, but — because the Formatter checks each bit on the disk — it takes more time than other system generation procedures.

### Mistakes and Errors

If you type an incorrect answer to a Disk Formatter question, and have not yet pressed **↓** to enter the answer, press the DEL key or CTRL-U to erase the wrong characters.

If you have pressed **↓** and want to abort formatting, type CTRL-C CTRL-A and go to step 22. If CTRL-C CTRL-A doesn’t work, type the break sequence (CMD and BREAK/ESC keys) and return to step 14.

If you abort formatting by either method during surface analysis, be sure to run the entire FULL format again.

If the Disk Formatter reports a disk or other error, check the error message in the table near the end of the Disk Formatter chapter.



## Disk Formatter Dialog

14. The SCP-CLI prompt is still on the system console. Reset the computer by typing  
**RESET ↵**  
After a few moments, the SCP CLI prompt returns.
15. With AOS/VS on tape, skip to step 20. With AOS/VS on diskette, continue.
16. Bootstrap (start) from your DG media. With diskette, type  
**BOOT 64 ↵**  
*Operating System Load Menu*  
*1 Continue immediately with operating system load*  
*2 Enter the Technical Maintenance Menu*  
...  
*The default system pathname is*  
...  
*Enter choice [1]:*
17. There is no operating system on the hard disk; you must enter the Technical Maintenance Menu. Type  
**2 ↵**  
*Technical Maintenance Menu*  
...  
*6 Run a specified program*  
...  
*Enter choice [1]:*
18. Select choice 6:  
**6 ↵**  
SYSBOOT displays  
*Pathname?*
19. Type the Disk Formatter's filename, **DFMTR ↵** — for example,  
**DFMTR ↵**  
and skip to step 22.
20. With tape, wait for the tape unit READY light to glow (if there is one). Then bootstrap by typing  
**BOOT 23 ↵**  
*Tape file number?*
21. Type the file number for the Disk Formatter, which is **2 ↵** — for example,  
**2 ↵**
22. The bootstrap program now loads the Disk Formatter from the supply medium. This takes 15 to 20 seconds. The Formatter starts up and displays  
*AOS/VS Disk Formatter Rev n*  
*Full format destroys any AOS/VS file structure, Partial retains it.*  
*Full (F) or Partial (P or NEW LINE)?*  
Type  
**F ↵**

*Full format*

*Specify each disk in the LDU (press NEW LINE when done)*

*Disk unit name?*

23. This *Disk unit name* question starts a sequence of questions to identify this LDU.
- A sealed Winchester disk unit named DPJ0 is built into your computer system. The add-on units shown in Table D-1 are options. If you have any add-on Winchester disks, format them after you've done the first disk. For your first disk, type
- DPJ0 )

**Table D-1. Add-On Disks, DS/7000-Series and MV/2000 DC Systems**

| <b>Disk Model Number and Description</b>       | <b>Device Code</b> | <b>Disk Number on Controller</b> | <b>Disk Unit Name</b> |
|------------------------------------------------|--------------------|----------------------------------|-----------------------|
| 6329. A 120-Mbyte sealed Winchester disk.      | 24                 | Second                           | DPJ1                  |
| 6328. A 71-Mbyte sealed Winchester disk.       | 24                 | Second                           | DPJ1                  |
| 6310. A 39-Mbyte sealed Winchester disk.       | 24                 | Second                           | DPJ1                  |
| 6309. A 737,000-byte, 5.25 inch, minidiskette. | 64                 | First Second                     | DPJ10 DPJ11           |

After you answer the *Disk unit name* question, the Disk Formatter asks

*Device code [default] ?*

- 23a. The default device code appears in square brackets. Press ) to choose the default:
- )

*Disk unit name?*

- 23b. The Disk Formatter will repeat the *Disk unit name?* and *Device code?* questions until you answer ) to *Disk unit name?* This allows you to create an LDU that includes more than one disk.

You want a single-disk LDU, so answer

)

*Do you want to allocate a diagnostic area? [Y]*

- 23c. This question lets you reserve an area on disk for later installation of powerup diagnostics and/or DG's Advanced Diagnostic Executive System (ADES).

On DS/7000-series and MV/2000 DC systems, this diagnostic area is needed for powerup diagnostics and (if you acquire them) the full set of ADES diagnostics. Powerup diagnostics and ADES run only from the system disk (DPJ0). Thus, for DPJ0 with a DS/7000-series or MV/2000 DC system, you must answer Yes. For DPJ1, type N ) and skip to step 23e.

For DPJ0, press

)

*Enter the number of blocks (1750 to 35230) required. [23420]*

- 23d. The displayed figures are octal. The amount of space you specify here will be reserved for diagnostics and won't be available for AOS/VS file storage.

The full ADES product for DS/7000-series and MV/2000 DC systems needs up to a maximum of 6,000 blocks (13560 octal), which comes to about 3 Mbytes. This much space isn't needed for the powerup diagnostics, but it's safest to specify the maximum. (If you specify too little space, and later decide to install the full ADES product, the disk must be reformatted to provide more space.)

The full ADES product *must* be installed if you've purchased a DG service contract. Usually, the ADES product is installed on the disk by a DG field engineer. Installing it is explained in *Installing and Running Coresident Diagnostics on the ECLIPSE MV/2000 DC and DS/7000-Series Workstations*.

To specify the maximum amount of space needed, type

13560 ↵

After you specify a diagnostic area, the Formatter assumes this is a system disk. It displays

*Disk number 1: 00000000000 through n*

*LDU unique I.D. (1 to 6 characters)? [ ]*

The numbers 0 through n are the first and last logical addresses on the disk, in octal.

- 23e. The Disk Formatter wants a unique ID for the disk. The ID must be 1 to 6 characters long. We suggest an ID of 1 for your first LDU and 2 for your second (if you have a second hard disk). For the first disk, for example, type

1 ↵

*LDU name (1 to 31 characters) [ ]?*

- 23f. Later, when you start up AOS/VS (or initialize this LDU), the name you type now will be displayed.

The first disk you format (DPJ0) will be the system root directory (:). For this, the name you type is not important in terms of file access.

If you have a second hard disk, and are formatting it, the name you type here becomes the filename of the LDU. People can use this name just as any other directory filename. For example, you might use the name UDD. You can always change an LDU name later with a Disk Formatter Partial format (covered in the Disk Formatter chapter).

For your first LDU, DPJ0, we suggest the name ROOT. So, for example, type

ROOT ↵

If you're formatting the second hard disk, note the name for later reference.

*Access Control List*

*Username or template (1 to 15 characters)?*

- 23g. A user, identified by a user name, or a group or users, identified by a template, can have different kinds of access to an LDU. A good general-purpose username template is +, which specifies all users. So type

+ ↵

*Access (O, W, A, R, E, or NEW LINE) ?*

- 23h. The Formatter wants to know which privileges to give the user name(s) you just specified. There are five types of privileges: Owner, Write, Append, Read, Execute (O,W,A,R,E). A NEW LINE (answer of ↵) gives the user no privileges. Execute (E) access will suffice for most LDUs. So type

E )

*Username or template (1 to 15 characters)?*

- 23i. The Disk Formatter will repeat the *Username* and *Access* questions, allowing you to give very specific user and access information, until you answer ) to *Username* ... Generally, answer ) to this question. Later, if needed, you can change access to the LDU. So press

)

*Surface analysis? [N]*

24. This step starts a series on surface analysis for this LDU. (The value in brackets is the default, which the Formatter will use if you answer with ).

During analysis, the Formatter writes a pattern to each 16-bit word on the disk and reads it back. Answer Yes by typing

Y )

*Disk number?*

- 24a. The Formatter wants the number of the disk to analyze. For a single-disk LDU, press

)

*You may run up to five (5) patterns. How many would you like to run?*

- 24b. The Formatter can run up to five bit patterns on the disk. You can specify any number, 1 through 5. It's very important for the Formatter to identify all bad blocks so that AOS/VS will bypass them. We recommend that you run all five patterns on each disk you format.

Each pattern takes from about 8 minutes (on a 39-Mbyte disk) to about 24 minutes (on a 120-Mbyte disk). Decide on a number of patterns and type this number. For example, to run five patterns, type

5 )

*Analyzing disk #n*

— *Running pattern n*

The Formatter runs the patterns you specified, one by one. If it finds too many bad blocks, it aborts. This may mean that the disk heads are misaligned. But in most cases, it's simply a matter of waiting.

When the Formatter has finished the patterns, it describes the bad blocks on the disk.

- 24c. If the Formatter found no bad blocks, it displays *0 bad disk blocks*. Skip to step 24d, *Additional bad block number?* question.

If it found any bad blocks, it prompts

*n bad disk blocks*

*Display bad block statistics? [N]*

- 24d. The Formatter is asking if you want to see the bad block statistics. These statistics may be useful, so answer Yes.

Y )

The Formatter now displays the bad block statistics on the system console.

*Additional bad block number (press NEW LINE when done):*

- 24e. You have no additional bad blocks to enter, so press

)

*n bad disk blocks*

*Display bad block statistics [N]*

- 24f. Press  
 }  
*n bad disk blocks*  
*Bitmap size: n*  
*Bitmap address? [default]*  
 The bitmap is a system table that describes which blocks are in use and which are free for data storage.
25. Select the default address by pressing  
 }  
*System disk? [Y]*
26. This step starts a series that determines whether and where an AOS/VS system will reside on the LDU. (The Formatter skips this question if you allocated a diagnostic area earlier, in step 23c).  
 Your first LDU must be a system disk, so answer } for the default. For your *second* LDU, type N }. But for the first LDU, press  
 }  
*Overlay area size? [default]*
- 26a. Choose the default area size by pressing  
 }  
*Overlay area address? [default]*
- 26b. Choose the default address by pressing  
 }  
*Disk number n remap area size? [default]*
27. Choose the default remap area size by pressing  
 }  
*Disk number n remap area address? [default]*
- 27a. Choose the default remap area address by pressing  
 }  
 — *LDU created*  
*Done!*  
 ...  
 SCP-CLI>

Congratulations! You've formatted an LDU as a system disk. It will rarely — if ever — need full formatting again. If this LDU may be run as a nonmaster LDU, we suggest that you note the date, LDU ID and unit name, and any bad block information — and attach the note to the computer cabinet.

The Formatter is done and the SCP-CLI has control. If you have other new disks, someone must format them into LDUs before they can be used. You might want to create the LDU(s) now — while you're familiar with the procedure. To do it now, type **CONTINUE** } and return to step 22. To format a disk *not* described in this appendix, see the Disk Formatter chapter.

If you don't want to format other disks now, continue and install powerup diagnostics.

## Installing Powerup Diagnostics

Next, you'll install powerup diagnostics on the hard disk. The computer can't run without these. Until they are installed on the hard disk, the SYSTEM MEDIA diskette or tape must be in its unit whenever you turn power on.

28. Remove the first AOS/VS diskette or tape from unit 0. Keep it handy — you'll need it again soon.
29. Get the SYSTEM MEDIA diskette or tape. Insert it in unit 0.
30. Boot from the diskette or tape. For diskette, type **BOOT 64** ↵. For tape, type **BOOT 23** ↵. For example,

**BOOT 64** ↵

The hardware now reads the diagnostics installer from the diskette or tape. Then it displays

*Do you want to install powerup diagnostics on your hard disk? If these diagnostics are not installed on the hard disk, you will need to insert this diskette each time you power up. For the diagnostics to work, the disk on which they will be installed must have a Diagnostic Area reserved by the operating system's software formatter.*

*Install powerup diagnostics (Y or N)?* Y

31. You want to install, so say Yes:

↵

The diagnostics installer now copies powerup diagnostics from diskette or tape to the reserved area on the hard disk. Then it returns control to the SCP CLI.

...  
**SCP-CLI>**

32. Now, you should test installation of the powerup diagnostics. Remove the diskette or tape from unit 0.

- 32a. Turn computer power off and on again.

After a pause, the hardware reads the powerup diagnostics from the hard disk. As before, the diagnostics run. Control passes to the Automatic Program Load Menu:

*nn/nn/nn nn:nn:nn*

### *Automatic Program Load Menu*

*1 Continue immediately with preset values*

*2 Change preset values*

...

*Enter choice [1]:*

(If you see no message after turning power off and on, return the diskette/tape to its unit. Turn power off and on again, and return to step 30.)

- 32b. You want to return to the SCP CLI. Type **2** ↵.

### *Change Preset Values Menu*

...

*6 Enter the SCP CLI*

...

*Enter choice [1]:*

- 32c. To enter the SCP CLI, type **6** ↵.

...

**SCP-CLI>**

It works. Powerup diagnostics have been copied onto the hard disk, from which they will be run automatically in the future. Return the SYSTEM MEDIA diskette/tape to its cover.

## Installing and Bringing Up the AOS/VS Starter System from Diskettes

This section describes installing and bringing up AOS/VS from diskettes. To do it from tape, skip all the way to step 70.

The Installer program installs an AOS/VS system from DG-supplied media onto an LDU. (AOS/VS must reside on disk before it can run.)

### Mistakes and Errors

If you make a mistake, handle it the same way as with the Disk Formatter.

If the Installer reports a disk or other error, check the error message in the table near the end of the Installer chapter.

If the Installer stops with an *ABORT* message, return to the first Installer step (for diskette, step 33) and run the Installer again.

Depending on your AOS/VS medium, proceed to the appropriate section. For tape, skip all the way to step 70.

### Installing the Starter System from Diskettes

33. The *SCP-CLI*> prompt is showing on the console. Reset the CPU:

RESET )

(A few moments pass.)

*SCP-CLI*>

34. Bootstrap from diskette:

BOOT 64 )

(There's a delay of 5 to 10 seconds.)

*Operating System Load Menu*

*1 Continue immediately with operating system load*

*2 Enter the Technical Maintenance Menu*

...

*Enter choice [1]:*

35. You need the Technical Maintenance Menu, so select choice 2:

2 )

This displays the Technical Maintenance Menu:

*Technical Maintenance Menu*

...

*6 Run a specified program*

...

*Enter choice [1]:*

36. Select choice 6:

6 )

*Pathname?*

37. Type the filename of the Installer program (INSTL):

INSTL )

The bootstrap program now loads the Installer into memory. This takes about 15 seconds. The Installer prompts

*AOS/VS Installer Rev n*

*Specify each disk in the LDU*

*Disk unit name?*

38. Now, from unit 0, remove AOS/VS diskette 1, and insert AOS/VS diskette 2.

39. Type the name of your system disk, DPJ0:

DPJ0 ↵

*Device code [24]?*

40. Default the device code by pressing

↵

*— Disk bootstrap installed*

*Do you want to install a System Bootstrap [Y] ?*

41. You must install the system bootstrap, SYSBOOT, on the LDU. so press

↵

*Install from which unit [MTC0] ?*

42. To install from diskette, type the diskette unit name:

DPJ10 ↵

*Device code [default] ?*

43. Press ↵ for the default:

↵

The Installer now copies SYSBOOT from the diskette to the LDU. This takes about 30 seconds. Then it displays

*— System Bootstrap installed*

*Do you want to install a System [Y] ?*

44. Now, remove AOS/VS diskette 2 from the unit, and insert diskette 3. This diskette has the starter system on it.

45. You want to install a system, so press

↵

*Install from which unit [DPJ10] ?*

46. Press ↵

*Device code [default] ?*

47. For the default, press

↵

The Installer now reads the AOS/VS system from diskette 3 and copies it to the LDU. This takes 2 to 3 minutes. Then it responds

*— System installed*

*Done!*

48. Remove the diskette from unit 0.

You've installed the needed bootstraps and an AOS/VS system on your LDU. Now you can bring up the system.



## Bringing Up the AOS/VS Starter System from Diskettes

49. The SCP CLI has control. Use it to reset the computer:

RESET )

Wait a few moments for the *SCP CLI*> prompt to return.

50. Boot again, this time from *disk*. The disk device code is 24. So type

BOOT 24 )

### *Operating System Load Menu*

*1 Continue immediately with operating system load*

*2 Enter the Technical Maintenance Menu*

*Loading will continue automatically unless you respond within 45 seconds.*

...

*Enter choice [1]:*

51. Press )

... (delay of 10 to 15 seconds) ...

*AOS/VS Rev xx.xx*

*Master LDU: xx* (xx is the name you specified to the Formatter)

*Override default specs [N] ?*

52. Specs means parameters in the system specification file created during VSGEN. To answer the question, go to step 53.

(If, instead of a *specs* question, you see *Date (MM/DD/YY)?*, this means AOS/VS was unable to get the date and time from the boot clock. Type the date as numbers for month, day, and year. Spaces or slashes can separate each number. For example, for May 23, 1986, you'd type

5 23 86 )

*Time (HH:MM:SS)?*

Type the time, based on a 24-hour clock, in hours, minutes, and seconds. (Minutes and seconds are optional. If you omit them, the system sets each to 0.) Use spaces or colons to separate items. For example, for 2:30 p.m., you'd type

14 30 )

*Override default specs [N] ?*

53. To the ...*specs* question, you must answer yes, so type

Y )

*Number of buffers in cache [default]?*

- 53a. Press

)

*Swap directory definition [default]?*

- 53b. Press

)

*Page directory definition [default]?*

- 53c. Press

)

*Initial load [N]?*

54. In an *Initial load*, the system loads the CLI and other needed files onto the LDU. These files must be loaded the first time you bring up the starter system. They need not be loaded again unless — later on — you want to load a new AOS/VS revision. Answer yes by typing

Y )

*Filename [@MTC0:6]?*

55. Get the fourth AOS/VS diskette and insert it in diskette unit 0. This diskette has the CLI and essential system files on it.

- 55a. Type the labeled diskette pathname of the file on diskette. This is @LFD:VOL1:FIRST\_DUMP\_FILE, so type

@LFD:VOL1:FIRST\_DUMP\_FILE )

*PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED  
UNIT [@DPJ10] VOLUME ID [VOL1] ? [Y]*

- 55b. Confirm by pressing

)

The starter system now copies files from the diskette to the LDU. It takes about 2 minutes per diskette.

(If you see the message *PHYSICAL UNIT OFFLINE*, this probably means you inserted the diskette wrong. Remove it from the unit, reinsert it as described earlier (Figure D-1), and press ). If the message is *THE LABEL ON THIS DISKETTE IS NOT THE LABEL REQUESTED*, or *AN UNLABELED DISKETTE HAS BEEN INSERTED*, this means you've inserted the wrong diskette. Find the fourth diskette in the AOS/VS set (not the SYSTEM MEDIA set or the UD set). Insert it in unit 0, then retry. If the message is *FILE DOES NOT EXIST*, you probably typed the wrong pathname, or inserted a diskette from the wrong group. Remove the diskette, check its paper label and select another diskette if needed; then retry.)

When all files have been copied from diskette, it prompts

*PLEASE INSERT NEXT DISKETTE  
UNIT [@DPJ10] VOLUME ID [VOLn] ? [Y]*

- 55c. Get the next diskette in the AOS/VS set. Remove the diskette from unit 0 and insert the next diskette. Press ).

Again, the starter system copies files from the diskette to disk.

Repeat this step (55c) until the system console displays

*PLEASE REMOVE THE DISKETTE  
AOS/VS CLI REV x.xx date time  
)*

Congratulations! You've brought up AOS/VS and its CLI from diskette. The ) prompt means the CLI it is ready for a command.

(If you get a *FILE DOES NOT EXIST* message, a needed file wasn't loaded. Perhaps you forgot to answer Y ) to the *Initial load* question. In any case, run Emergency Shutdown (ESD) by typing RESET ), START 50 ), and ); then return to step 49 to try again. Type Y ) to each *REPLACE OLD COPY* message. For a description of errors by numeric code, see Chapter 17.)

- 55d. Remove the diskette from unit 0.

56. The next steps are to load all the system programs and files that are part of the AOS/VS system. These programs and files are on diskettes number 6 through m (m is the number of the last diskette). These files make up the second dump file of AOS/VS programs. Get the first diskette in the second dump file and insert it in unit 0.

Turn on Superuser to provide write access.

) SUPERUSER ON )  
\*)

57. To load from a sequence of labeled diskettes, turn CLI Operator mode on:

\*) OPERATOR ON )  
\*)

58. Start loading from labeled diskettes via the LOAD command, using the pathname @LFD:VOL1:SECOND\_DUMP\_FILE, as follows:

\*) LOAD /V/R @LFD:VOL1:SECOND\_DUMP\_FILE )

*PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED  
UNIT [@DPJ10] VOLUME ID [VOL1] ? [Y]*

59. You want the defaults, unit DPJ10 and volume ID VOL1. So confirm by pressing

)

The system now copies the contents of the diskette to the LDU. This takes a few minutes. Because you used the /V switch in the LOAD command, the CLI verifies files loaded by displaying their names on the system console. The /R switch ensures that the most recent version of each file remains on the LDU.

(If you see an error message, check step 55c for recovery action.)

When all files have been copied from the diskette, the system console displays

*PLEASE INSERT NEXT DISKETTE  
UNIT [@DPJ10] VOLUME ID [VOLn] ? [Y]*

60. Remove the diskette from unit 0 and insert the next diskette in the AOS/VS diskette set.

61. Press

)

The system copies files from diskette to the LDU. (If you see the message *PHYSICAL UNIT OFFLINE*, this means that the diskette was misinserted in the unit or that no diskette was inserted. If needed, remove the diskette; then insert the correct diskette properly, as shown in Figure D-1 and press ) again to retry. If you see *THE LABEL ON THE DISKETTE IS NOT THE ONE REQUESTED*, this means you've inserted the wrong diskette. Find the correct diskette, which has the number displayed after *REQUESTED*:, less 5. Then retry.)

62. Return to step 60 and repeat the sequence until you see

*PLEASE REMOVE THE DISKETTE*  
\*)

You've loaded all the AOS/VS software from diskettes. During the process, several directories were created: directory :UTIL (with utilities), directory :SYSGEN (for system generation), and directory :HELP (for help).

You still need to load the AOS/VS update (if any) and the microcode file.

63. Remove the last AOS/VS diskette from the unit and insert the AOS/VS update diskette, with UD on its paper label (described near the beginning of this appendix). If there is more than one UD diskette, use the first one.

64. Type the **LOAD** command again, using the labeled diskette pathname **@LFD:VOL1:UPDATE**, as follows:

**\*) LOAD /V/R @LFD:VOL1:UPDATE )**

*PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED  
UNIT [@DPJ10] VOLUME ID [VOL1] ? [Y]*

65. You want the defaults, unit **DPJ10** and volume ID **VOL1**. So confirm by pressing  
**)**

The system now copies the contents of the update diskette to the LDU. If it prompts for a second diskette, remove the diskette, insert the next update diskette, and repeat this step. Generally, though, there will be just one update diskette. When all update files have been loaded, you'll see

*PLEASE REMOVE THE DISKETTE*

**\*)**

You're almost done. Next, you'll load a microcode file onto your hard disk.

## Loading the Microcode File from Diskette

66. Remove the diskette from unit 0. From the first diskette set, get the *second* diskette — the **.MCF** diskette with **AOS DUMP FORMAT** on its paper label. Insert this diskette in unit 0.
67. Next, you need to load the appropriate microcode file from diskette. There may be more than one microcode file on the diskette, so, for neatness, you should specify the name you want. Microcode filenames are as follows:

| Computer | Microcode Filename |
|----------|--------------------|
|----------|--------------------|

|            |            |
|------------|------------|
| DS/7700    | DS7700.MCF |
| DS/7500    | DS7500.MCF |
| MV/2000 DC | MV2000.MCF |

Load the microcode files from the diskette by typing

**\*) LOAD /V/R @DPJ10 filename )** (Load from physical diskette; for example,  
**LOAD /V/R @DPJ10 MV2000.MCF )**  
*xxnn00.MCF* (After 30 seconds or so, CLI verifies load of microcode file.)

**\*)**

This puts the microcode file on your LDU. (If you see no verification of the load, repeat the command. It's important to have the microcode file on your LDU.)

68. Remove the diskette from unit 0.
69. Check the date and time by typing **DATE )** and **TIME )**. If either is wrong, fix it with the CLI command **DATE** (format **DATE dd-mmm-yy** — for example **DATE 5-JUN-86 )**, or **TIME** (uses a 24-hour clock, format **TIME hh:mm:ss** — for example **TIME 14:34:05 )**).

You're virtually done. Skip all the way past the tape description to step 98.

## Installing and Bringing Up the AOS/VS Starter System from Tape

This section describes installing and bringing up AOS/VS from tape. (Doing this from diskettes is described earlier, starting with step 33.)

The Installer program installs an AOS/VS system from DG-supplied media onto an LDU. (AOS/VS must reside on disk before it can run.)

### Mistakes and Errors

If you make a mistake, handle it the same way as with the Disk Formatter.

If the Installer reports a disk or other error, check the error message in the table near the end of the Installer chapter.

If the Installer stops with an *ABORT* message, return to the first Installer step (for tape, step 70) and run the Installer again.

### Installing the Starter System from Tape

70. The *SCP-CLI>* prompt is showing on the console. Reset the CPU:  
*RESET* )  
Wait a few moments for the *SCP-CLI>* prompt to return.
71. To start from tape (device code 23), type  
*BOOT 23* )  
*Tape file number?*
72. The Installer is in tape file 3, so type  
*3* )  
TBOOT moves the tape forward to file 3, reads the Installer file, and executes the Installer program. The Installer displays  
*AOS/VS Installer Rev n*  
*Specify each disk in the LDU*  
*Disk unit name?*
73. Type the unit name of your newly created LDU, DPJ0:  
*DPJ0* )  
*Device code [24] ?*
74. Press  
)  
— *Disk bootstrap installed*  
*Do you want to install a System Bootstrap [Y] ?*
75. You must install the system bootstrap program, SYSBOOT, on the LDU, so press  
)  
*Install from which unit [MTC0] ?*
76. Type the name of your tape unit, MTJ0:  
*MTJ0* )  
*Device code [23] ?*

77. Take the default by pressing  
 )  
*File number [4] ?*
78. The system bootstrap, SYSBOOT, is in tape file 4. So press  
 )  
 There's a delay while the tape moves forward to file 4. Then the Installer copies  
 SYSBOOT to the LDU and displays  
 — *System Bootstrap installed*  
*Do you want to install a System [Y] ?*
79. You want to install a system, so press  
 )  
*Install from which unit [MTJ0] ?*
80. Press  
 )  
*Device code [23] ?*
81. Press  
 )  
*File number [5] ?*
82. The AOS/VS system is always in file 5 of a system tape, so press  
 )  
 There's a delay while the Installer copies the AOS/VS system from tape to the LDU.  
 Then it displays  
 — *System installed*  
*Done!*  
 ...  
*SCP-CLI>*

You've installed the needed bootstraps and an AOS/VS system on your LDU. Now you can bring up the AOS/VS system.

### **Bringing Up the AOS/VS Starter System from Tape**

83. The SCP CLI has control. Use it to reset the computer:  
 RESET )  
 Wait a few moments for the *SCP-CLI>* prompt to return.
84. Boot again, this time from *disk*. The disk device code is 24. So type  
 BOOT 24 )  
*Operating System Load Menu*  
*1 Continue immediately with operating system load*  
*2 Enter the Technical Maintenance Menu*  
 Loading will continue automatically unless you respond within 45 seconds.  
 ...  
*Enter choice [1]:*

85. Press **]**  
 ... (delay of 10 to 15 seconds) ...  
*AOS/VS Rev xx.xx*  
*Master LDU: xx* (xx is the name you specified to the Formatter)  
*Override default specs [N] ?*
86. Specs means parameters in the system specification file created during VSGEN. To answer the question, go to step 87.  
 (If, instead of a *specs* question, you see *Date (MM/DD/YY)?*, this means AOS/VS was unable to get the date and time from the boot clock. Type the date as numbers for month, day, and year. Spaces or slashes can separate each number. For example, for May 23, 1986, you'd type  
**5 23 86 ]**  
*Time (HH:MM:SS)?*  
 Type the time, based on a 24-hour clock, in hours, minutes, and seconds. (Minutes and seconds are optional. If you omit them, the system sets each to 0.) Use spaces or colons to separate items. For example, for 2:30 p.m., you'd type  
**14 30 ]**  
*Override default specs [N] ?*
87. To the *...specs* question, you must answer answer yes, so type  
**Y ]**  
*Number of buffers in cache [default]?*
- 87a. Press  
**]**  
*Swap directory definition [default]?*
- 87b. Press  
**]**  
*Page directory definition [default]?*
- 87c. Press  
**]**  
*Initial load [N]?*
88. In an *Initial load*, the system loads the CLI and other needed files onto the LDU. These files must be loaded the first time you bring up the starter system. They need not be loaded again unless — later on — you want to load a new AOS/VS revision. Answer yes by typing  
**Y ]**  
*Filename [@MTC0:6]?*
89. Type your tape unit name and the file number; this is **@MTJ0:6**. For example  
**@MTJ0:6 ]**  
 The starter system now copies files from tape to the LDU. This takes a while. Then  
*AOS/VS CLI REV n date time*  
**)**

Congratulations! You've brought up AOS/VS and its CLI from tape. The ) prompt means the CLI is ready for a command.

(If you get a *FILE DOES NOT EXIST* message, a needed file wasn't loaded. Perhaps you forgot to answer Y ) to the *Initial load* question. In any case, run Emergency Shutdown (ESD) by typing RESET ), START 50 ), and ); then return to step 83 to try again. For a description of errors by numeric code, see Chapter 17.)

## Loading AOS/VS System Files from Tape

90. The next steps are to load all the system programs and files that are part of the AOS/VS system. These programs and files are in tape file 7. First, turn on Superuser to provide write access.

```
) SUPERUSER ON )
*)
```

91. Load the files in tape file 7 by typing

```
*) XEQ LOAD_II/V/R @MTJ0:7 )      (Use the LOAD_II program.)
```

...

The LOAD\_II program verifies (/V switch) the filenames loaded by displaying their names. The whole directory structure on the tape is copied, creating directory :UTIL (with utilities) directory :SYSGEN (for system generation), and directory :HELP (for help). The /R switch ensures that the most recent version of each file remains on the LDU. This load takes quite awhile.

After all the files have been loaded, the CLI Superuser prompt returns:

```
*)
```

- 91a. Rewind the tape by typing

```
*) REWIND @MTJ0 )
```

92. Now, if you received an AOS/VS *update* tape, get it. If not, skip to step 93. Updates have revision numbers with the last two digits greater than 00. For example, 7.01 is an update number. Remove the tape from unit 0, insert the update tape in unit 0, and type

```
*) LOAD/V/R @MTJ0:0 )
```

... (CLI verifies files loaded.) ...

```
*)
```

This puts AOS/VS update and patch files on the LDU, for access later on.

- 92a. Rewind the tape by typing

```
*) REWIND @MTJ0 )
```

93. Remove the tape from the unit.

If you received system media on tape, continue. If you received them on diskette, not tape, return to "Loading the Microcode File from Diskette," and do steps 66 through 68.

## Loading the Microcode File from Tape

94. Get the SYSTEM MEDIA tape you used at the beginning and mount it in unit 0.

95. You need to load the appropriate microcode file from tape. There may be more than one microcode file on the tape, so, for neatness, you should specify the name you want. Microcode filenames are as follows:



| Computer | Microcode Filename |
|----------|--------------------|
|----------|--------------------|

|            |            |
|------------|------------|
| DS/7700    | DS7700.MCF |
| DS/7500    | DS7500.MCF |
| MV/2000 DC | MV2000.MCF |

Load the microcode files from the diskette by typing

\*) **LOAD/V/R @MTJ0:1 filename** ) (Load from tape file 1;  
for example,  
**LOAD/V/R @MTJ0:1 MV2000.MCF** )  
(After 30 seconds or so, CLI  
verifies load of microcode file.)

\*)

This puts the microcode file on your LDU. (If you see no verification of the load, repeat the **LOAD** command. It's important to have the microcode file on your LDU.)

95a. Rewind the tape by typing

\*) **REWIND @MTJ0** )

96. You're done with DG-supplied system tapes. Remove the tape from the unit, put the cover on it, and store it safely. You may need it again if you need to reinstall diagnostics. Put the covers on all DG-supplied tapes and store them safely too.

97. Check the date and time by typing **DATE** ) and **TIME** ). If either is wrong, fix it with the CLI command **DATE** (format **DATE dd-mmm-yy** — for example **DATE 5-JUN-86** ), or **TIME** (uses a 24-hour clock, format **TIME hh:mm:ss --** for example **TIME 14:34:05** ).

98. You're finished with AOS/VS programs, updates, and computer microcode. Next, if you have a DS/7000-series computer, you should load the DG/VIEW window management software. This was provided with your machine to help you and your users create and use windows.

For DG/VIEW on diskettes, get the first (perhaps the only) DG/VIEW diskette and insert this in unit 0. Type

\*) **DIR** : )

\*) **OPERATOR ON** )

...

\*) **LOAD/V/R @LFD:VOL1:DGVIEW** ) (Ignore any *OPERATOR EXISTS* message.)  
(Use labeled tape volume ID of  
VOL1. The filename is DGVIEW.)

... (CLI verifies files loaded) ...

**PLEASE REMOVE THE DISKETTE** (If it asks for a second diskette,  
remove the diskette, insert next,  
press ).)

\*)

Remove the diskette from unit 0, store it, and continue to step 99.

For tape, mount the tape in unit 0 and type

\*) **DIR** : )

\*) **LOAD/V/R @MTJ0:0** )

... (CLI verifies files loaded) ...

\*) **REWIND @MTJ0** )

\*)

Dismount and store the tape.

99. Well done! You've powered up, formatted an LDU, installed an AOS/VS system on it, brought up AOS/VS, and loaded all files you need to generate and use your tailored system.

If you're interested in the files as shipped on the system diskettes, see Table D-2. For files on the system tape, see Table D-3. All these files are now on your LDU. The LDU also contains directory :PATCH, with current patch files (if you loaded an AOS/VS update). Also, the LDU contains the microcode file, xxnn00.MCF.

## Step Summary

Figure D-2, following the tables, is a summary of all the steps you've taken — from turning on the system console to locking the computer.

**Table D-2. AOS/VS System Diskettes File Format**

| Diskette Number | Program Filename                | Tape File Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1               | DFMTR<br><br>INSTL<br><br>FIXUP | Disk Formatter utility, which formats physical disks into LDUs. You run this by typing <b>DFMTR</b> ) in response to the <i>Pathname?</i> query.<br><br>Installer utility, which installs an AOS/VS system from a system tape. You run this by typing <b>INSTL</b> ) in response to the <i>Pathname?</i> query.<br><br>Disk Fixer utility, which finds and can correct (fix) disk file errors if abnormal AOS/VS shutdown occurs. You run <b>FIXUP</b> by selecting choice 7, "Run <b>FIXUP</b> " from the Technical Maintenance Menu.                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 2               | SYSBOOT                         | SYSBOOT is the system bootstrap program. This diskette has SYSBOOT on it in a form that the Installer can read. The Installer then installs it on an LDU.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 3               | AOS/VS system                   | On the DG-supplied AOS/VS diskette, this is the AOS/VS starter system. Use the Installer to install the starter system on an LDU. On a system diskette you make yourself, it is your tailored AOS/VS system. Use SYSBOOT's Technical Maintenance Menu to make the tailored system the default system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 4 - n           | First Dump File                 | The CLI and other system program files, including the system Agent, peripheral manager (PMGR), and copies of programs in diskette 1. AOS/VS copies the contents of these diskette into the LDU root directory when you specify <b>INITIAL LOAD</b> , then type the labeled diskette pathname.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| n + 1 - m       | Second Dump File                | You copy the contents of this file onto the LDU using the <b>LOAD</b> command. This file contains nearly all AOS/VS system programs, including the <ul style="list-style-type: none"> <li>• <b>CONTEST</b> system exerciser</li> <li>• <b>Disk File Editor (FED)</b></li> <li>• <b>DISPLAY</b> file display</li> <li>• <b>Error message (ERMES)</b> and message object files (.OBs)</li> <li>• <b>EXEC</b> and <b>PREDITOR</b></li> <li>• <b>HELP</b> directory and files</li> <li>• <b>LABEL</b> tape labeler</li> <li>• <b>Link</b></li> <li>• <b>Library File Editor</b></li> <li>• <b>Macroassembler (MASM)</b></li> <li>• <b>Process Enviroment Display (PED)</b></li> <li>• <b>Release Notice</b> (latest on software)</li> <li>• <b>SED</b> and <b>SPEED</b> text editors</li> <li>• <b>System macros</b></li> <li>• <b>Utility program symbol table files (.ST)</b></li> <li>• <b>SYSGEN</b> directory with <b>VSGEN</b> system generation program and libraries</li> </ul> |

**Table D-3. AOS/VS Tape File Format**

| <b>Tape File Number</b> | <b>Program Filename</b> | <b>Tape File Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0                       | TBOOT                   | Tape bootstrap; a short program that can load files 1, 2, and 3 from this tape.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 1                       | FIXUP                   | Disk Fixer utility, which finds and optionally corrects disk file errors if abnormal AOS/VS shutdown occurs. TBOOT loads this program into memory and executes it after you type 1 ↓ to the <i>Tape file number?</i> query                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 2                       | DFMTR                   | Disk Formatter utility, which formats physical disks into LDUs. TBOOT loads DFMTR into memory and executes it after you type 2 ↓ to the <i>Tape file number?</i> query.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 3                       | INSTL                   | Installer utility, which installs an AOS/VS system from a system tape. TBOOT loads INSTL into memory and executes it after you type 3 ↓ to the <i>Tape file number?</i> query.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 4                       | SYSBOOT                 | The system bootstrap program loads an AOS/VS system or other program into memory <i>from disk</i> , then executes the program. The Installer installs SYSBOOT on an LDU.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 5                       | AOS/VS system           | On the DG-supplied system tape, this is the AOS/VS starter system. Use the Installer to install the starter system on the disk. On a system tape you make, it is your tailored AOS/VS system. Use SYSBOOT's Technical Maintenance Menu to make the tailored system the default system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 6                       | First Dump File         | The CLI and other system program files, including the system Agent, peripheral manager (PMGR), LOAD_II program, and copies of programs in tape files 0 through 4. AOS/VS copies the contents of this tape file into the LDU root directory when you specify INITIAL LOAD.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 7                       | Second Dump File        | <p>You copy the contents of this file onto disk using the LOAD_II program, as part of the initial load procedure. This tape file contains nearly all AOS/VS programs, including the</p> <ul style="list-style-type: none"> <li>· CONTEST system exerciser</li> <li>· Disk File Editor (FED)</li> <li>· DISPLAY file display</li> <li>· Error message (ERMES) and message object files (.OBs)</li> <li>· EXEC and PREDITOR</li> <li>· HELP directory and files</li> <li>· LABEL tape labeler</li> <li>· Link</li> <li>· Library File Editor</li> <li>· Macroassembler (MASM)</li> <li>· Process Environment Display (PED)</li> <li>· Release Notice (latest on software)</li> <li>· SED and SPEED text editors</li> <li>· System macros</li> <li>· Utility program symbol table files (.ST)</li> <li>· SYSGEN directory with VSGEN system generation program and libraries</li> </ul> |

1. Turn computer power on if off.
2. Turn system console on and make sure it is on line. The ON LINE light should glow; use CMD and ON LINE keys.
3. Press keyboard ALPHA LOCK key until ALPHA LOCK light glows.
4. If you have a tape unit separate from the cabinet, turn it on.
5. With system media supplied on tape, put SYSTEM MEDIA tape on unit 0. Put unit on line if this applies. Skip to step 7.
6. With system media supplied on diskette, get the diskette labeled SYSTEM MEDIA. Insert it in unit 0 with write-enable notch up and label facing right. Close latch.
7. Turn computer power on using the power switch on the cabinet. Computer runs powerup tests. Then it displays

*Automatic Program Load Menu*

...

*Enter choice [1]:*

- 7a. See if time, *nn/nn/nn* is right; make a mental note.
8. Select change preset values by typing 2 ↵

*Change Preset Values Menu*

...

*6 Enter the SCP CLI*

...

9. If date and time were okay in step 7a, skip to step 10.
- 9a. If they were displayed as *DD/MM/YY HH:MM:SS*, type 2 ↵.
- 9b. Type correct date (example, for July 23, 1986, type *23-JUL-86* ↵) or press ↵ if date is correct. Then type correct time, 24 hour clock (example, for 2:15 p.m., type *14:15:00* ↵ or press ↵ if time is correct. For *Offset to GMT*, press ↵.

*Change Preset Values Menu*

...

10. *Enter choice [1]:* 6 ↵

...

*SCP-CLI>*

11. Remove the SYSTEM MEDIA diskette or tape from unit 0.
12. Insert AOS/VS diskette number 1 or the AOS/VS tape in unit 0.
13. You've finished powerup and can run the Disk Formatter.

### **Running the Disk Formatter**

14. *SCP-CLI> RESET* ↵ (Type *RESET* ↵ and wait for prompt.)
15. With AOS/VS on tape, skip to step 20. With it on diskette, do this:

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*Figure D-2. Step Summary, Bringing Up AOS/VS on a Blank Disk — Data General DS/7700, DS/7500, and ECLIPSE MV/2000 DC Systems (continues)*

16. **BOOT 64** ↓ (Type **BOOT 64** ↓)  
*Operating System Load Menu*
17. *Enter choice [1]: 2* ↓  
*Technical Maintenance Menu*
18. *Enter choice [1]: 6* ↓
19. *Pathname? DFMTR* ↓  
 Skip to step 22.
20. For tape, type **BOOT 23** ↓
21. *Tape file number? 2* ↓  
*AOS/VS Disk Formatter REV n*  
 ...
22. *Full (F) or Partial (P or NEW LINE)? F* ↓
23. *Disk unit name? DPJ0* ↓
- 23a. *Device code [24] ?* ↓ (Press ↓)
- 23b. *Disk unit name?* ↓
- 23c. *Do you want to allocate a diagnostic area? [Y]*  
 For DPJ0, type press ↓. For DPJ1, type **N** ↓ and skip to step 23e.
- 23d. *Enter the number of blocks (1750 to 35230)...[23420] ?*  
 We recommend enough space for the full ADES product. It requires up to a maximum of 13560 (octal) blocks. In any case, specify at least 2500 (octal). For example, **2500** ↓  
*Disk number 1: 00000000000 through n*
- 23e. *LDU unique I.D. (1 to 6 characters) [/? 1* ↓ (Type disk ID)
- 23f. *LDU name (1 to 31 characters) [/? ROOT* ↓ (Type valid disk ID)
- 23g. *Username or template (1 to 15 characters)? +* ↓
- 23h. *Access (O, W, A, R, E, or NEW LINE) ? E* ↓
- 23i. *Username or template (1 to 15 characters)?* ↓
24. *Surface analysis? [N] Y* ↓
- 24a. *Disk number?* ↓
- 24b. *You may run up to five (5) patterns. How many ...? 5* ↓ (Choose patterns)  
 — *Running pattern n* (Takes 8 to 24 minutes per pattern)
- 24c. If it found no bad blocks, go to 24e.  
*n bad disk blocks*

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Figure D-2. Step Summary, Bringing Up AOS/VS on a Blank Disk — Data General DS/7700, DS/7500, and ECLIPSE MV/2000 DC Systems (continued)

- 24d. *Display bad block statistics? [N] Y* ↓  
 Note bad blocks.
- 24e. *Additional bad block number (press NEW LINE when done):* ↓  
*Bitmap size: n*
- 24f. *Display bad block statistics? [N]* ↓
25. *Bitmap address? [default]* ↓
26. *System disk? [Y]* ↓ (Skipped if you allocated a diagnostic area.)
- 26a. *Overlay area size? [default]* ↓
- 26b. *Overlay area address? [default]* ↓
27. *Disk number n remap area size? [default]* ↓
- 27a. *Disk number n remap area address? [default]* ↓

— LDU created  
 Done!

SCP-CLI>

If you have another hard disk, type **CONTINUE** ↓ and return to step 22. For *Disk unit name*, answer **DPJ1** ↓ and *System disk?* answer **N** ↓. Don't allocate a diagnostic area. All other answers are the same.

## Installing Powerup Diagnostics

28. Remove the first AOS/VS diskette or tape from unit 0.
29. Get the SYSTEM MEDIA diskette or tape. Insert it in unit 0.
30. Boot from the diskette or tape. For diskette, type **BOOT 64** ↓. For tape, type **BOOT 23** ↓.

*Do you want to install powerup diagnostics on your hard disk?*

...

31. *Install powerup diagnostics (Y or N)? Y Y* ↓

... (pause) ...

SCP-CLI>

32. Remove the diskette or tape from unit 0.
- 32a. Turn computer power off and on again. It runs powerup tests. Then

*Automatic Program Load Menu*

*1 Continue immediately with preset values*

*2 Change preset values*

...

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Figure D-2. Step Summary, Bringing Up AOS/VS on a Blank Disk — Data General DS/7700, DS/7500, and ECLIPSE MV/2000 DC Systems (continued)

32b. Enter choice [1]: 2 ↵

(If no message appears, return diskette/tape to unit. Turn power off and on again; return to step 30.)

*Change Preset Values Menu*

...

6 Enter the SCP CLI

...

32c. Enter choice [1]: 6 ↵

...

SCP-CLI>

### **Installing and Bringing Up the AOS/VS Starter System from Diskettes**

33. SCP-CLI> RESET ↵

34. SCP-CLI> BOOT 64 ↵

... (short delay) ...

*Operating System Load Menu*

1 Continue immediately with operating system load

2 Enter the Technical Maintenance Menu

...

35. Enter choice [1]: 2 ↵

*Technical Maintenance Menu*

...

6 Run a specified program

...

36. Enter choice [1]: 6 ↵

37. Pathname? INSTL ↵

AOS/VS Installer Rev n

Specify each disk in the LDU

Disk unit name?

38. Remove AOS/VS diskette 1 and insert AOS/VS diskette 2.

39. Type DPJ0 ↵

40. Device code [24]? ↵

— Disk bootstrap installed

41. Do you want to install a System Bootstrap [Y] ? ↵

42. Install from which unit [MTC0] ? DPJ10 ↵

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Figure D-2. Step Summary, Bringing Up AOS/VS on a Blank Disk — Data General DS/7700, DS/7500, and ECLIPSE MV/2000 DC Systems (continued)

43. *Device code [default] ?* ↓  
... (Pause for about 30 seconds) ...  
— *System Bootstrap installed*  
*Do you want to install a System [Y] ?*
44. Remove AOS/VS diskette 2 and insert diskette 3.
45. Press ↓
46. *Install from which unit [DPJ10] ?* ↓
47. *Device code [default] ?* ↓  
... (Pause for 2 to 3 minutes) ...  
— *System installed*  
*Done!*  
*SCP-CLI>*
48. Remove the diskette from unit 0.

### **Bringing Up the AOS/VS Starter System from Diskettes**

49. *SCP-CLI> RESET* ↓
50. *SCP-CLI> BOOT 24* ↓  
*Operating System Load Menu*  
*1 Continue immediately with operating system load*  
...- 51. *Enter choice [1]:* ↓  
... (Pause of 10 to 15 seconds) ...  
*AOS/VS Rev xx.xx*  
*Master LDU: xx* (xx is the name assigned with Formatter)
- 52. *Override default specs [N] ?*  
On *Override* message, go to 53.  
  
(If, instead of a *specs* question, you see *Date (MM/DD/YY)?*, this means boot clock isn't operating. Type date; for example, for May 23, 1986, type 5 23 86 ↓. Then it asks the time: *Time (HH:MM:SS)?* Type the time, based on 24-hours; for example, for 2:30 p.m., type 14:30:00 ↓)
- 53. *Override default specs [N] ? Y* ↓- 53a. *Number of buffers in cache [default]?* ↓- 53b. *Swap directory definition [default]?* ↓- 53c. *Page directory definition [default]?* ↓- 54. *Initial load [N]? Y* ↓ (Type Y ↓.)  
*Filename [@MTC0:6]?*

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*Figure D-2. Step Summary, Bringing Up AOS/VS on a Blank Disk — Data General DS/7700, DS/7500, and ECLIPSE MV/2000 DC Systems (continued)*



55. Get the fourth AOS/VS diskette and insert it in unit 0.
- 55a. Type @LFD:VOL1:FIRST\_DUMP\_FILE, as follows:  

```
@LFD:VOL1:FIRST_DUMP_FILE )
PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED
```
- 55b. UNIT [@DPJ10] VOLUME ID [VOL01] ? [Y] )  
 ... (System copies files to LDU, at 2 minutes per diskette) ...  

```
PLEASE INSERT NEXT DISKETTE
UNIT [@DPJ10] VOLUME ID [VOL01] ? [Y]
```
- 55c. Get the next diskette in the AOS/VS set. Remove the diskette from unit 0 and insert the next diskette. Press ).  
 Repeat this step (55c) until the system console displays  

```
PLEASE REMOVE THE DISKETTE
AOS/VS CLI REV x.xx date time
)
```
- 55d. Remove the diskette from unit 0.
56. Get the first diskette in the second dump file and insert in unit 0.  

```
SUPERUSER ON )
*)
```
57. \*) OPERATOR ON )  

```
*)
```
58. Start loading from labeled diskettes using pathname @LFD:VOL1:SECOND\_DUMP\_FILE, as follows:  

```
*) LOAD/V/R @LFD:VOL1:SECOND_DUMP_FILE )
PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED
```
59. UNIT [@DPJ10] VOLUME ID [VOL1] ? [Y] )  
 ... (System loads files) ...  

```
PLEASE INSERT NEXT DISKETTE
UNIT [@DPJ10] VOLUME ID [VOLn] ? [Y]
```
60. Remove the diskette from unit 0 and insert the next diskette in the AOS/VS diskette set.
61. Press )
62. Return to step 60 and repeat the sequence until you see  

```
PLEASE REMOVE THE DISKETTE
*)
```
63. Remove the last AOS/VS diskette from the unit. Insert the first AOS/VS update diskette (if any), with UD on its paper label.

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Figure D-2. Step Summary, Bringing Up AOS/VS on a Blank Disk — Data General DS/7700, DS/7500, and ECLIPSE MV/2000 DC Systems (continued)

64. Type the LOAD command again, using the labeled diskette pathname @LFD:VOL1:UPDATE, as follows:

\*) LOAD/V/R @LFD:VOL1:UPDATE ↓

*PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED*

65. UNIT [@DPJ10] VOLUME ID [VOL1] ? [Y] ↓

... (It copies diskette, asking for others as needed) ...

*PLEASE REMOVE THE DISKETTE*

\*)

### Loading the Microcode File from Diskette

66. Remove the diskette from unit 0. From the first diskette set used, get second diskette (.MCF AOS DUMP FORMAT). Insert this diskette in unit 0.

67. Load microcode file. Names are as follows: DS/7700 is DS7700.MCF; DS/7500 is DS7500.MCF; and MV/2000 DC is MV2000.MCF. Type

\*) LOAD/V/R @DPJ10 filename ↓ (Load from physical diskette; for example,  
LOAD/V/R @DPJ10 MV2000.MCF ↓)

... (Pause of 30 seconds or so) ...

xxnn00.MCF (CLI verifies load of file.)

\*)

If no name is displayed, repeat the step.

68. Remove the diskette from unit 0.
69. Check the date and time by typing DATE ↓ and TIME ↓. If either is wrong, fix it with the CLI command DATE (for example DATE 5-JUN-86 ↓), or TIME (for example, TIME 14:34:05 ↓).

You're practically done. Skip to step 98.

### Installing and Bringing Up the AOS/VS Starter System from Tape

70. RESET ↓

71. BOOT 23 ↓

72. 3 ↓

... (Tape moves forward) ...

*AOS/VS Installer Rev n*

*Specify each disk in the LDU*

73. Disk unit name? DPJ0 ↓

74. Device code [24] ? ↓

— Disk bootstrap installed

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Figure D-2. Step Summary, Bringing Up AOS/VS on a Blank Disk — Data General DS/7700, DS/7500, and ECLIPSE MV/2000 DC Systems (continued)

```

75.    Do you want to install a System Bootstrap [Y] ? ↵
76.    Install from which unit [MTC0] ? MTJ0 ↵
77.    Device code [23] ? ↵
78.    File number [4] ? ↵
      ... (Delay while tape moves) ...
      — System Bootstrap installed
79.    Do you want to install a System [Y] ? ↵
80.    Install from which unit [MTJ0] ? ↵
81.    Device code [23] ? ↵
82.    File number [5] ? ↵
      ... (Delay while Installer copies AOS/VS system) ...
      — System installed
      Done!
      ...
      SCP-CLI>

```

### Bringing Up the AOS/VS Starter System from Tape

```

83.    RESET ↵
84.    BOOT 24 ↵

      Operating System Load Menu

      1 Continue immediately with operating system load
      2 Enter the Technical Maintenance Menu

      Loading will continue automatically unless you respond
      within 45 seconds.
      ...
85.    Enter choice [1]: ↵
      ... (Delay of 10 to 15 seconds) ...

      AOS/VS Rev xx.xx

      Master LDU: name
86.    Override default specs [N] ?

      Go to 87.

      (If, instead of a specs question, you see Date (MM/DD/YY)?, this means boot clock isn't operating.
      Type date; for example, for May 23, 1986, type 5 23 86 ↵. Then it asks the time: Time (HH:MM:SS)?
      Type the time, based on 24-hours; for example, for 2:30 p.m., type 14:30:00 ↵

```

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Figure D-2. Step Summary, Bringing Up AOS/VS on a Blank Disk — Data General DS/7700, DS/7500, and ECLIPSE MV/2000 DC Systems (continued)

87. *Override default specs [N] ? Y ↓*
  - 87a. *Number of buffers in cache [default]? ↓*
  - 87b. *Swap directory definition [default]? ↓*
  - 87c. *Page directory definition [default]? ↓*
  88. *Initial load [N]? Y ↓*
  89. *Filename [@MTC0:6]? @MTJ0:6 ↓*  
*AOS/VS CLI REV n date time*  
*)*
  90. *) SUPERUSER ON ↓*  
*\*)*
  91. *\*) XEQ LOAD\_II/V/R @MTJ0:7 ↓ (Use the LOAD\_II program.)*  
*... (LOAD\_II program verifies filenames loaded) ...*
  - 91a. *\*) REWIND @MTJ0 ↓*
  92. Now, if you received an AOS/VS *update* tape, mount it.  
*\*) LOAD/V/R @MTJ0:0 ↓*  
*... (CLI verifies files loaded) ...*  
*\*)*
  - 93a. *\*) REWIND @MTJ0 ↓*
  93. Remove the tape from the unit.  
  
If you received powerup diagnostics on tape, continue. If you received them on diskette, not tape, return to "Loading the Microcode Files from Diskette," and do steps 66 through 68.
- ### Loading the Microcode File from Tape
94. Get the SYSTEM MEDIA tape used at the beginning; mount in unit 0.
  95. Load microcode file. Names are as follows: DS/7700 is DS7700.MCF; DS/7500 is DS7500.MCF; and MV/2000 DC is MV2000.MCF. Type  
*\*) LOAD/V/R @MTJ0:1 filename ↓(Load from tape file*  
*1; for example,*  
*LOAD/V/R @MTJ0:1 MV2000.MCF ↓)*  
*... (Pause while tape moves) ...*  
*xxnn00.MCF (CLI verifies load of file.)*  
*\*)*  
  
If no name is displayed, repeat the step.
  - 95a. *\*) REWIND @MTJ0 ↓*
  96. You're done with DG-supplied system tapes. Remove tape from unit; store all tapes safely.

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Figure D-2. Step Summary, Bringing Up AOS/VS on a Blank Disk — Data General DS/7700, DS/7500, and ECLIPSE MV/2000 DC Systems (continued)

97. Check the date and time by typing **DATE** ↵ and **TIME** ↵. If either is wrong, fix it with the CLI command **DATE** (for example **DATE 5-JUN-86** ↵), or **TIME** (for example, **TIME 14:34:05** ↵). This sets both AOS/VS real-time clock and boot clock.
98. If you have a DS/7000-series computer, load DG/VIEW as follows:  
 For DG/VIEW on diskettes, get the first (maybe only) DG/VIEW diskette; insert in unit 0. Type  
 \*) **DIR** :  
 \*) **OPERATOR ON** ↵  
 ...  
 \*) **LOAD/V/R @LFD:VOL 1:DGVIEW** ↵  
 ... (CLI verifies files loaded) ...  
**PLEASE REMOVE THE DISKETTE** (If it asks for a second diskette,  
 remove the diskette, insert next,  
 press ↵.)  
 \*)  
 Remove diskette from unit 0, store, continue to next step.  
 For tape, mount the tape in unit 0 and type  
 \*) **DIR** : ↵  
 \*) **LOAD/V/R @MTJ0:0** ↵  
 ... (CLI verifies files loaded) ...  
 \*) **REWIND @MTJ0** ↵ \*)  
 Dismount and store the tape.
99. You're done. Congratulations!

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Figure D-2. Step Summary, Bringing Up AOS/VS on a Blank Disk — Data General DS/7700, DS/7500, and ECLIPSE MV/2000 DC Systems (concluded)

## What Next?

If you want to stop for a while, fine. To shut down AOS/VS, you can type **BYE** ↵, then **Y** ↵. To bring it up again, type **BOOT 24** ↵; at the Operating System Load Menu, press ↵. If asked the date and time, supply these. Then take the default for the *Override default specs* question.

If this is your first system, and you want to generate a tailored system now, go to Chapter 4.

If you are rebuilding and restoring a tailored system, the next steps are to start EXEC (Chapter 5) and load user and application directories and files from backup media.

End of Appendix

# Glossary

This is the glossary of terms used in the book. They appear in alphabetical order.

**A-type process** A process that has a PID between 1 and 255. It can't execute any program if PIDs 1-255 are in use. Error conditions may result if a process with a PID over 255 tries to communicate with an A-type process. A is the PID-size type of all processes before AOS/VS Revision 7.00 (except the CLI and EXEC).

**abort** The result of a serious error condition. When a program (like the CLI) hits an error, it may display a warning, error, or abort message. The abort message is the most serious of the three: it means the error was so serious that the program couldn't continue.

**access control list (ACL)** A list of usernames and access types, associated with every file, that specifies the access allowed. The usernames can be specific usernames or name templates. The access types are O (Owner); W (Write); A (Append); R (Read); and E (Execute). You can set an ACL with the ACL command. An example ACL is SAM,OWARE +,RE.

**accumulator** A hardware register within the CPU. Accumulators are used for arithmetic, value comparisons, address manipulations, and other things. An MV/Family main CPU can have eight user-accessible accumulators: four fixed-point, 32-bit accumulators and four floating-point, 64-bit accumulators.

**ACL** See access control list.

**ADES** See MV/ADES.

**Agent** The heart of the user interface in AOS/VS. In conjunction with the operating system, peripheral manager (PMGR) and the CLI, the Agent preprocesses most system calls, validating input when it can, and acting on behalf of each user to communicate with AOS/VS. Files are AGENT.PR and AGENT.ST in the root directory.

**ANSI** American National Standards Institute, a committee that publishes standards for a large range of things, including computer languages and tapes, machine screws, and copiers.

**anyPID program** A program that can run at any PID up to the maximum specified at VSGEN. The system will run it above 255 if possible. An anyPID program's program file has been edited with the SPRED editor and its PID-size type made anyPID.

**AOS** Advanced Operating System, DG's Advanced Operating System for 16-bit ECLIPSE computers.

**AOS/DVS** Advanced Operating System/Distributed Virtual Storage, DG's 32-bit operating system for distributed processing on a local area network.

**AOS/VS** Advanced Operating System/Virtual Storage, DG's Advanced Operating System for 32-bit ECLIPSE computers.

**archive** See backup.

**argument** Something that is acted upon by a command, statement, or instruction. For example, in QPRINT MYFILE J, MYFILE is an argument to the QPRINT command. In PRINT "Hello", "Hello" is an argument to the PRINT statement.

**ASCII** American Standard Code for Information Interchange. This code establishes standard numeric values for each character used in text. The numbers range from 000 for the null character to 177 (octal) for the DEL character. An international character set extends the ASCII set with numbers from 200 (octal) to 377 (octal); these numbers indicate non-U.S., language-specific characters (for example, the U.K. currency symbol).

**asynchronous line** A communications line that uses an asynchronous structure to transmit characters. In such a structure, each character has its own "framing" information: traditionally one start bit (before the character) and one stop bit (after the character). Asynchronous lines are generally used for consoles and for intersystem communication. They consume less system overhead than synchronous lines, but are not as fast.

**ATI** Asynchronous Terminal Interface, a device that manages user terminals in some MV/8000 systems. It consists of an input/output processor (IOP) and one or more multiplexor boards.

**ATU** Address Translation Unit, a circuit board within the main processor that translates logical addresses to physical addresses.

**audit-trail logging** See logging.

**B-type process** A process that has a PID between 1 and 255. It can't run if PIDs 1-255 are in use, but it can create and communicate with a process of any PID-size type. Most DG programs, including the CLI and EXEC, run as B-type processes. By default, the CLI run for each user is a B-type process. Thus, by default, a user CLI must run in the range 1-255 but can execute any PID-type program. Most processes from programs supplied with AOS/VS are B-type processes.

**backup** The procedure of copying disk-based information for safekeeping, done daily at most computer sites. The copy medium is usually magnetic tape, but can be diskette or disk. AOS/VS aids to backup are the DUMP command, DUMP\_II program, PCOPY program, and MSCOPY program.

**backup set** The set of tapes that contains a complete backup created by the MSCOPY program — all tapes needed to restore an LDU. A backup set includes the full backup set and all incremental backup sets. Each full backup creates a new backup set.

**bad block** On the magnetic surface of a disk, a flawed area that won't hold information. The Disk Formatter notes such areas in a bad block table so the operating system will avoid them; and it creates a remap area of good blocks for the system to use instead of bad ones. If a new bad block develops on the disk, and AOS/VS tries to use the block for I/O, it will detect the bad block and abort the command with a HARD ERROR message.

**batch** The technique of processing in a continuous, autonomous stream. Batch jobs don't require a console and they run without human interaction (for example, overnight); they are ideal for big, well-defined tasks, like large sorts. You can tell AOS/VS to run an operation in batch via the QBATCH command.

**baud** The rate at which a line (or modem) can transfer data, in bits per second. Normally, on asynchronous lines, each character requires 10 bits, so characters are transferred at 1/10 the baud rate. The standard (and default) baud rate for consoles is 9600 (960 characters per second). For modems it is 1200.

**bitmap** An area on each logical disk that indicates which disk blocks are free and which are used for data storage.

**block** See disk block.

**blocked process** A process whose execution is suspended, waiting for an event that may or may not occur. By default, a user process blocks when it creates a (son) process. A process can block voluntarily when it creates a son, via the PROCESS/BLOCK command. Or, another (Super) process can block it, or AOS/VS can block it.

**boot, bootstrap** To load a program from a device (tape or disk) into memory and transfer control to it. Bootstrap programs are designed to load other, larger programs like operating systems.

**boot clock** A hardware clock that gives AOS/VS the system date and time. A boot clock is a standard feature of the ECLIPSE MV/20000, MV/2000 DC, and the Data General DS/7000-series computers.

**bpi** Bits per inch; a measure of data density on magnetic tape. The standard DG tape densities are 800, 1600, and 6250 bpi.

**break sequence** A control sequence that involves pressing the CMD and BREAK/ESC keys (or the BRK or BREAK key). Typed on the system console, if the CPU is unlocked, the break sequence removes the console from AOS/VS' control and gives control to the SCP CLI. You can restore control to AOS/VS by typing TTY ↓ (or, on MV/4000s, MV/4000 DCs, or Data General DS/4000-series, CONTINUE ↓.)

Typed on a user console, the break sequence can break binary mode (used by certain programs when they write to the console), or do other things like log the user off (described in Chapter 4, under console characteristics).

**BSCGEN** An AOS/VS program that allows you to generate a configuration file for synchronous lines. This file name is then passed as the data file to the process that manages the lines when this process is created. Someone must run BSCGEN if the local system is to run DG's HASP II (HAMLET), RJE80, RCX70, or user programs that make calls to the sync lines.

**bus** A connection between hardware components. For example, a CPU has a memory bus and an I/O bus. There is also a bus between the SCP (if present) and main processor (the S bus).

**byte** 8 bits, can store one ASCII character (e.g., A) or one of 256 different integers.

**C-type process** A process that has a PID above 255 or below 255, depending on what processes are free. A C-type process can execute any PID-size type program. But error conditions may arise after it executes a smallPID program (since the father process has a PID the son can't understand).

**C2 (security class)** A level of data security achieved by a computer system: hardware, firmware, and software. The C2 class is more stringent than C3 and less stringent than B1. These classes are established by the U.S. National Computer Security Center (NCSC).

**CEO** DG's Comprehensive Electronic Office system, which includes electronic mail, calendar, filing, and word processing. A subset product, CEO Word Processing – Independent, offers word processing.

**checksum** A test used to verify data integrity. One checksum method is to compute the sum of all data bytes and compare it to the known sum. If the values do not match, the data has been corrupted. Checksums are used to verify that data has been loaded correctly (for example, microcode or FIXUP) and as a system sanity check on system constants.

**child processor** A job processor (physical processor) other than the primary (mother) processor. Each child processor must be initialized (JPINITIALIZE command) before AOS/VS can use it. Mother and child processors exist only in computers with more than one job processor. *See also* mother processor and job processor.

**class** A set of processes defined to receive special scheduling treatment. Classes are defined by a system manager, using the CLASP utility or an assembly-language program that uses class-defining system calls.



**CLI (Command Line Interpreter)** The AOS/VS (and SCP-OS) command language. AOS/VS CLI commands allow people to communicate with AOS/VS. When AOS/VS is brought up, it automatically runs a CLI process as PID 2 on the system console. This is the *master CLI*, from which all subordinate (son) processes are created. Typically, AOS/VS runs a CLI process for each user who logs on under EXEC. CLI files are CLI.PR, CLIST, and CLI.OL, in the root directory.

The SCP CLI runs under the SCP operating system, in the microprocessor CPU (if any). SCP CLI commands control the main processor and start up AOS/VS.

**CMD key** A key on the terminal keyboard that, in conjunction with other keys (like BREAK/ESC), can do things like produce the break sequence.

**cold start** Startup when power to the CPU has been off.

**compute bound** A process that — within a given interval — issues many job processor instructions. The instructions might involve computations, or data comparisons and sorts. Multiple job processors (and classes and logical processors) are most efficient when a system runs compute-bound (not I/O bound) processes. *See also* I/O bound.

**console** An interactive device with a keyboard for input and a screen or printer for output. The system console connects directly to the SCP and main CPUs and can issue commands to them. User consoles interact with the computer through a multiplexor. The filename of a user console is @CONn; the person or program using any console can address it by the name @CONSOLE.

**CONTEST** A package of AOS/VS test programs that tests system hardware (tape unit 0, master LDU, CPU, and main memory) and software. You can run CONTEST under AOS/VS, from the CLI.

**control point directory (CPD)** *See* directory.

**control store** The part of a computer where microcode is stored.

**converting non-DG tapes for AOS-AOS/VS** *See* magnetic tape.

**cooperative process** A process created by a system utility to communicate with it and other processes. EXEC, for example, creates and uses a cooperative process named XLPT to manage printing devices for it.

**CPI/24 (Computer-PBX-Interface)** A controller board that connects an MV/Family computer to a PBX (Private Branch Exchange) telephone exchange. Phone lines from the PBX, instead of cables, connect console lines to the CPU. A device called a DAM (data-access module) is also needed at the user's phone set. One CPI/24 can manage 24 asynchronous lines; it's named after the CPI software interface, T1/DS-1 version.

**crash** *See* panic.

**CTRL key** A key, like CMD, that's used in conjunction with other keys. CTRL sequences are used to interrupt commands (CTRL-C CTRL-A) and programs (CTRL-C CTRL-B), for cursor control, and to suspend and restore screen display.

**cursor** On a CRT console screen, the cursor indicates the current position on a line. It is either a box superimposed on a character position or an underscore beneath a character position.

**DAM (data-access module)** A device used to connect a phone set to a CPI/24, which in turn connects to a PBX telephone exchange.

**database** A central location (one or more disk files) for data, which can be shared by more than one user or program. DG has two systems for creating and managing databases: INFOS II and DG/DBMS.

**data-sensitive record** A type of record delimited by a special, agreed-upon character. Standard delimiter characters are ↓ (ASCII 12), form feed (ASCII 14), and null (ASCII 0). Data-sensitive and fixed-length records are the most common record types.

**DCU (Data Control Unit)** A device used to manage synchronous communications lines. *See also* ISC.

**deadlock** A situation in which the AOS/VS scheduler cannot react to all the demands on it; the system does not respond and seems frozen.

**debugger** A program that allows you to run another program, set stopping places called breakpoints, and, at each breakpoint, examine and change variables in the program. A debugger can really speed up program development. AOS/VS includes an assembly-language debugger. For high-level languages, DG offers the SWAT debugger.

**dedicated line** A phone line installed and used exclusively for communication between computer systems. Dedicated lines can remain open and available through day and night. Communication over a dedicated line is more precise, faster, and more expensive than communication over a switched line.

**default, by default** A value or parameter that a program uses if you don't specify a different one. Two examples: PREDITOR has the default answer of :CLI.PR for each user's initial program, and the SED text editor displays line numbers by default.

**detail logging** *See* logging.

**DG/L language** A programming language, developed at DG, that resembles ALGOL.

**diagnostic area** An area reserved on disk for the MV/ADES diagnostic system. This area — 8,000 blocks or more — can be reserved by the Disk Formatter when a disk is Full formatted. Later, the MV/ADES system must be installed — usually by a DG field engineer. The benefits of disk-resident MV/ADES are speed (it runs far faster from disk than from any other medium) and the option of running diagnostics from a remote site.

**diagnostic program** A program run to determine the source of a hardware failure (or incipient failure). DG's MV/ADES system is a series of diagnostic programs.

**DIB (Disk Information Block)** A block of information written to each physical disk in an LDU by the AOS/VS Disk Formatter during a Full format. The information includes the disk type, LDU unique ID, and the types and sequence of all disks in the LDU. AOS/VS and all its programs require a valid DIB before they can access the disk as an LDU.

**DIP (dual in-line package) switch** A very small switch, often in a group of eight, that enables or disables a hardware function; for example, 8-bit operation on a console. An alternative to DIP switches is hardware (wire) jumpers, but DIP switches are far more convenient. You can change the setting of DIP switch with a pencil point.

**directory** A file that contains (points to) other files. AOS/VS uses directories extensively. A "standard" directory has no set size; it grows according to the files in it. A *control point directory* is a directory created with a maximum space size (in 512-byte blocks).

You can create a noncontrol point directory with the CLI command `CREATE/DIR dirname` ; you can create a control point directory with the command `CREATE/DIR/MAX=size dirname` . The PREDITOR program creates each user's initial directory as a control point directory. On the master LDU, the root (:) is the master control point directory. You can tell the amount of space remaining in a control point directory via the command `SPACE cpd-pathname` .

**DISCO** A display program that shows disk load and seek distance on disks in your system. You run it by typing `XEQ DISCO`.

**disk block** An area on a disk that includes 512 bytes of storage.

**Disk Formatter** A program supplied with AOS/VS, in both stand-alone and stand-among versions, used to create LDUs, change LDU specifications, and check disk surfaces for flaws (bad blocks).

**diskette** A flexible disk used for software distribution and file backup. Also called a floppy. The standard diskette used with MV/Family systems holds 737,000 bytes.

**DRT** Dual Receiver/Transmitter, a device controller with a device code of 34. On MV/4000 DC, MV/4000 SC, and Data General DS/4000-series computers, it is on the multifunction I/O controller board (IOC). This DRT supports one asynchronous line that can be used for a modem. On an MV/2000 DC and on DS/7700- and DS/7500-series computers, the DRT is on the OSB. It has four lines, one of which can be used for either RS232 modem connection or RS232 direct connect. The remaining three lines can be used for RS232 direct connect only.

**dual-ported disk** A disk connected to two computers at the same time. Only one computer can access the disk at a time, but having one or more disks connected to a second computer can drastically reduce downtime if one computer fails.

**dump** To copy information en masse on to another medium. Most dumps are done for backup. Sometimes a dump is done to provide diagnostic information, as in a memory dump (which copies computer memory so programmers can examine it, try to reproduce the problem, and solve it).

**DUMP\_II program** An AOS/VS utility program that copies disk-based material using the same format and switches as the CLI command DUMP. DUMP\_II is faster than DUMP.

**element, file** See file element.

**emulator** A program that defines computer instructions that aren't defined in the hardware. Functionally, it resembles microcode. An ECLIPSE MV/4000 DC or Data General DS/4000-series system must have an emulator installed and running in its IOC board before it can be used.

**EPROM** Erasable programmable read-only memory. See also RAM.

**ESD** A part of AOS/VS that does an Emergency Shutdown, closing all open files and allowing immediate restart. ESD is most useful after a panic (*FATAL AOS/VS ERROR*). You can run it after a panic as described in Chapter 6. (ESD is also an acronym for ElectroStatic Discharge — static electricity — and its effect on computers.)

**EXEC** A utility supplied with AOS/VS that manages the multiuser environment: user logon and logoff, batch processing, printer queues, and user mount requests. EXEC accepts commands from any process with username OP. EXEC program files include EXEC.PR, EXECVS.PR (ring 6 part of EXEC), FCU.PR, QCMP.PR, and XLPT.PR.

**FCU (Forms Control Utility)** A program that inserts printing specs in files or file UDAs for nonstandard form printing.

**FED** A disk file editor utility supplied with AOS/VS — used for patching programs and changing the LOCK\_CLI password, among other things.

**field engineer** A DG engineer whose primary responsibility is hardware.

**file** A collection of information stored as a unit, under a *filename*. Some device filenames are rigidly defined (e.g., @MTB0 for tape, @LPT for the line printer queue, @CONSOLE for the console); but disk filenames and LDU filenames are flexible. See also names.

**file element** A set of contiguous 512-byte disk blocks that AOS/VS allots to each file as the file grows. The default file element size is four blocks, but users can specify larger element sizes via the CREATE/ELEMENTSIZE= switch when they create files.

**fileset** Name for one or more disk files written (usually dumped) to a set of one or more labeled magnetic tape/diskette volumes. For example, if a user writes one or more volumes to a three-volume set in a single operation, the fileset includes the three volumes. The fileset ID is written to the labels and allows the system to keep track of the volumes that contain the fileset.

**firmware** Instructions that control some operations of a computer-based device; similar to microcode.

**FIXUP** A utility program that restores file integrity and streamlines the file structure on an LDU. You must run FIXUP after an abnormal shutdown in which ESD failed, but you can run it anytime to neaten up. You should run it when you suspect system data has been corrupted (for example, if the system panics whenever someone accesses a specific directory).

**floating-point unit (FPU)** One or more circuit boards that speed up computations with floating-point numbers. A hardware FPU is standard on MV/10000 SX machines and an available option on most others. On MV/family machines without a hardware FPU, floating-point computations are handled in microcode.

**form feed** A character (CTRL-L, ASCII 14) that tells a printer to stop printing on the current page and start at the top of the next page. Typed on a CRT keyboard, a form feed clears the screen.

**formatting (disks)** An operation that prepares the magnetic surface of a disk or diskette for data storage. *Hardware* formatting divides the disk surface into sectors (disk blocks), then checks the disk surface for flaws. All DG disks and diskettes are hardware formatted before they are shipped. Hardware formatting is done by the MV/ADES system.

*Software* formatting creates tables that the operating system needs on a disk or diskette. Among these is a bad block table that allows the system to find good substitutes for bad blocks (including those found during hardware formatting). Software formatting creates a Logical Disk Unit (LDU) from one (or more than one) physical disk. Software formatting is not needed for diskettes that you don't want to use for directories; for example, it isn't needed for diskettes you'll use for system backup. Software formatting is done by the AOS/VS Disk Formatter (DFMTR).

**fragmentation** Storage in fragments. For fast access on disk, the elements of a file should be stored sequentially on the disk surface. AOS/VS does this when there are no other file elements in the way (when an LDU is relatively empty).

But after an LDU begins to fill up, fragmentation begins: AOS/VS must seek farther for space for new file elements. For example, one element is near an outer cylinder, and the next available space is near an inner cylinder. To write the next element, the read/write head must move all the way across the disk. File fragmentation often occurs when an LDU is nearly full. It can significantly slow access to the disk involved. The DISCO program can give you some idea of the amount of fragmentation on an LDU.

**FRU (Field Replaceable Unit)** (1) A circuit board that can be replaced on site. (2) A diagnostic test that checks one or more of these circuit boards.

**FTA** The XODIAC network file transfer agent. It helps copy files from one computer system to another.

**function key** One of the keys in the topmost row of a console keyboard. Each key, alone or in conjunction with the SHIFT and/or CTRL keys, can represent a command. (Pressing a key is easier than typing a command.) A product's function keys (if it has any) are identified by a shaped *template* that fits over them.

**gate array** In software, a series of locations that specify entry points (or gates) to a segment. AOS/VS uses gate arrays for protecting rings while at the same time permitting fast access. In hardware, a gate array is a chip that stores these entry points and makes fast addressing possible.

**generic file** A category of files, some of whose names you can set with CLI commands. For example, the generic LISTFILE can be set to @CONSOLE or a disk file; and generic file @NULL is a useful destination file when you don't care about reading the data written.

**GIS** Graphics Instruction Set, a hardware option available with Data General DS/4000-series computers. It works in conjunction with DG's GKS (Graphics Kernel System) to produce graphics and enable mouse operations.

**group 1 process** A high-priority process. The priority range for each group is chosen at VSGEN, and the default for group 1 is priority 1-255 (resident or pre-emptible) and 4-255 (swappable). Group 1 processes get CPU time on a priority basis. Equal priority group 1 processes get time on a round-robin basis.

**group 2 process** A medium-priority process. The priority range is chosen at VSGEN. The default range is 256–258, which for swappable process appears as 1–3. The system treats group 2 processes (but not group 1 or 3 processes) heuristically, which favors processes with many blocking events. Group 2 processes can be of any type: the default for all processes except PID 1 (PMGR) is swappable 2 (actually 257), group 2.

**group 3 process** A low-priority process. The range is chosen at VSGEN. Group 3 processes get CPU time on a priority basis. Within the same priority, they get time on a round-robin basis. Group 3 processes can be any type.

**hang** See deadlock.

**hardware diagnostic** A test program designed to identify current (and potential) problems with peripheral hardware, like disks. DG's MV/ADES (Advanced Diagnostic Executive System) includes series of such tests (as does DG's DTOS, another diagnostic system).

**hash frame size** A value associated with a directory, used to index into the data structure that contains the directory filenames. The default value is 7. This is appropriate for a medium size directory. The proper hash frame size for any directory can reduce the number of disk accesses needed to find a filename in the directory.

**heuristic treatment** AOS/VS studies group 2 processes and assigns them priority based how much time passes between blocking events. AOS/VS raises the internal priority of processes with many blocking events and lowers the internal priority of processes with few blocking events. This is called heuristic treatment; it favors interactive processes (which have many blocking events). See also timeslice.

**hierarchy (process)** All processes are related in a structure that resembles an inverted tree. The highest processes are the peripheral manager process (PMGR, PID 1) and the master CLI process (PID 2).

**histogram** A data array that shows what parts of a program are consuming CPU time. It shows how much CPU time has been used running specific sections of the program, identifying heavily used sections of it. Histograms can help programmers rewrite code to run faster. You can create histograms with the HISTO and HISTOREPORT programs.

**host** A computer system that's connected to one or more other systems. The system you are on is called the *local* host; any of the other systems is called a *remote* host.

**hybrid program** A program that cannot run if PIDs 1-255 are in use. (In this way, it is like a smallPID program.) A hybrid program, unlike a smallPID program, can communicate with processes with PIDs above 255. A hybrid program's program file has been edited with the SPRED editor and its PID-size type made hybrid. Most programs shipped with AOS/VS Revision 7.00 are hybrid programs.

**IAC (Intelligent Asynchronous Controller)** A multiplexing device that handles user terminals. There are 16-line and 8-line IACs.

**IACRS** See peripheral manager.

**IBM tapes** See labeled tape or magnetic tape.

**image** See LDU image.

**INFOS II** A file management system, available with AOS/VS, that lets users create, maintain, and use large databases, via COBOL, FORTRAN 77, PL/I, RPG II, C, Pascal, and other application programs. INFOS II is a superset of an ISAM file system, with an ISAM extension called DBAM (database access method). It has an interactive graphics and report-generator query program named PRESENT.

**initial program** The first program run for a user, as designated in the user's profile. When the user logs on, the operating system reads the profile and executes the specified initial program, such as the CLI.

**initialize** A general-purpose computer term meaning “introduce” or “open” in the context of hardware and software. For example, to initialize AOS/VS means to give it vital information (like date and time) at startup. To initialize a logical disk unit (LDU) means to open it to the AOS/VS file system.

**Installer** A utility program that places a disk bootstrap, system bootstrap (SYSBOOT), and/or AOS/VS system on a system LDU.

**Internet** A communications/networking system that uses the TCP/IP protocol (transmission control protocol/internet protocol). This protocol is based on Arpanet, on recommendations by the U.S. Department of Defense. Internet has a virtual terminal program called TELNET and a file transmission program call TCP. Internet is an alternative to DG's XODIAC system.

The Internet system is useful for an MV/Family system in a network with other manufacturers' systems that use TCP/IP. It's also useful in networks of UNIX-based systems. For DG-only systems, XODIAC is the preferred networking system.

**interrecord gap (IRG)** The gap between records on magnetic tape. As it writes to tape, the system writes a record (a bufferful of data), spins the tape forward slightly, then writes another record. The space between records is the interrecord gap. Interrecord gaps are waste space; the fewer such gaps, the more material a given tape can hold.

One way to reduce the number of gaps is to increase the record (buffer) size. Bigger buffers produce fewer records and fewer gaps, thus increase tape capacity. (On cartridge tapes, though, bigger buffers can prevent the unit from streaming.) The default buffer size for DUMP is 2,048 bytes; it can comfortably be increased to 8,192 bytes. PCOPY's buffer size can also be changed.

**I/O bound** A process that — within a given interval — demands much more I/O than processor attention. *See also* compute bound.

**IOC (I/O Controller)** A PC board that speeds up CPU access to devices like disks, tapes, and consoles. Most disk and tape units also have their own, individual controller boards. An MV/10000 has *two* IOCs. On an MV/4000 DC or Data General DS/4000-series system, the IOC actually *provides* access to disks, tapes, and other devices. This IOC requires an emulator to run; its formal name is *multifunction I/O controller board*.

**IOPRS** *See* peripheral manager.

**ISC (Intelligent Synchronous Controller)** A device that handles synchronous communications lines (often used for communication with IBM systems). An alternative to a DCU.

**Janitor** A CEO utility program that deletes documents and cleans up the mail directory.

**job processor** A hardware entity that computes and interprets program instructions. The term includes and extends the standard definition of central processing unit (CPU). When AOS/VS starts up, it recognizes only the default processor, JP0. If your computer has more than one job processor, you must initialize the additional ones with the CLI command JPINITIALIZE. In a system with multiple job processors, the default processor, JP0, is called the mother. Each additional processor is called a child.

**Kbyte** In main memory, 1,024 bytes (1,024 characters); an 8-Kbyte buffer holds 8,192 characters. On disk (or diskette), a Kbyte is 1,000 characters; a 727-Kbyte diskette holds 727,000 characters.

**kernel** The part of the operating system that contains device drivers, system parameter tables, and other things. It talks to the hardware, PMGR, and — through the Agent — to users.

**LABEL utility** Program that creates DG-, IBM-, or ANSI-format labeled tapes or diskettes. *See also* labeled tape/diskette *and* magnetic tape.

**labeled tape or labeled diskette** A magnetic tape or diskette with labels. Each label is information — including a volume ID (valid) — that describes the contents of the tape or diskette. For tape, this information is written by the LABEL utility (when you execute LABEL) and by the operating system (when you or a user program issues a command that writes to the tape). You can label and write a tape in either DG, ANSI, or IBM format.

For diskette, label information is written — usually — by the CLI, and by the operating system (when you or a user program issues a command that writes to the diskette). Labeled tape or diskette has many advantages over the unlabeled variety; we recommend it for all your backups.

**LAN** See local area network.

**laser document printer** A printer that produces high-quality copy that resembles typeset printing.

**LDU** Logical disk unit: one or more physical disks, processed by the Disk Formatter into one logical disk.

**LDU image** If two LDUs have the same name but different LDU unique IDs, they are said to be images of each other. An image may be synchronized (data is the same) or unsynchronized (data is different). See also mirroring.

**LDU unique ID** The LDU unique ID is a 6-character field in the Disk Information Block (DIB) you create with the Disk Formatter. The system and system utilities can tell from the LDU unique ID whether the LDU can be part of a mirrored LDU.

**letter-quality printer** A printer that produces copy suitable for a business letter. The copy looks like text from an electric typewriter.

**line (communications)** See asynchronous line or synchronous line.

**line (of text)** A sequence of ASCII characters that ends with either a NEW LINE, form feed, or null character.

**link entry or link file** A file whose sole function is to indicate another file's pathname. You can create a link entry with the command CREATE/LINK. For example, a link named MAR to :UDD:CHRIS:MARCH\_REPORT makes access to MARCH\_REPORT easy; for example, you can type just TYPE MAR .

**LOAD\_II program** An AOS/VS utility program that restores material dumped from disk by either the DUMP command or DUMP\_II program.

**local (item)** An *item* (like system, console, or printer) that is managed by your computer system without a communications line. The opposite of local is *remote*. For example, in a XODIAC network, from your local console, you can log on to a remote system and use the remote printer. Or, when you use a modem line, your local console communicates with the remote system.

**local area network (LAN)** A network of computer systems that are relatively close to one another — up to a mile apart. This is a good arrangement for one or more MV/Family systems (as hubs of the network) and DESKTOP GENERATION systems as remote hosts.

**locality** A number, or group of numbers, that determines the class of a process. There are two kinds of locality: user locality (defined by PREDITOR in a user profile), and program locality (defined in a program file preamble by the SPRED utility).

**log on** To pass a recognition procedure and be accepted by a computer system (log on is DG's term for log in). For example, to log on to a user terminal under AOS/VS, you type your username and password. The log-on requirement helps provide security and privacy for user files, and prevents unauthorized people from using a computer system.

**logging** Having the system record error and user activity in a log file. Later, reports generated from log files can tell you the date and time of device errors and the amount of system resources consumed by users. In AOS/VS, errors are always logged, in file :ERROR\_LOG. User *account* logging is an option.

If you want account logging, you can choose minimal detail (default) or full detail. Minimal detail records information that's primarily useful for billing (for example, CPU and I/O usage, and pages printed). Full-detail logging also records file accesses, failed log-on attempts, and other security-related events. Generally, if you want a very secure system, you should run full-detail logging. And, you should generate and read reports from these logs regularly. Full-detail logs grow quickly to consume a lot of disk space. You can start or stop account logging with the SYSLOG command; and you can generate reports from logs with the REPORT program.

**logical address** The address that a user or user program sees. For CPU addresses, the main processor translates each logical address to a physical address to access main memory. For disk addresses, AOS/VS does the translation.

**logical disk mirroring** See mirroring.

**logical disk unit (LDU)** One or more physical disks, processed by the Disk Formatter into one "logical unit."

**logical processor** A scheduling structure that you can create, allot classes processing time on, and connect to job processors — via CLASP. You can create up to 16 logical processors with CLASP, and move job processors to different ones for different processing environments.

**LP** See logical processor.

**macro** A file that contains CLI commands, and that is executable.

**LPMGR** See peripheral manager.

**magnetic tape** A medium used for software distribution and data backup. Types of tape unit are MTBn (1600 or 800 bpi), MTCn (with reels, 1600 bpi; with cartridge, 6400 bpi), and MTD (6250 or 1600 bpi). Tape capacity varies from 8 Mbytes per cartridge to over 150 Mbytes per reel, depending on unit and buffer size (see interrecord gap). Files written on unlabeled tape are accessed by device name and file number; for example, @MTB0:0, @MTB0:1, @MTB0:2, and so on. On labeled tape, files are accessed by filename (like TAPE:FILE). People can label tapes with the LABEL utility.

AOS/VS software shipped on tape arrives on an *AOS/VS system tape*. The SYSTAPE.CLI macro create a tailored system tape in the same format as this AOS/VS system tape. Tapes written on an IBM or other non-DG system can be converted and loaded into an AOS/VS system with the AOS/VS DISPLAY utility or the Sort/Merge program.

**master CLI** See CLI.

**master LDU** The logical disk unit that holds the currently running AOS/VS system.

**Mbyte** Abbreviation for megabyte. In terms of computer memory, it is 1,048,576 characters; two Mbytes of main memory can hold 2,097,152 characters. In terms of disk storage, Mbyte means 1,000,000 bytes; a 354-Mbyte disk can hold 354,000,000 characters.

**MCA (Multiprocessor Communications Adapter)** A device that allows network communications between DG systems that are hardwired (not connected via phone line) to one another.

**MCP1 (Multicommunications Processor)** A PC board that includes an asynchronous line controller that supports 8 lines, a synchronous line controller that supports 2 lines, and a data channel line printer controller. You identify the async lines, sync lines, and printer controller to VSGEN as if they were separate devices.



**memory contention** A state in which the memory desired by all processes exceeds the physical memory in the machine. AOS/VS has several elaborate ways to handle memory contention. To summarize these: as contention increases, AOS/VS tries paging; if contention still increases, AOS/VS tries swapping.

**microcode** Control sequences that implement the instruction set of a computer. It consists of a series of microinstructions.

**Microcode Subscription Service** A service that provides new revisions of MV/Family microcode (and SCP-OS and SCP-DTOS FRUs) as DG creates them. A year's membership is included with an MV/Family computer; membership is available thereafter.

**mirroring** Mirroring or logical disk mirroring is an option where the operating system maintains two logically identical LDU images. Mirrored LDUs provide high data availability since the system can continue to function on one image if the other image is taken out of service (as for backup) or if there is a hard disk error. The system treats two LDUs separated by a ! as one mirror. Example: INIT @DPJ1!@DPJ2 !. Chapter 15 explains logical disk mirroring.

**modem** A device that connects an asynchronous line from a computer to a telephone line, and connects the other end of a telephone line to a console. Two modems are needed for each active remote console.

**mother processor** The default job processor, usually JP0. If your computer has other job processors, each one is called a child processor. You can bring each child processor on line with the CLI command JPINITIALIZE.

**mouse** An asynchronous input device that you move across a flat surface, sending signals to the computer. Software in the computer then translates the signals into coordinates, to select a menu item or draw a picture. AOS/VS doesn't support a mouse directly; instead, the Graphics Kernel System (GKS) identifies the mouse as a user device when GKS starts up; and GKS supports the mouse while it runs.

**MSCOPY (Modified Sector Copy)** A utility program for backup that can copy only the modified sectors (disk blocks) of an LDU. Other backup programs, like DUMP\_II, back up entire modified *files*. MSCOPY can save backup time for an LDU that has a few very large files, like INFOS II or DG/DBMS database files. MSCOPY works only with disks whose controllers support modified sector I/O (like model 6236 and 6239 disks).

**multifunction I/O controller board** The IOC for an ECLIPSE MV/4000 DC, MV/4000 SC, or Data General DS/4000-series computer. This IOC includes the following device controllers: disk (DPJ), diskette (DPJ1), tape (MTC), system console (CON0), printer, modem line (DRT), and LAN. An IOC emulator program — supplied on diskette and installed on the hard disk — allows it to communicate with the main processor.

**multiplexor** A general term for a device that sorts and controls multiple signals. In this book, a multiplexor is part of a user-console handling device called an IAC, MCP1, CPI/24, or ATI. On IACs, MCP1s, and CPI/24s, the multiplexor is an integral part of the device; on ATIs each multiplexor is a separate PC board called AMI-8 or ALM-16.

**MV/ADES (Advanced Diagnostic Executive System)** A system of hardware diagnostics for peripherals. It includes tests, exercisers, formatters, and alignment test programs.

**names** AOS/VS filenames can be from 1 through 31 characters, including letters, numbers, underscore (\_), period (.), dollar sign (\$), and question mark (?). LDU names (assigned with the Disk Formatter) can be 1 through 15 of the above characters. Labeled tape volid names can be 1 through 6 characters. Usernames (assigned via PREDITOR) can be 1 through 15 characters; and passwords can be 6 through 15 characters. AOS/VS devicenames are rigidly defined; they begin with 3 letters (e.g., MTB, DPF, LPB), sometimes followed by a one- or two-digit number to indicate the controller and unit number; e.g., MTB0, DPF0.

**NBA (Network Bus Adapter)** A device used by DG's XODIAC networking system for a network of computers, within 1 mile of one another.

**network** A group of computer systems that can communicate via a communications link. Broad-based networks can include different manufacturers' systems. DG's XODIAC network system, with its X.25 interface and agents (FTA, RMA, VTA), allows AOS/VS systems to participate in a Public Data Network (PDN), or private or local area network with other DG systems, including DG DESKTOP GENERATION systems. The Internet networking system is an alternative to XODIAC, for networks including non-DG systems and systems that run UNIX.

**object file or object binary** A file produced by a compiler or assembler that contains binary translations of code from the source file. (The source file code was written by a person.) By default, the compiler/assembler names the object file after the source file, but replaces the language-specific suffix with .OB. For example, the object file produced from MYFILE.SR would be MYFILE.OB. To make an object file into an executable program, you must run the Link utility on it. Several object files that contain error message text are shipped with AOS/VS (for example, ZERMES.OB).

**overlay** A section of executable program code that can be called into a reserved area of memory as needed, then overwritten by another overlay called into memory. Overlays associated with a program usually reside in an overlay file that has the suffix .OL. The overlay mechanism isn't required by AOS/VS, but can be used by many programs that run under both AOS and AOS/VS.

**PAGE** A directory used by AOS/VS as part of its memory management scheme.

**page** In memory, a 2,048-byte quantity.

**page fault** An event in which the system must add a page to a process working set of pages, because the process needs information that isn't in physical memory. Page faults involve a certain amount of overhead: the system must find a free page (perhaps from another process), add it to the working set, and read information into it.

Normally, only one page is added to the working set on any fault, but you can specify more pages via the SPRED utility. A relatively large number of page faults may indicate an inefficient program. This can be significant for application programs that run continuously; many page faults can degrade overall system response. (Page faults are displayed in column FTA by the PED utility.)

**page-seconds** Indicator of process memory usage. It's formed by multiplying the number of memory pages used by the number of CPU seconds used. For AOS (not AOS/VS), page-milliseconds (pages \* ms) are used instead of page-seconds. The PED and REPORT utilities both give page-second figures for processes.

**paging** Action that AOS/VS takes to handle light-moderate memory contention. To satisfy one process' needs for new pages when no physical memory is free, AOS/VS removes unused pages from lower priority process working sets, writes them to page files (in directory :PAGE), and gives the newly freed pages to the higher priority process. *See also* swapping.

**panic** An error that halts AOS/VS processing with a fatal error message on the system console.

**password** A combination of characters that, typed in conjunction with your username, allows you to log on to AOS/VS (or AOS) from a user console or virtual console. Passwords are assigned by the PREDITOR editor, but — by default — users can change their own passwords. Passwords are the primary means of maintaining data privacy and security. Keep them private.

**password encryption** A process that takes the password a user types and changes it into a protected text string that another user cannot figure out. AOS/VS offers password encryption for security.

**patch** A correction or update made to a program on disk. DG provides patch files in updates for AOS/VS programs like EXEC, AOS/VS systems, and the CLI. You can apply patches easily with the auto-patch macro set, described in Chapter 4.

**pathname** A path, usually including one or more directory names, to a file. For example, :UDD:JACK:MYDIR:MYFILE is a pathname.

**PCOPY** A fast copy program, used to back up an LDU by making a physical copy of it, onto another LDU, magnetic tape, or diskettes.

**PED (Process Environment Display)** A utility program that displays process vital statistics.

**peripherals directory (PER)** The AOS/VS directory that holds all device entries. Its full pathname is :PER or shorthand prefix @. The prefix @ that you use with device names specifies the peripherals directory.

**peripheral manager (PMGR)** A group of AOS/VS programs that supervises all character I/O (e.g., with user consoles). At startup, the system runs the PMGR process (LPMGR.PR) as PID 1. The PMGR process then loads operating systems into console-handling devices; for example, with IACs or MCP1s, it loads a copy of IACRS into each device. Then, AOS/VS is ready to have the multiuser environment brought up.

**peripheral microcode installer** A program, supplied on tape with any disk controller that uses its own microcode, that installs the latest revision of microcode on disk. The new microcode can then be loaded automatically into the device controller as needed.

**physical address** The address that the hardware sees. For a CPU, it points to a specific address in main memory. For a disk, it is an address on the physical disk (as opposed to a logical address on the LDU).

**PID** The Process ID that the system creates and associates with each process.

**PL/I** A programming language (Programming Language/I) developed at IBM during the sixties. PL/I is the official DG implementation language; many AOS/VS utility programs are written in it.

**PMGR** See peripheral manager.

**preamble** Part of program .PR file that specifies any of certain nonstandard parameters (like swap file size) to be used when the program runs. You can change values in a program preamble with the SPRED utility.

**PREDITOR** The user profile editor supplied with AOS/VS, which creates user profiles that identify system users to EXEC, and allows them to log on and off.

**process** A program set up for execution; or, more specifically, the memory, CPU, disk, and other system resources used by an executing program. AOS/VS runs each program as a process. See also blocked process.

**profile** See user profile.

**protocol** A set of conventions defining the format for communication between programs.

**pseudomacro** A CLI construct designed to make macros more useful; returns a value. For example, [!DATE] returns the current date.

**queue** A file that stores print and batch requests until the printer and system are ready to process them. The system runtime queue directory and file are :QUEUE:Q. The default line printer queue is @LPT.

**RAM** Random Access Memory. Most of a computer's memory is RAM memory. Programs can read from and write to RAM.

**RDOS (Real-time Disk Operating System)** A DG operating system that can run up to two programs simultaneously.

**ready process** An unblocked process whose minimum working set is in physical memory, and which is not waiting for an external event (like a system call) to complete. Each ready process is eligible for CPU time. The highest priority ready process gets control of the CPU when the process that has control blocks *or* the current subslice expires, whichever comes first.

**record** A series of one or more characters written to or read from a file. Records can be read and written by a text editor (they are lines of text like these). Or, records can be read and written by your own applications programs.

**Release Notice** Notice of recent software changes that DG hasn't yet been able to include in pertinent manuals, supplied with AOS/VS and other software as a printed listing and a disk file in :UTIL (pathname :UTIL:RELEASE.n.nn; e.g., :UTIL:RELEASE.7.00).

**remote (item)** An item (like a system, console, or printer) managed by another computer or by your computer over a communications line. The opposite of remote is *local*. For example, a remote console is one attached to your system via a modem. But when you're using this console, it's local and the system is remote.

**reset** To return a hardware register to an initial state. System reset clears accumulators and program counters, sets device controllers to their initial state, unlocks whatever was locked, and lets you restart what you were doing (like starting the system).

**revision** A new version of AOS/VS (or other software) and manuals, or a new version of microcode. DG issues a new revision of AOS/VS about every six months, sending it to customers on DG's Software Subscription Service. New revisions of microcode/SCP-OS are sent to customers on the Microcode Subscription Service.

**ring** A barrier separating 512 Mbyte segments of main memory from access by programs in other segments. AOS/VS protects system and user data by enforcing ring crossing protocols.

**RMA** The XODIAC network Resource Management Agent. It allows people on one system to use devices on other computer systems and send mail between systems. *See also* network.

**ROM** Read-only memory. Another form of ROM (PROM) is programmable; and still another (EPROM) is erasable and programmable. The part of the SCP that does the power up checking is EPROM. All forms of ROM are nonvolatile: they retain their values when power is shut off.

**root directory (:)** The system master directory that contains and gives access to all other directories.

**SCP (System Control Program)** A microcode program that provides a user interface (called the "soft console") to the main processor. The SCP is an operating system that has its own CLI (SCP-CLI). The SCP can load programs from disk or tape (BOOT command). On most MV/Family computers, the SCP is stored in the microcode file, in the root directory. A different SCP operating system, SCP-DTOS, serves to load the SCP-OS from its shipping medium (tape or diskette) *and* to run FRU diagnostics.

**scratchpad memory** A high-speed, RAM, part of memory outside (but accessible to) the main CPU. It contains constants and temporary storage locations.

**search list** A list of directories that AOS/VS searches when it can't find a file in the working directory; set with the CLI command SEARCHLIST. The search list of a user process is often set in the user's log-on macro; if not, the user process gets the search list of the master CLI. The master CLI, PID 2, search list is usually set in the UP.CLI macro. If you get a *FILE DOES NOT EXIST* error, and you know that the file exists, check your search list.

**sector** *See* disk block.

**segment** AOS/VS main memory is divided into eight 512 Mbyte units, called segments. Hardware rings between the segments protect system and user data.

**shared disk** *See* dual-ported disk.

**smallPID program** A program that cannot run if PIDs 1-255 are in use. SmallPID is the PID-size type of all programs before AOS/VS Revision 7.00 (except the CLI and EXEC, which were hybrid in Revision 6.00). By default, the Link program creates programs of smallPID-size.

**Software Subscription Service** A service that provides new revisions of AOS/VS and support software as DG creates them. A year's membership is included with purchase of AOS/VS; membership is available thereafter.

**software trouble report (STR)** A formal report, made by a customer to DG through a DG systems engineer, about a serious problem that the customer is having with the software. The cause may be a user or DG error. To solve the problem, DG personnel try to duplicate it; thus they need as much information about the problem as possible. Or, instead of reporting errors, an STR can simply offer suggestions.

**source file** A file that contains source statements for a program. If the program is written in a compiled language, the source file must be compiled before the program can be run. If the program is in BASIC, you can usually just run the source file. For compiled languages, the source file is the most important file (more important than the .OB and .PR files, which can easily be recreated by the compiler and Link program).

**spoofers** See index or Chapter 16.

**spooling** A method of storing information on disk temporarily for later processing. AOS/VS uses spooling when fast processes (like the XLPT process) have to use slow devices, like printers.

**SPRED (Selective Preamble Editor)** A utility program to edit program preambles. In a preamble, you can specify: multiple page loads when the process is created; multiple page additions to working set on a page fault; a nonstandard swap file size for the process; PID-size type; and program locality. Some of these changes can improve the performance of programs that use many unshared pages. Others permit using big PIDs or classes. Some SPRED operation must have been enabled at VSGEN; if not, the specified action won't occur.

**stand-alone program** A program that runs by itself, without an operating system to manage its I/O, supervise scheduling, etc. Each operating system is itself a stand-alone program. There are also stand-alone versions of the Disk Formatter, Installer, FIXUP and PCOPY.

**stand-among program** A version of stand-alone program reconfigured to run under AOS/VS. There are stand-among versions of the Disk Formatter, Installer, FIXUP, and PCOPY. The advantage of the stand-among programs is that you need not shut down AOS/VS to run them (but they cannot be run on the master LDU).

**STR** See software trouble report.

**streaming tape unit** A tape unit that performs well (streams) when data arrives at a specific rate. If the data arrives too slowly or too fast, the unit doesn't stream; I/O can take 10 times as long as when the unit does stream. Streaming tapes don't need vacuum drives and large motors, and they are less expensive than other types (other types being MTB and MTD). Streaming tape units available with AOS/VS include reel-to-reel and cartridge models (both are type MTC units).

**subslice** The time interval between scheduler runs. A hardware timer called a PIT (programmable interval timer) generates an interrupt every 32 milliseconds, telling the scheduler to run. Nearly always, a different process gets CPU control after the scheduler runs.

**Superprocess** A privilege that allows a user process to control any process on the system. You can turn Superprocess on (if you have the privilege) via the command `SUPERPROCESS ON`.

**Superuser** A privilege that allows a user to bypass file access controls and access any file on the system. You can turn Superuser on (if you have the privilege) via the command `SUPERUSER ON`.

**support organization** The DG group or person with whom you have a contract for help and support. Inside the US, this is usually the Atlanta support center. Outside the US, it is often your local systems engineer.

**SWAP** An AOS/VS directory used for virtual/main memory swapping; an integral part of AOS/VS memory management.

**swapping** Action that AOS/VS takes to handle memory contention. When a set of processes is too large to fit into memory at once, AOS/VS makes room as follows: it fits the working sets of some processes into memory, stores the working sets of others in swap files (directory :SWAP) and rotates processes in and out of memory.

Swapping lets AOS/VS keep a group of processes that runs efficiently in memory, avoiding page faults and thrashing. In typical worse-cases comparison, with a large process, handling a page fault takes about 0.1 second, while swapping takes about 0.5 second — five paging operations equal a swap. A major disadvantage of swapping is that a process in memory may need to communicate with a swapped process — and must wait until the swapped process swaps back in. This slows response significantly.

**SWAT** DG's high-level language debugger, that works with AOS/VS COBOL, FORTRAN 77, PASCAL, C, and PL/I.

**switch** A slash (/) followed by a value. Switches change the meaning of a command or action performed on its arguments; they are a major feature of AOS/VS and AOS programs.

**switched line** A normal telephone line, which makes connections via normal telephone switching stations. It is less expensive (and slower) than a dedicated telephone line.

**symbol table file** A file, built by Link when it builds a program file, that identifies all symbols used in the program. Symbol table files are needed for debugging programs or patching program files. These files are *not* needed for normal program execution. Standard symbol table files have the suffix .ST; SWAT debugger symbol table files have the suffixes .DS and .DL.

**synchronous line** A communications line that uses a synchronous protocol to transmit or receive data. Synchronous lines are often used for high speed and/or long distance communication between computer systems. They are faster than asynchronous lines but require more system overhead.

**system bootstrap (SYSBOOT)** The program that — after it's been read into memory by the hardware disk bootstrap — loads microcode if needed and starts an AOS/VS system, diagnostics, or stand-alone program (like FIXUP). Both disk and system bootstraps are needed to start any program from an LDU. The Installer program can install both of them, in addition to installing an AOS/VS system.

**system console** The console connected directly to the CPU. User consoles are not connected *directly*, but through a multiplexor that sorts incoming and outgoing data flow.

**system engineer** A DG engineer whose primary expertise is software, and secondary is hardware. Field engineers generally handle hardware.

**system tape (AOS/VS and MV/n)** See magnetic tape.

**template** (1) A template is shorthand for part of a filename, used with one of the template characters (+, -, \, #), to access one or more files. For example, the template FOO+ matches all filenames that begin with the characters FOO in a specified directory.

(2) A template is a cardboard or plastic strip that fits on or next to the topmost group of keys on the keyboard (function keys), labeling them.

**timeslice** A unit of time that includes from 1 to 64 subslices. It is the amount of time AOS/VS expects a group 2 process to last without blocking. If a process lasts without blocking for more than its timeslice, AOS/VS reduces its internal priority, thus penalizing it in relation to other group 2 processes. If a process blocks before its timeslice expires, AOS/VS raises its internal priority, giving it CPU preference over other group 2 processes.

Thus, the scheduling arrangement for group 2 processes favors highly interactive processes (which have many blocking events as people pause for thought). This arrangement is not ideal for noninteractive (batch type) processes, which have *few* blocking events. The latter processes will run better as group 1 or group 3 processes. You can have the PED program display a process timeslice *exponent* (subslices power of 2). For example, a timeslice exponent of 3 means that AOS/VS expects the process to last eight subslices without blocking.

**TCB (Trusted Computing Base)** The components of a computer system (hardware, software, and firmware) that people rely upon to operate securely. On an MV/Family system with AOS/VS, the TCB includes the computer, disk units, system console, tape units (perhaps), AOS/VS tailored system, PMGR, Agent, EXEC, PREDITOR, and CLI.

**TCP/IP** A network protocol; *see* Internet.

**thrashing** A condition in which the scheduler has the system spending most of its time reading or writing pages. AOS/VS is doing little or no useful processing. It copes by exclusively swapping (not paging) processes.

**Trojan horse** A program designed to do something useful for a site — and does this — but also does things it was not authorized to do, like gather confidential information, such as passwords, for its author.

**trusted computer system** A computer system — hardware, software, and firmware — with access controls secure enough to let it process sensitive information.

**UDA (user data area)** A storage area, associated with a file but not part of the file, that can contain user data for programs to read and act on. Often, the user data are print control characters that specify how the file will be printed. You can create, edit, and delete a file UDA with the FCU utility.

**UNIX** An operating system developed — along with the C programming language — by Bell Labs during the 1970s. Bell made UNIX available to the general public, and it evolved to run on many different manufacturers' systems. It's popular largely because it runs on so many different systems.

**user data area** *See* UDA.

**user directory** The directory created and maintained for each interactive user. Usually, this becomes the working directory when the user logs on. It can have subordinate directories.

**user directory directory (:UDD)** The AOS/VS directory that contains each user directory.

**User ID** The term for username in CEO.

**user profile** A disk file, created via the PREDITOR utility, that contains each user's username, password, disk space allowance, and other privilege specifications.

**user, system** Anyone who (in any capacity) has logged onto an AOS/VS system. This can be programmer, manager/operator seeking information, or nontechnical person.

**username** The name under which an AOS/VS user logs on; specified to the PREDITOR utility. The username is also the name of the user directory.

**UTIL** The utilities directory, contains most (if not all) utility programs on the system. UTIL's pathname, :UTIL, is often found in search lists.

**utility, utility program** A program supplied by DG to help you generate systems or build programs — for example, the Disk Formatter, PED, and Link.

**virtual console** A device entry on an AOS/VS system that allows remote AOS/VS or AOS users to log on as if they were on a local console; provided by XODIAC network VTA (Virtual Transfer Agent). VTA's virtual consoles are unrelated to real consoles; for example, an AOS/VS system running 40 real consoles for 40 local users can also run virtual consoles for remote users.

**volatile memory** Memory whose contents are lost when power goes down. Semiconductor RAM memory (which holds the SCP and AOS/VS operating systems) is volatile. ROM memory is nonvolatile.

**volume ID or valid** A six-character identifier written in the initial label of a labeled tape (by LABEL utility or PCOPY or MSCOPY program) or a diskette (by CLI, LABEL program, or PCOPY). Along with other things, the volume ID helps the system keep track of the tape/diskette volumes in a fileset.

**VSGEN** A program that allows you to create AOS/VS operating systems tailored to your needs.

**VTA** The XODIAC network Virtual Terminal Agent. It enables people to log on to a remote computer system.

**warm start** Startup in which power has remained on to the CPU.

**Wastebasket (CEO)** A location where CEO places deleted documents. Users can retrieve deleted documents from their Wastebaskets until someone runs the CEO Janitor program.

**windowing** An option on systems with pixel-mapped (graphics) consoles. Windowing lets a user run one or more processes at the same time and do I/O to each in separate rectangular areas on the console screen.

**working directory** The directory where you are; the current directory.

**working set** The number of 2,048-byte memory pages a process is using and has in main memory. PED displays the working set size in column WSS.

**X.25** The XODIAC network management support process, which runs all other network operations. X.25 is the name of an international standard for intercomputer communications.

**XLPT** Name of EXEC's cooperative process that manages printers and other spooled devices.

**XODIAC** DG's networking system, which allows an AOS/VS or AOS system to communicate with other DG systems in a private or local area network. XODIAC also allows DG systems to participate in a Public Data Network like TELENET. *See also* Internet.

End of Glossary





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