# VAXft Systems Mini-Reference Guide

Order Number EK-VXFT1-HR.003

**Digital Equipment Corporation**

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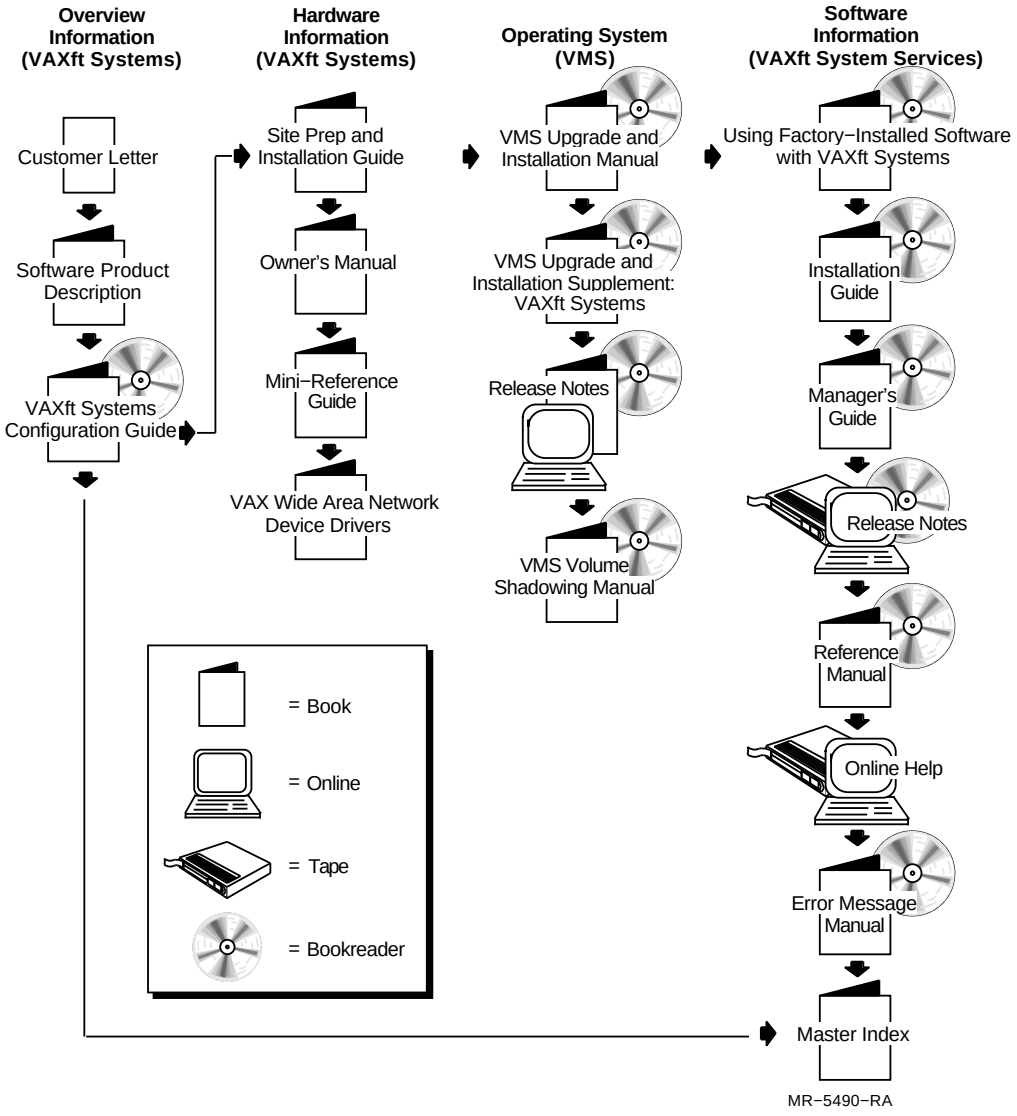
# VAXft Systems Documentation Road Map



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# About This Manual

## Intended Audience

This manual is intended for use by Digital Customer Services and other qualified personnel responsible for operating or maintaining a fault-tolerant VAXft system.

## Document Structure

This manual provides general system information. It is made up of the following chapters:

- **Chapter 1, Controls and Indicators —** Explains the use of the cabinet operating controls.
- **Chapter 2, Console Operation —** Summarizes the CIO mode and MIO mode console commands and describes the BOOT command syntax.
- **Chapter 3, System Registers —** Summarizes system address space and lists the operating registers.

## Related Documentation

The VAXft documentation set includes the following manuals:

- *VAXft Systems Site Preparation and Installation Guide* (EK-VXFT1-IN)—Provides site preparation guidelines and the system specifications. Describes how to install, boot, and verify the system. Provides procedures for removing, handling, and replacing the logic modules, and for removing and replacing the system drives.
- *VAXft Systems Owner's Manual* (EK-VXFT1-OM)—Provides a functional description of the VAXft system. Describes the system controls and indicators, console commands, bootstrap functions, and tape drive operation. Provides procedures for removing and replacing

the system drives and for removing, handling, and replacing the logic modules.

- *VAXft Systems Mini-Reference Guide* (EK-VXFT1-HR)—Provides summaries of the system controls and indicators, console operation, console commands, bootstrap functions, and system registers.

## Additional Documentation

Other documents related to the VAXft system include:

- *VAXft Systems Guide to VAX Fault Tolerant Systems*—Describes the VAXft system and describes fault-tolerant computing.
- *VAX Wide Area Network Device Drivers*—Describes the software utilities used in wide area network communications.
- *VAXft System Services Installation Guide*—Provides step-by-step procedures for installing the VAXft system services software on your VAXft system.
- *VAXft System Services Manager's Guide*—Describes the VAXft system and the VAXft system services software. Provides information on managing a fault tolerant system that is running VAXft system services software.
- *VAXft System Services Release Notes*—Provides information related to the current version of VAXft system services. Provides additional information for installing and maintaining your VAXft system.
- *VAXft System Services Reference Manual*—Provides reference information on VAXft system services operation. Describes the DCL commands used on a VAXft system.
- *VAXft System Services Online Help*—Provides information about using the VAXft system services specific information and the DCL commands used on a VAXft system.
- *VAXft System Services Error Message Manual*—Provides descriptions of error messages that may be encountered in using VAXft system services. Provides a reference for fault tolerant and system error messages.
- *VAXft System Services Master Index*—Provides a complete index for the software documentation set.

- *VMS Upgrade and Installation Manual*—Describes the installation and upgrade procedures for the current release of the VMS operating system. Provides information on the user environmental test package (UETP).
- *VMS Upgrade and Installation Supplement: VAXft Systems*—Supplements the *VMS Upgrade and Installation Manual* with information specific to the VAXft computer including startup, shutdown, and backup procedures.
- *VMS Release Notes*—Provides notes on various aspects of the VMS operating system.
- *VMS Volume Shadowing Manual*—Provides an in-depth discussion of volume shadowing (phase II), shadow sets, the mount utility, and DCL commands used to mount, monitor, and dismount volume shadow sets.

# 1
# Controls and Indicators

This chapter explains the use of the controls and indicators on the cabinet summary panels.

This chapter includes:

- Cabinet access
- System cabinet summary panel
- Expander cabinet summary panel

## 1.1 Cabinet Access

All operating and service access takes place from the front of the system.

### 1.1.1 Model 310 and 410 Systems

Figure 1–1 identifies the front doors and base cap on the computer cabinets.

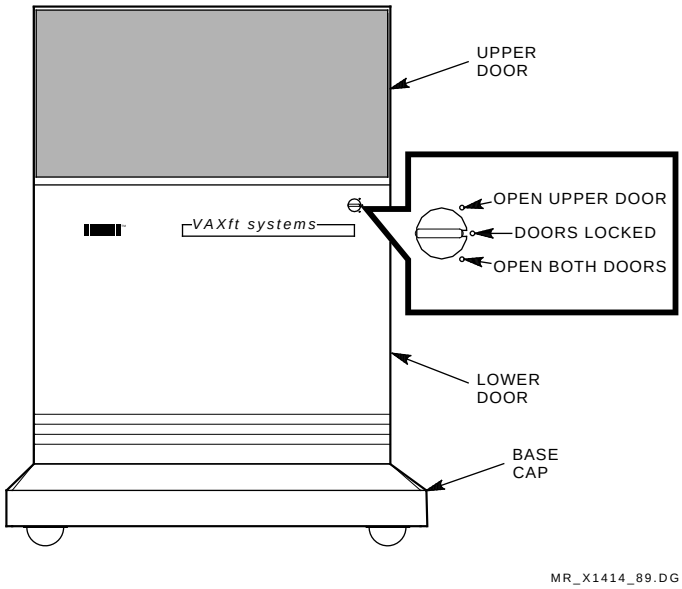



**Figure 1–1 Model 310 or 410 System Cabinet, Front View**

Figure 1–1 also shows the front panel latch and its functions. (The upper door may be opened by itself or both doors may be opened together.) A key (PN 12-17119-01), supplied with each cabinet must be used to turn the latch.

- The upper door provides access to the summary panel and cannister drives.
- The lower door is opened only for maintenance purposes. The lower door provides access to the cables and main circuit breaker in each cabinet, logic modules in the system cabinets, and carrier disk drives in the expander cabinets.

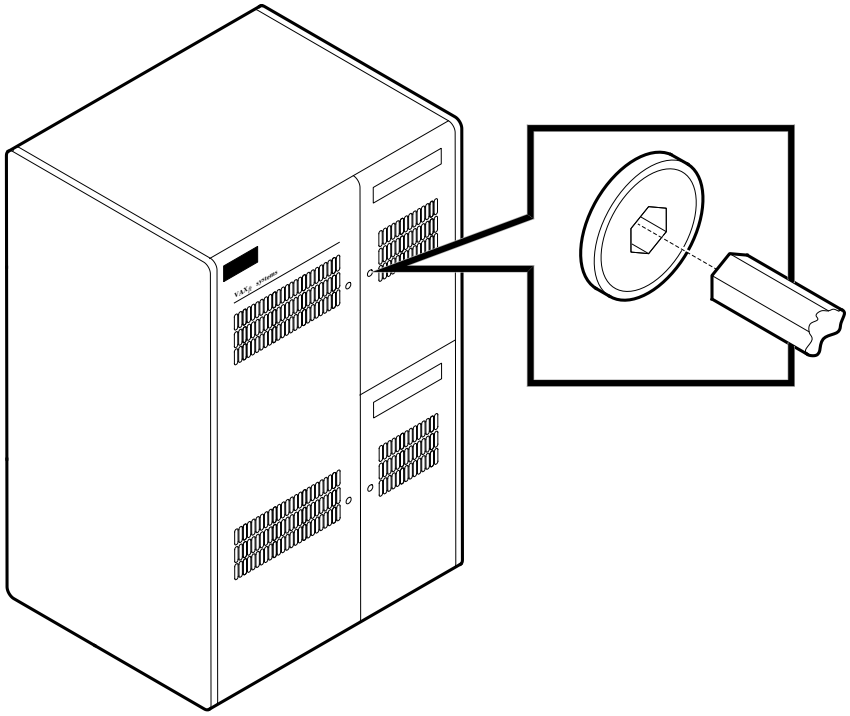
  **CAUTION**
  **Installation and maintenance procedures may be performed only by qualified personnel. They must be familiar with the electrostatic discharge (ESD) procedures and power procedures for the VAXft system.**

- The base cap provides additional access for routing and installing cables.

  **WARNING**
  **A cabinet may weigh as much as 118 kg (260 lb) and is too heavy to be handled by one person. At least two people are required to move a cabinet.**

### 1.1.2 Model 610 and 612 Systems

Figure 1–2 identifies the front doors on the computer cabinets.



MR-0423-91DG

**Figure 1–2 Model 610 or 612 System Cabinet, Front View**

Figure 1–2 also shows the key (supplied with the system) used to turn the latch.

- The upper door provides access to zone A of the system or expander cabinet.
- The lower door provides access to zone B of the the system or expander cabinet.

**CAUTION**

**Installation and maintenance procedures may be performed only by qualified personnel. They must be familiar with the electrostatic discharge (ESD) procedures and power procedures for the VAXft system.**

**WARNING**

**A cabinet may weigh as much as 433 kg (956 lb) and is too heavy to be handled by one person. At least two people are required to move a cabinet.**

## 1.2 System Cabinet Summary Panel

Figure 1–3 shows the layout of the summary panel in the system cabinets. Each switch is labeled as left or right to indicate the disk drive it controls. (The switches have no effect on a TF-series tape drive.)

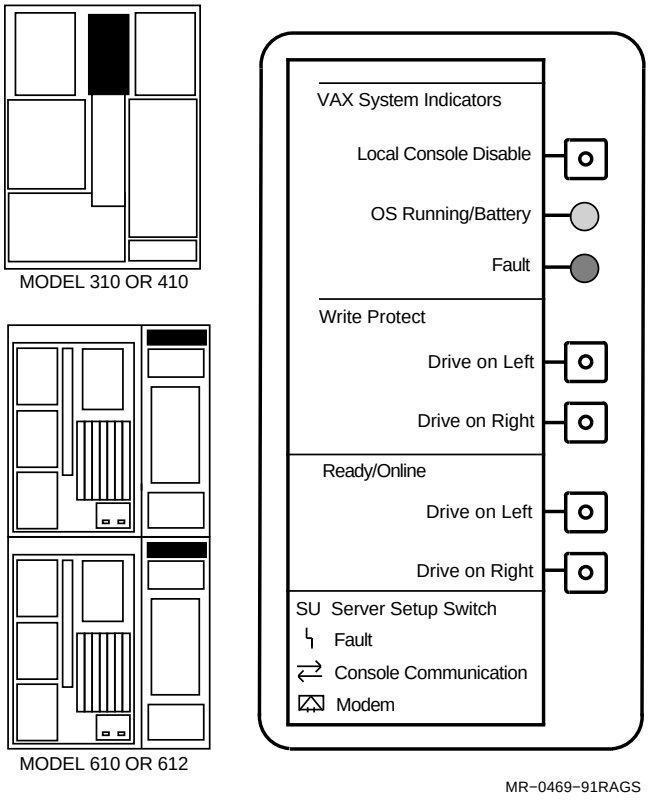



**Figure 1–3 System Cabinet Summary Panel**

Table 1–1 describes the functions of the system cabinet summary panel elements.

**Table 1–1 System Cabinet Summary Panel Elements**

| Element | Function |
|---|---|
| Local Console Disable | Two-position switch with amber indicator. Enables or disables the Break key function for the local console terminal. (The switch has no effect on the remote console terminal. Full access privileges for the remote operator are set by the local operator.)<br><br>When the switch is released (OFF, button out), the Break key function is enabled and the indicator is dark (unlit). The local operator may leave program I/O (PIO) mode and enter console I/O (CIO) mode by pressing the Break key. The console returns the >>> prompt.<br><br>When the switch is pressed in (ON), the Break key function is disabled and the indicator is amber (lit). If the Break key is pressed, the Break character is passed to the operating software. |
| OS Running/Battery | Green indicator. When the indicator is green (lit), the operating software is running. When the indicator is dark (unlit), the operating software is not running (the processor may be running the console firmware). When the indicator is blinking, the system cabinet is running on battery power. |
| Fault | Red indicator. The normal state of the indicator is dark (unlit). When the indicator is blinking quickly, a logic problem is present. When the indicator is blinking slowly, a power system problem is present.<br><br>The MFI of the faulty device may also indicate the fault. The normal state of an MFI is dark (reset). |

**Table 1–1 (Cont.) System Cabinet Summary Panel Elements**

| Element | Function |
|---|---|
| Write Protect[1] | Two-position switches with amber indicators. The switches enable or disable the associated drives for writes by the software. When pressed in, a switch disables writes to the drive and the indicator is amber (lit). When released (button out), a switch enables writes to the drive and the indicator is dark (unlit). |
| Ready/On Line[1] | Two-position switches with green indicators. The switches enable or disable the associated drives for acceptance of commands from software. When the switch is released (button out), the drive is enabled. When it is pressed in, the drive is disabled. When the indicator is green (lit), the associated drive is up to speed. When it is dark (unlit), the drive is not up to speed or does not have power applied. |

[1]The Write Protect and On Line switches control the RF-series disk drives and have no effect on a TF-series tape drive. TF-series protection is set by a write-protect switch on the TK tape cartridge.

## 1.3 Expander Cabinet Summary Panel

Figure 1–4 shows the layout of the summary panel in the expander cabinets. The upper and lower switches are labeled from left to right as X through 5 to indicate the disk drives they control. (The switches have no effect on a TF-series tape drive.)

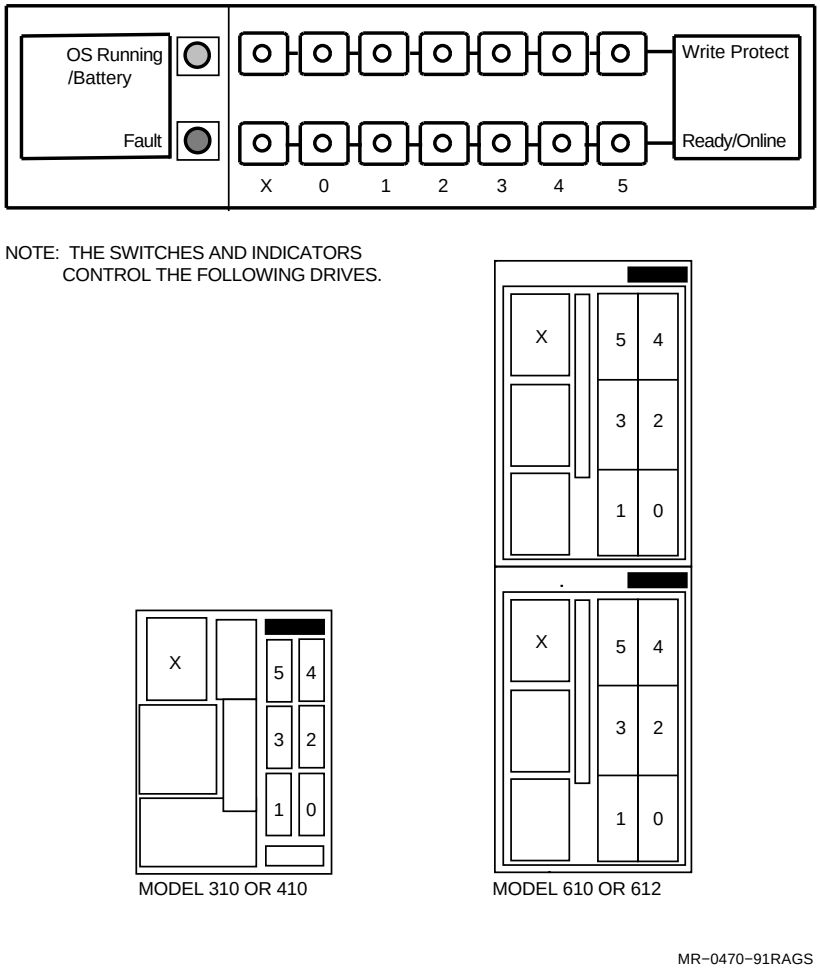



**Figure 1–4 Expander Cabinet Summary Panel**

Table 1–2 describes the functions of the expander cabinet summary panel elements.

**Table 1–2 Expander Cabinet Summary Panel Elements**

| Element | Function |
|---|---|
| OS Running/Battery | Green indicator. When the indicator is green (lit), the cabinet is running on ac power. When the indicator is blinking, the system cabinet is running on battery power. |
| Fault | Red indicator. The normal state of the indicator is dark (unlit). When the indicator is blinking, a fault is present.<br><br>The MFI of the faulty device may also indicate the fault. The normal state of an MFI is dark (reset). |
| Write Protect[1] | Two-position switches with amber indicators. The switches enable or disable the associated drives for writes by the software. When pressed in, a switch disables writes to the drive and the indicator is amber (lit). When released (button out), a switch enables writes to the drive and the indicator is dark (unlit). |
| Ready/On Line[1] | Two-position switches with green indicators. The switches enable or disable the associated drives for acceptance of commands from software. When the switch is released (button out), the drive is enabled. When it is pressed in, the drive is disabled. When the indicator is green (lit), the associated drive is up to speed. When it is dark (unlit), the drive is not up to speed or does not have power applied. |

[1]The Write Protect and On Line switches control the RF-series disk drives and have no effect on a TF-series tape drive. TF-series protection is set by a write-protect switch on the TK tape cartridge.

# 2
# Console Operation

This chapter briefly describes the console modes. It lists CIO and MIO mode console commands and describes system booting.

This chapter includes:

- Console modes and mode change commands
- CIO mode console command summary
- MIO mode console command summary
- Control and function keys
- BOOT command
- BOOT devices

## 2.1 Console Modes and Mode Change Commands

Console operators communicate with the system in one of the three input/output (I/O) operating modes shown in Figure 2–1.

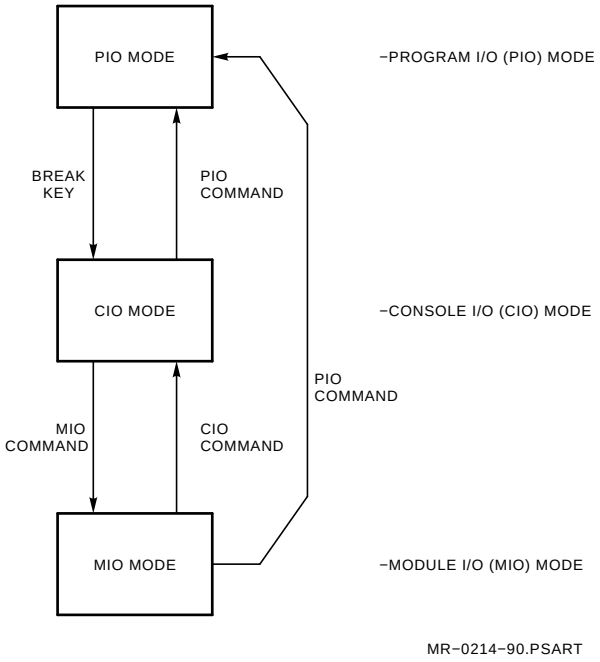



**Figure 2–1 Console Modes and Mode Change Commands**

**PIO Mode —** Program I/O mode may be entered from *either* of the other modes. To enter PIO mode, use one of these commands: SET TERMINAL PROGRAM or PIO.

In PIO mode, all keyboard characters are passed to the operating software. For a remote operator to use PIO mode, full access privileges must be set by the local operator.

**CIO Mode —** Console I/O mode may be entered from PIO mode by pressing the Break key. First, be sure the Local Console Disable switch on the summary panel is released (button out). Then press the Break key on the console terminal. If the Local Console Disable switch is set (button in), the Break character is passed to the operating software like any other character.

CIO mode may be entered from MIO mode by using the CIO command.

To recognize and process CIO mode console commands, the operating software must be halted and the processor must be running the console firmware. If you enter a CIO command (except for HALT) with the operating software running, an error message returns.

**CAUTION**

**To accept the CIO mode console commands, the processor must be halted. Any attempt to access the system registers while the system is running may cause the system to crash. All operators with appropriate privileges may halt, start, or continue the operating software from CIO mode.**

**MIO mode —** Module I/O mode cannot be entered directly from PIO mode. MIO mode may be entered *only* from CIO mode. To enter MIO mode, use the MIO command.

MIO mode console commands affect only the console; the processor may be running or halted. For a remote operator to use MIO mode, full access privileges must be set by the local operator.

## 2.2 CIO Mode Console Command Summary

Table 2–1 briefly describes the CIO mode console commands.

**Table 2–1 CIO Mode Console Command Summary**

| Command | Function |
|---|---|
| BOOT [/qualifier] [device list] [/qualifier] | |
| Qualifier: | /R5:n |
| Devices: | Disk (DI), tape (MI), Ethernet (EP) |
| Function: | Initializes the system, and then loads and starts the VMB program from ROM. |
| BOOT name | Initializes the system, and then invokes a stored boot command specified by the 1- to 4-character symbolic name. |
| CONTINUE | Resumes execution from the point where the system halted. |
| DEPOSIT [/qualifier] address data [/qualifier] | |
| Qualifiers: | /B /W /L /P /V /I /G /N:*count* |
| Function: | Stores the specified data in the specified address. |
| EXAMINE [/qualifier] address [/qualifier] | |
| Qualifiers: | /B /W /L /P /V /I /G /N:*count* |
| Function: | Displays the data stored in the specified address. |
| HALT | Suspends execution and causes the processor module to invoke the processor console firmware. |
| INITIALIZE | Initializes the system to its power-on state. |
| MIO | Changes the console mode from CIO to MIO. |

**Table 2–1 (Cont.) CIO Mode Console Command Summary**

| Command | Function |
|---|---|
| NEW CPU | Updates a new processor module with system information from the processor module located in the partner zone.<br><br>The NEW CPU command is used only by qualified maintenance personnel. |
| PIO | Changes the console mode from CIO to PIO. |
| REPEAT command | Continuously executes the specified console command until the operator types Ctrl/C. The command may be any CIO command except TEST Z (KA550 only), REPEAT, CIO, PIO, MIO, HALT, SHOW, or SET.<br><br>The REPEAT command is used only during maintenance procedures. |
| SET BOOT name [/qualifier] [device list] [/qualifier] | |
| Qualifier: | /R5:n |
| Function: | Names and stores a boot command in EEPROM. |
| SET [/P] PORT /qualifier(s) | Sets the operating parameters for the terminal port issuing the command. |
| SET TERMINAL PROGRAM | Sets the I/O mode for the terminal issuing the command. |
| SET ZONE option | Establishes the zone configuration as either zone A or zone B. The zone configuration is always stored in the EEPROM of the zone issuing the command.<br><br>The SET ZONE command is used only during installation and maintenance procedures. After a SET ZONE, you must initialize the system. |
| SHOW option | Displays the system operating parameters. |

**Table 2–1 (Cont.) CIO Mode Console Command Summary**

| Command | Function |
|---|---|
| SHOW BOOT | Identifies the zone and issuing terminal (0 = local, 1 = remote), and displays the settings for all stored boot commands. |
| SHOW CONFIGURATION | Displays a table of the modules in the backplane. |
| SHOW CPU | Displays the ROM version of the CPU and the primary CIO module. |
| SHOW ETHERNET | Displays the physical Ethernet address. |
| SHOW PORT | Displays the port address. |
| SHOW ALL | Displays boot, configuration, CPU, and Ethernet parameters. |
| START [address] | Begins execution of the operating software from the specified address or, if the address is omitted, at the PC contents that were saved on the previous HALT. If memory management is enabled, the address is virtual. If memory management is not enabled, the address is physical. |
| TEST [/RBD] | Invokes the RBD monitor on the processor module.<br>The TEST command is used only by qualified maintenance personnel. |
| Z n | Invokes the RBD monitor on any system logic module except for the primary system I/O controller module, processor module, or a memory module. The n specifies the slot ID number of an approved I/O or adapter module in the backplane of the local zone.<br>The Z command is used only by qualified maintenance personnel and cannot be used to go to another zone. |

The address specifier used with the DEPOSIT and EXAMINE commands may be a 1- to 8-character hex address or may specify one of the symbolic addresses listed in Table 2–2.

**Table 2–2 Symbolic Addresses for DEPOSIT and EXAMINE**

| Symbol | Name or Function |
|---|---|
| PSL | Processor status longword. The address space qualifier is not allowed when PSL is used as the symbolic address. |
| PC | Program counter. |
| SP | Stack pointer. |
| FP | Frame pointer. |
| AP | Argument pointer. |
| R*n* | General register number *n* in decimal notation. |
| + (plus) | The location following the last location accessed by an EXAMINE or DEPOSIT. For references to physical or virtual memory, the accessed location is the last address *plus* the size of the last reference. For all the other addresses (IPRs and GPRs), the location is the last address plus 1. |
| - (minus) | The location preceding the last location accessed by an EXAMINE or DEPOSIT. For references to physicial or virtual memory, the accessed location is the last address *minus* the size of the last reference. For all the other addresses (IPRs and GPRs), the location is the last address minus 1. |
| * (asterisk) | The last location referenced by an EXAMINE or DEPOSIT. |

## 2.3 MIO Mode Console Command Summary

Table 2–3 briefly describes the MIO mode console commands.

**Table 2–3 MIO Mode Console Command Summary**

| Command | Function |
|---|---|
| CIO | Changes the console mode from MIO to CIO. |
| DIALOUT | Invokes the console autonotification process.<br><br>The DIALOUT command is used only during maintenance procedures. |
| DISABLE REMOTE | Disables all remote terminal console privileges. Has the same function as the SET REMOTE OFF command.<br><br>If the remote terminal is connected directly to the system I/O module, the remote terminal becomes inactive. If the remote connection is made through a modem, the command does not take effect until the remote terminal breaks the connection. Dial-in access is also disabled. |
| ENABLE REMOTE [USER] | Enables remote terminal console privileges. Without the USER option, this command has the same function as the SET REMOTE FULL command, enabling all privileges including dial-in access through a modem.<br><br>With the USER option, this command has the same function as the SET REMOTE SECURE command, enabling access for the remote operator, but only in PIO mode. If the remote terminal is in any other mode, the command does not take effect until the operator enters the PIO mode. |

**Table 2–3 (Cont.) MIO Mode Console Command Summary**

| Command | Function |
|---|---|
| HANGUP | Breaks the remote console terminal telephone connection by deasserting the data terminal ready (DTR) signal. |
| PIO | Changes the console mode from MIO to PIO. |
| RBD | Invokes the RBD monitor on the primary system I/O controller module. Has the same function as the TEST/RBD command.<br><br>The RBD command is used only by qualified maintenance personnel. The RBD command must not be used while the operating system is running. |
| SET [/P] [/qualifier] option parameter | |
| | Establishes the console settings. Without the /P qualifier, the command stores the setting in volatile memory. With the /P qualifier, the command stores the setting both in volatile memory and in EEPROM. |
| SET [/P] LANGUAGE option | |
| Function: | Sets the console error message output. |
| Options: | ENGLISH, INTERNATIONAL |

**Table 2–3 (Cont.) MIO Mode Console Command Summary**

| Command | Function |
|---|---|
| SET [/P] LOCAL /qualifier(s) | |
| Function: | Sets the operating parameters for the local terminal port. |
| Qualifiers: | /BREAK, /NOBREAK; /UPPER, /LOWER; /HARDCOPY, /NOHARDCOPY; /SCOPE, /NOSCOPE; /SYNC_IN, /NOSYNC_IN; /SYNC_OUT, /NOSYNC_OUT; /SPEED=*rate* |
| | Valid baud rates are: 300, 600, 1200, 2400, 4800, 9600 (default), and 19200. |
| SET [/P] MODEM_TYPE option | |
| Function: | Defines the type of connection between the remote terminal and the system I/O module. |
| Options: | NONE (direct connection), V22 |
| SET [/P] NOTIFICATION option | |
| Function: | Sets the operating parameters for the autonotification process. The autonotification process is invoked when the system I/O module loses contact with the host operating system or when the DIALOUT command is issued. |
| Options: | See Table 2–4. |

**Table 2–3 (Cont.) MIO Mode Console Command Summary**

| Command | Function |
|---|---|
| SET [/P] PORT /qualifier(s) | |
| Function: | Sets the operating parameters for the terminal port issuing the command. |
| Qualifiers: | /BREAK, /NOBREAK; /UPPER, /LOWER; /HARDCOPY, /NOHARDCOPY; /SCOPE, /NOSCOPE; /SYNC_IN, /NOSYNC_IN; /SYNC_OUT, /NOSYNC_OUT; /SPEED=*rate* |
| | Valid baud rates are: 300, 600, 1200, 2400, 4800, 9600 (default), and 19200. |
| SET [/P] REMOTE option /qualifier(s) | |
| Function: | Sets the operating parameters and privileges for the remote terminal port. May be issued from any console terminal with full access privileges. Options and qualifiers cannot be issued in the same command. |
| Options: | FULL, SECURE, OFF |
| Qualifiers: | /BREAK, /NOBREAK; /UPPER, /LOWER; /HARDCOPY, /NOHARDCOPY; /SCOPE, /NOSCOPE; /SYNC_IN, /NOSYNC_IN; /SYNC_OUT, /NOSYNC_OUT; /SPEED=*rate* |
| | Valid baud rates are: 300, 600, 1200, 2400, 4800, 9600 (default), and 19200. |
| SET [/P] RESTART_ACTION option | |
| Function: | Defines the action the zone takes after an initialization or power-on sequence. |
| Options: | RESTART, BOOT, HALT |
| SET TERMINAL | Sets the I/O mode for the terminal issuing the command. Has the same function as the PIO command. |

**Table 2–3 (Cont.) MIO Mode Console Command Summary**

| Command | Function |
|---|---|
| SHOW [/P] option | |
| Function: | Displays the current settings for the specified option. Without the /P qualifier, the command displays the current settings stored in volatile memory. With the /P qualifier, the command displays the current settings stored in EEPROM. |
| Options: | LANGUAGE, LOCAL, NOTIFICATION[1], PORT, REMOTE, RESTART_ACTION, TERMINAL |
| TEST [/RBD] | Invokes the RBD monitor on the primary system I/O controller module. Without the /RBD qualifier, the command runs the power-on self-tests on the module. With the /RBD qualifier, the command has the same function as the RBD command.<br>The TEST command is used only by qualified maintenance personnel. |

[1]Display includes the MODEM_TYPE setting.

The SET NOTIFICATION options are listed in Table 2–4. An option specifier *must* be supplied. Quoted parameters *must* be entered within quotation marks (" ") as shown.

**Table 2–4 SET NOTIFICATION Command Options**

| Option | Function |
|---|---|
| P[hone_number] "number"[1] | |
| | The "number" is the phone number for the dial-out process. The quoted string is sent to the modem when autonotification is invoked.<br>Normal dial-outs use the phone number stored in volatile memory. Emergency dial-outs use the phone number stored in EEPROM. |

[1]The quoted string may consist of up to 255 ASCII characters if preceded by the escape (<ESC>) character (ASCII 27).

**Table 2–4 (Cont.) SET NOTIFICATION Command Options**

| Option | Function |
|---|---|
| M[essage] "message"[1] | |
| | The "message" is the message to be transmitted when the DIALOUT command is successful. |
| C[ountry] *name* | |
| | The *name* is the country from which a dialout message will occur. Each country has an associated retry count, retry delay, and disconnect timeout. Table 2–5 lists the countries you can select. The defaults are as follows:<br>• Retry count = 1<br>• Retry delay = 0<br>• Disconnect timeout = 60 |
| E[mergency_message] "message"[1] | |
| | The "message" is the message to be transmitted by the autonotification process if the I/O module loses communication with the processor module. |
| PARAM*n* "parameter"[1] | |
| | The "parameter" is one of three parameters (*n* = 1, 2, or 3) passed to the script interpreter for the dial-out procedure. |
| T[ransmit_delay] *value* | |
| | The *value* is a positive 0 to 255 (decimal) value representing the number of seconds the autonotification process waits before transmitting a message after data set ready (DSR) is asserted by the modem (indicating that the remote connection has been established). The value is also used as the delay after the message is sent before data terminal ready (DTR) is released. |

[1]The quoted string may consist of up to 255 ASCII characters if preceded by the escape (<ESC>) character (ASCII 27).

**Table 2–5 Dialout Countries**

| Country | Retry Count | Retry Delay | Disconnect Timeout |
|---|---|---|---|
| AL[geria] | 1 | 0 | 60 |
| AUSTRA[lia] | 10 | 120 | 61 |
| AUSTRI[a] | 10 | 120 | 90 |
| B[elgium] | 10 | 120 | 80 |
| C[anada] | 10 | 120 | 90 |
| D[enmark] | 10 | 120 | 61 |
| E[gypt] | 1 | 0 | 60 |
| FI[nland] | 4 | 120 | 90 |
| FR[ance] | 5 | 120 | 120 |
| G[ermany] | 8 | 120 | 90 |
| IR[eland] | 4 | 120 | 61 |
| IS[rael] | 4 | 300 | 61 |
| I[taly] | 4 | 300 | 61 |
| J[apan] | 10 | 300 | 61 |
| NET[herlands] | 10 | 120 | 61 |
| NEW[_zealand] | 4 | 300 | 61 |
| NO[rway] | 10 | 120 | 61 |
| P[ortugal] | 4 | 300 | 61 |
| SA[udi_Arabia] | 1 | 0 | 60 |
| SP[ain] | 4 | 300 | 61 |
| SWE[den] | 10 | 120 | 61 |
| SWI[tzerland] | 5 | 120 | 90 |
| UK | 7 | 120 | 61 |
| US[a] | 10 | 120 | 90 |

## 2.4 Console Control Characters

The ASCII control characters and function keys listed in Table 2–6 have special meanings when typed on a console terminal that is running in either CIO or MIO mode.

**Table 2–6 Console Control Characters and Function Keys**

| Character/Key | Function |
|---|---|
| Break | Causes the console to exit PIO mode and enter CIO mode. First, be sure that the Local Console Disable switch on the summary panel is released (button out). Then press the Break key on the console terminal. |
| Ctrl/C | Echoes ^C and causes the console to abort processing of a command. |
| Ctrl/O | Alternately enables and disables console output to the terminal. |
| Ctrl/R | Echoes ^R and retypes the command line. |
| Ctrl/S | Stops console transmission to the terminal until Ctrl/Q is typed. |
| Ctrl/Q | Resumes console output previously suspended by Ctrl/S. |
| Ctrl/U | Echoes ^U and erases the command line. |
| Esc or Ctrl/[ | Disables the meaning of the next character you type. This function is keyboard dependent. Refer to your terminal owner's manual. |
| Return | Terminates a command line and executes the command. |
| <x (delete) | Deletes the character to the left of the cursor. On a hard-copy terminal, use the rubout key. Refer to your terminal owner's manual. |
| Break Break | Enables autobaud. |

## 2.5 BOOT Command

The operating system may be booted using the syntax shown in Figure 2–2.

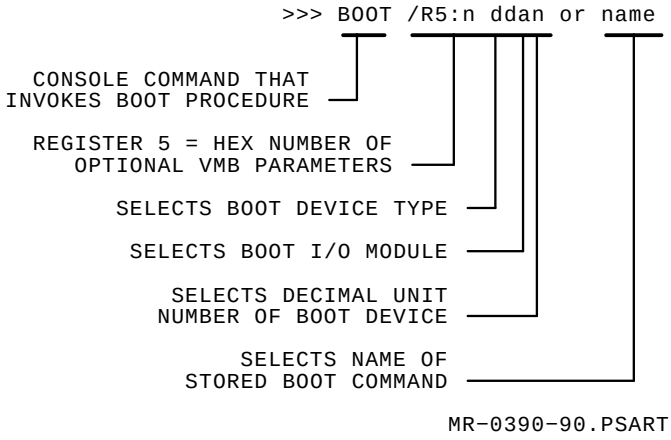



**Figure 2–2 BOOT Command Syntax**

Table 2–7 describes the /R5:n qualifier and two BOOT command options. Table 2–8 lists the VMB program control flag values for n.

**Table 2–7 BOOT Command Qualifier and Options**

| Qualifier/Option | Function |
|---|---|
| /R5:n | Register 5 parameter, where n is the hex value of a binary bit mask that selects one of the VMB program bootstrap options listed in Table 2–8. If /R5:n is omitted, the default value is 0. |
| ddan | Optional device specifier, takes the form ddan. Section 2.6 defines the variables for ddan.<br><br>The device specifier is used to identify the path(s) to the boot device(s). You may specify as many as four paths to one or more of the same type of device. Commas are used to separate these device specifiers. |
| name | Optional name specifier, invokes a stored BOOT command.<br><br>The name specifier must be a 1- to 4-character symbolic name for the stored boot command. Use of symbolic names that are the same as the device specifiers is *not* recommended. |

**Table 2–8 VMB Program Control Flags for /R5:n**

| Bit Position | Hex Value (n) | Flag Name/Function When Bit is Set |
|---|---|---|
| <0> | 1 | Conversational Boot — Returns the SYSBOOT> prompt. From this prompt, the console operator may enter SYSGEN parameters. |
| <1> | 2 | Debug — The operating system maps the XDELTA debugger into its system page tables. |
| <2> | 4 | Initial Breakpoint — The operating system executes a breakpoint (BPT) instruction after turning on memory management. |
| <5> | 20 | Bootstrap Breakpoint — The VMB and secondary bootstrap programs execute BPT instructions to transfer control to the XDELTA program. |
| <8> | 100 | Solicit File Name — The VMB bootstrap program prompts the console terminal for the secondary bootstrap procedure. |
| <31:28> | (0-F)000000 | Specify the top-level directory number for a system disk with multiple system roots. |

Table 2–9 provides some examples of BOOT and SET BOOT commands.

**Table 2–9 BOOT and SET BOOT Command Examples**

| Command Example | Function |
|---|---|
| **BOOT:** | |
| >>> BOOT /R5:4 DIA7 | General register R5 passes a value of 4 (hex) to the virtual memory bootstrap (VMB) program, setting bit <02>. Then the boot takes place from disk drive unit 7. |
| >>> BOOT DIA0, DIB1, DIF0, DIG1 | Four device specifiers are used, separated by commas. The system selects one or more of the paths to one or more of the boot devices. (See Section 2.6.) |
| >>> BOOT MAIN | The boot takes place from the stored boot command location called MAIN. |
| >>> BOOT | Without arguments, the boot takes place from the stored boot command location called DEFAULT. |
| **SET BOOT:** | |
| >>> SET /P BOOT MAIN /R5:4 DIA5 | Opens a stored boot command location called MAIN and stores the command both in volatile memory and in EEPROM. (If the SET BOOT had been issued without the /P qualifier, the command would be stored in volatile memory only.) |
| >>> SET /P BOOT DEFAULT /R5:4 DIA7 | Opens a stored boot command location called DEFAULT and stores the command both in volatile memory and in EEPROM. |
| >>> SET /P BOOT MAIN | Without arguments, the command clears the location called MAIN. |

## 2.6 BOOT Devices

The device specifier takes the form *ddan* where:

*dd* specifies the device type

MI is a TF-series tape drive
DI is an RF-series disk drive
EP is an Ethernet port

*a* specifies (using letters A through J) the zone and slot of the primary system I/O controller module as shown in Figure 2–3. Figure 2–3 also lists the correct module expansion sequence.

*n* specifies the decimal unit number of the boot device, which is the DSSI node ID number selected by the backplane.

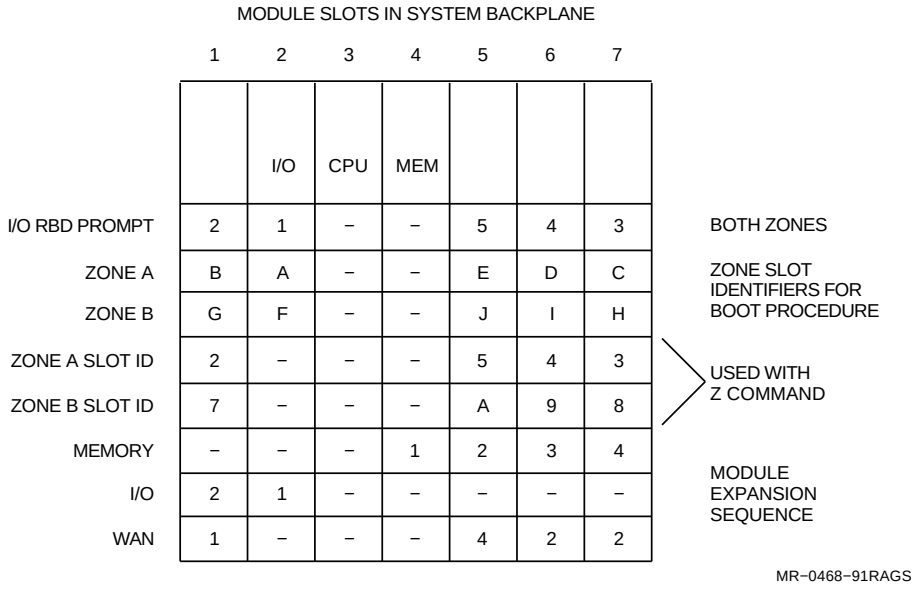



**Figure 2–3 I/O Module Zone/Slot Specifiers**

Figure 2–4 shows how the device specifiers select a system cabinet drive or Ethernet port in an entry-level system. (The summary panel controls the system cabinet drives as shown in Figure 1–3.) The drive unit numbers correspond to DSSI bus addresses that are hardwired on the drive backplanes. The left drive slot contains unit 5, and the right drive slot contains unit 7. DSSI bus address 6 is used by the primary I/O module in slot 2 of the logic backplanes. DSSI bus address 7 is used by the secondary I/O module in slot 1.

Figure 2–5 shows how the device specifiers select an expander cabinet drive in an expanded, dual access system. (The summary panel controls the expander cabinet drives as shown in Figure 1–4.) The drive unit numbers correspond to DSSI bus addresses that are hardwired on the drive backplanes. Units 0 through 4 are always carrier drives. Unit 5 may contain either a cannister drive or a carrier drive as an option. An expander cabinet does not support drives in both unit 5 slots. There are no system cabinet drives in an expanded, dual access system.

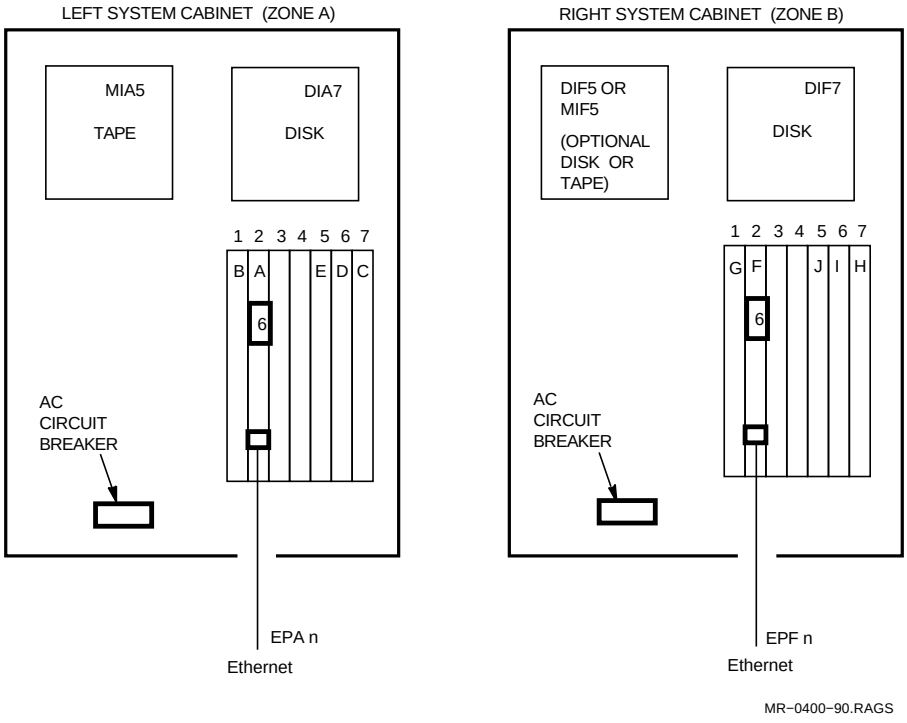



**Figure 2–4 System Cabinet Drive Specifiers**

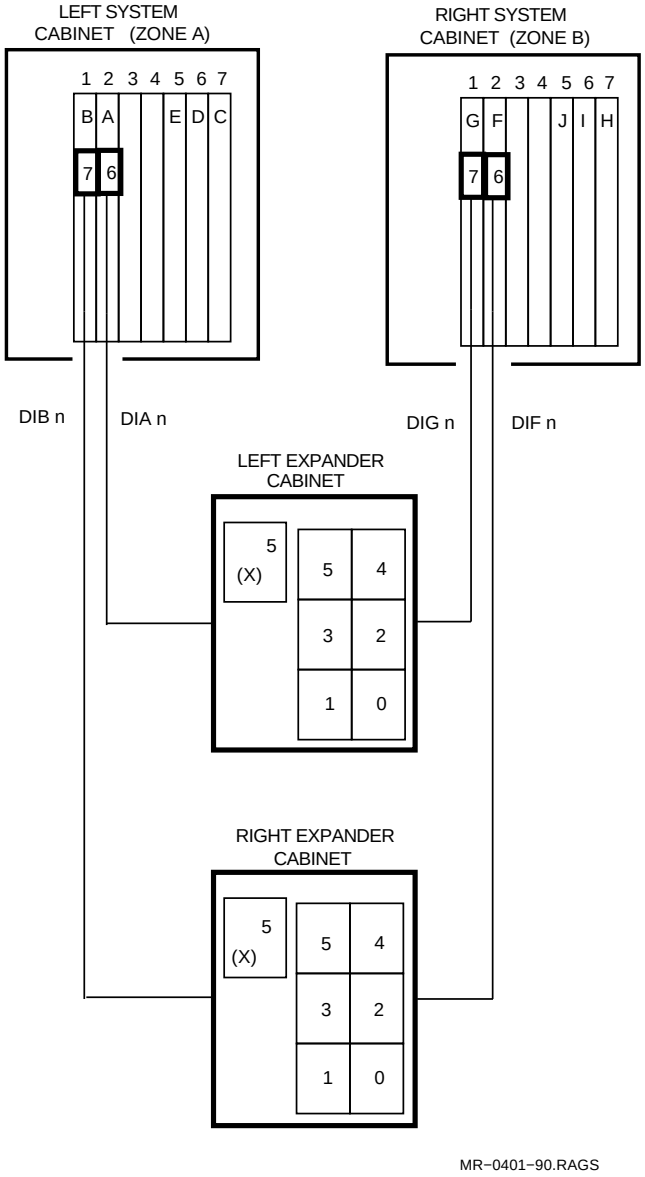



**Figure 2–5 Expander Cabinet Drive Specifiers**

# 3
# System Registers

This chapter contains illustrations of the system address space and lists the operating registers.

This chapter includes:

- Physical address space
- Processor status longword
- General purpose registers
- Internal processor registers
- System-specific registers
- Machine checks

## 3.1 Physical Address Space

Figure 3–1 shows the physical address space available in the VAXft system.

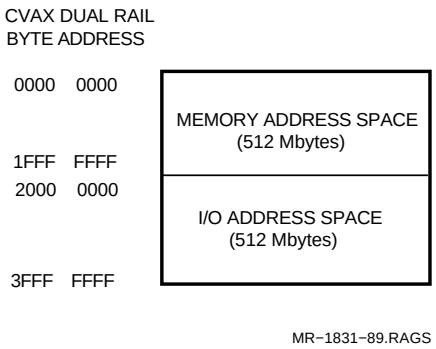



**Figure 3–1 Physical Address Space**

## 3.2 Processor Status Longword

Figure 3–2 is a bitmap showing the processor status longword.

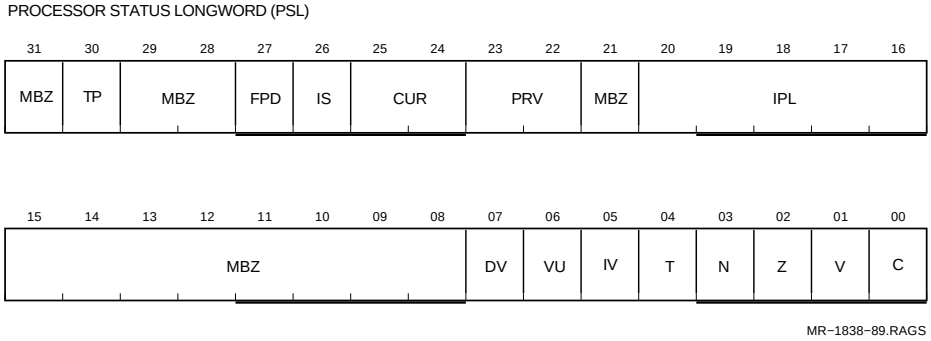



**Figure 3–2 Processor Status Longword**

## 3.3 General Purpose Registers

Table 3–1 lists the VAXft general purpose registers.

**Table 3–1 General Purpose Registers (GPRs)**

| Address | Mnemonic | Name |
|---|---|---|
| R0 | GPR0 | General Purpose Register 0 |
| R1 | GPR1 | General Purpose Register 1 |
| R2 | GPR2 | General Purpose Register 2 |
| R3 | GPR3 | General Purpose Register 3 |
| R4 | GPR4 | General Purpose Register 4 |
| R5 | GPR5 | General Purpose Register 5 |
| R6 | GPR6 | General Purpose Register 6 |
| R7 | GPR7 | General Purpose Register 7 |
| R8 | GPR8 | General Purpose Register 8 |
| R9 | GPR9 | General Purpose Register 9 |
| R10 | GPR10 | General Purpose Register 10 |
| R11 | GPR11 | General Purpose Register 11 |
| R12 | AP | Argument Pointer |
| R13 | FP | Frame Pointer |
| R14 | SP | Stack Pointer |
| R15 | PC | Program Counter |

## 3.4 Internal Processor Registers

Table 3–2 lists the VAXft internal processor registers.

**Table 3–2 Internal Processor Registers (IPRs)**

| Address | Mnemonic | Name | Type |
|---|---|---|---|
| IPR0 | KSP | Kernel Stack Pointer | R/W |
| IPR1 | ESP | Executive Stack Pointer | R/W |
| IPR2 | SSP | Supervisor Stack Pointer | R/W |
| IPR3 | USP | User Stack Pointer | R/W |
| IPR4 | ISP | Interrupt Stack Pointer | R/W |
| IPR5 to 7 | | Reserved | |
| IPR8 | P0BR | P0 Base Register | R/W |
| IPR9 | P0LR | P0 Length Register | R/W |
| IPR10 | P1BR | P1 Base Register | R/W |
| IPR11 | P1LR | P1 Length Register | R/W |
| IPR12 | SBR | System Base Register | R/W |
| IPR13 | SLR | System Length Register | R/W |
| IPR14, 15 | | Reserved | |
| IPR16 | PCBB | Process Control Block Base | R/W |
| IPR17 | SCBB | System Control Block Base | R/W |
| IPR18 | IPL | Interrupt Priority Level | R/W |
| IPR19 | ASTLVL | Asynchronous System Trap Level | R/W |
| IPR20 | SIRR | Software Interrupt Request Register | W |

**Table 3–2 (Cont.) Internal Processor Registers (IPRs)**

| Address | Mnemonic | Name | Type |
|---|---|---|---|
| IPR21 | SISR | Software Interrupt Summary Register | R/W |
| IPR22, 23 | | Reserved | |
| IPR24 | ICCS | Interval Clock Control/Status | R/W |
| IPR25 to 36 | | Reserved | |
| IPR37 | CADR | Cache Disable Register | R/W |
| IPR38 | | Reserved | |
| IPR39 | MSER | Memory System Error Register | R/W |
| IPR40, 41 | | Reserved | |
| IPR42 | SAVPC | Console-Saved PC | R |
| IPR43 | SAVPSL | Console-Saved PSL | R |
| IPR44 to 55 | | Reserved | |
| IPR56 | MAPEN | Memory Management Enable | R/W |
| IPR57 | TBIA | Translation Buffer Invalidate All | R |
| IPR58 | TBIS | Translation Buffer Invalidate Single | R |
| IPR59 to 61 | | Reserved | |
| IPR62 | SID | System Identification | R |
| IPR63 | TBCHK | Translation Buffer Check | W |
| IPR64 to 127 | | Reserved | |

## 3.5 System-Specific Registers

Figure 3–3 contains the system-specific register bitmaps.

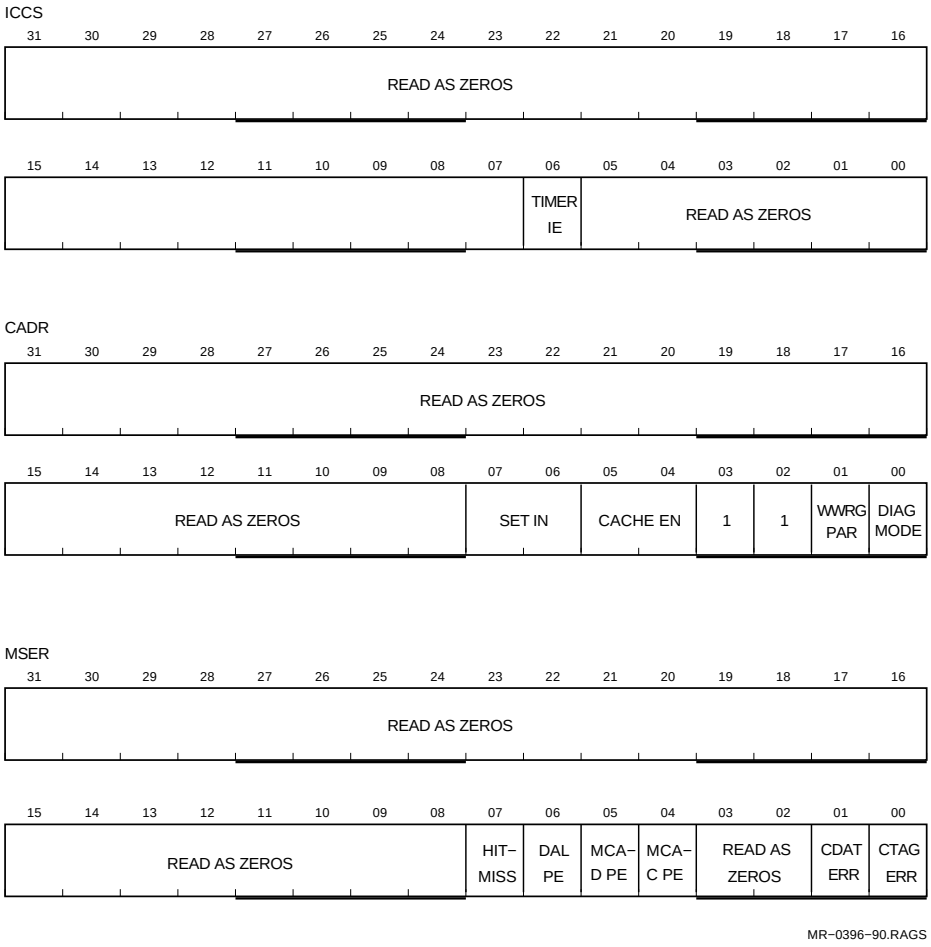



**Figure 3–3 (Cont.) System-Specific Registers**

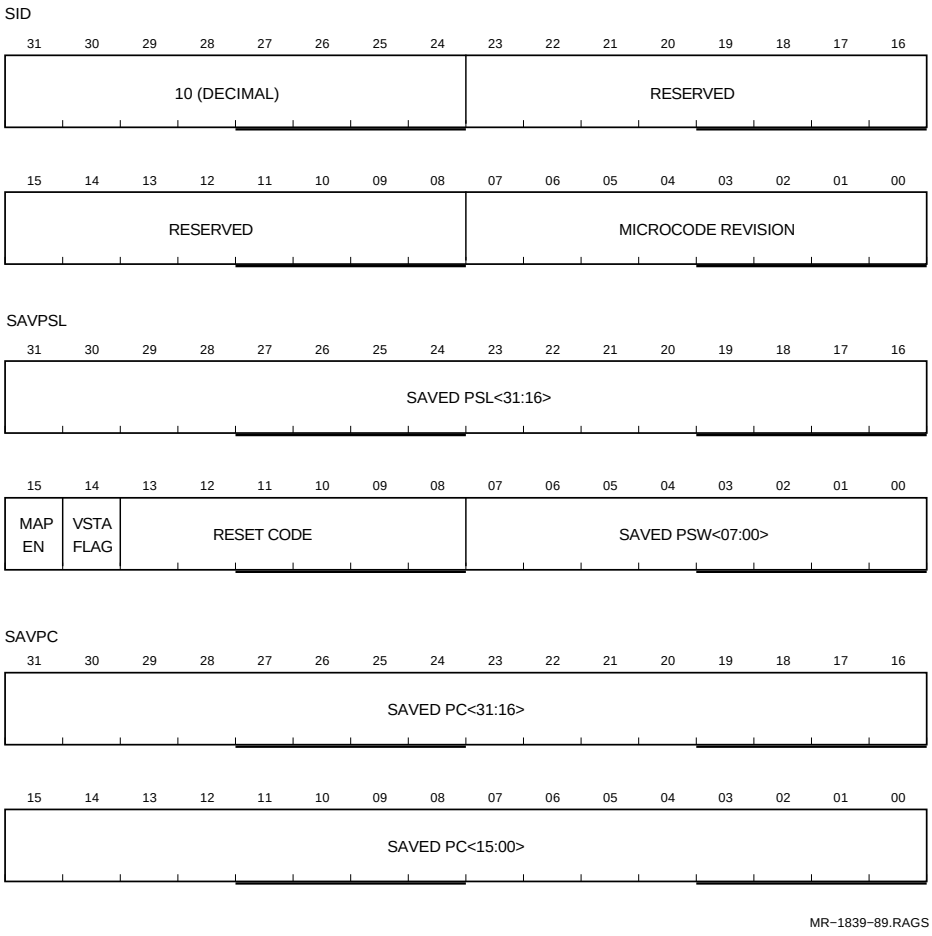



**Figure 3–3 System-Specific Registers**

## 3.6 Machine Checks

Figure 3–4 shows the contents of the interrupt stack after a machine check. Table 3–3 lists the machine check parameters.

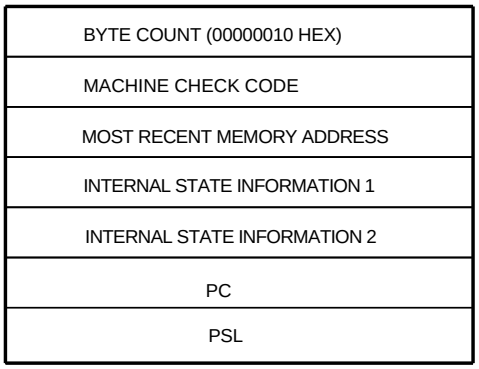



**Figure 3–4 Interrupt Stack Contents After Machine Check**

**Table 3–3 Machine Check Parameters**

| Parameter | Value (Bits) | Definition or Contents |
|---|---|---|
| Machine check code | 01 | CFPA protocol error |
| | 02 | CFPA reserved instruction |
| | 03 | CFPA unknown error |
| | 04 | CFPA unknown error |
| | 05 | Process PTE in P0 space (TB miss) |
| | 06 | Process PTE in P1 space (TB miss) |
| | 07 | Process PTE in P0 space (M = 0) |
| | 08 | Process PTE in P1 space (M = 0) |
| | 09 | Undefined interrupt ID code |
| | 0A | Impossible microcode state (MOVCx) |
| | 80 | Read memory bus error (normal read) |
| | 81 | Read memory bus error (SPTE, PCB, or SCB read) |
| | 82 | Write memory bus error (normal write) |
| | 83 | Write memory bus error (SPTE or PCB write) |
| Most recent memory address | <31:00> | Current contents of VAP register |
| Internal state information 1 | <31:24> | Current contents of OPCODE<7:0> |
| | <23:20> | 1110 |
| | <19:16> | Current contents of HSIR<3:0> |
| | <15:08> | Current contents of CADR<7:0> |
| | <07:00> | Current contents of MSER<7:0> |

**Table 3–3 (Cont.) Machine Check Parameters**

| Parameter | Value (Bits) | Definition or Contents |
|---|---|---|
| Internal state information 2 | <31:24> | Current contents of SC<7:0> |
| | <23:22> | 11 |
| | <21:16> | Current contents of STATE<5:0> |
| | <15> | Current contents of VAX CANT RESTART bit |
| | <14:12> | 111 |
| | <11:08> | Current ALU condition codes |
| | <07:00> | Delta PC at time of exception |
| PC | <31:00> | PC of start of current instruction |
| PSL | <31:00> | Current contents of PSL |