AlphaServer 2000/2100/2100 RM/ 2100 CAB Series

Service Guide

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Preface

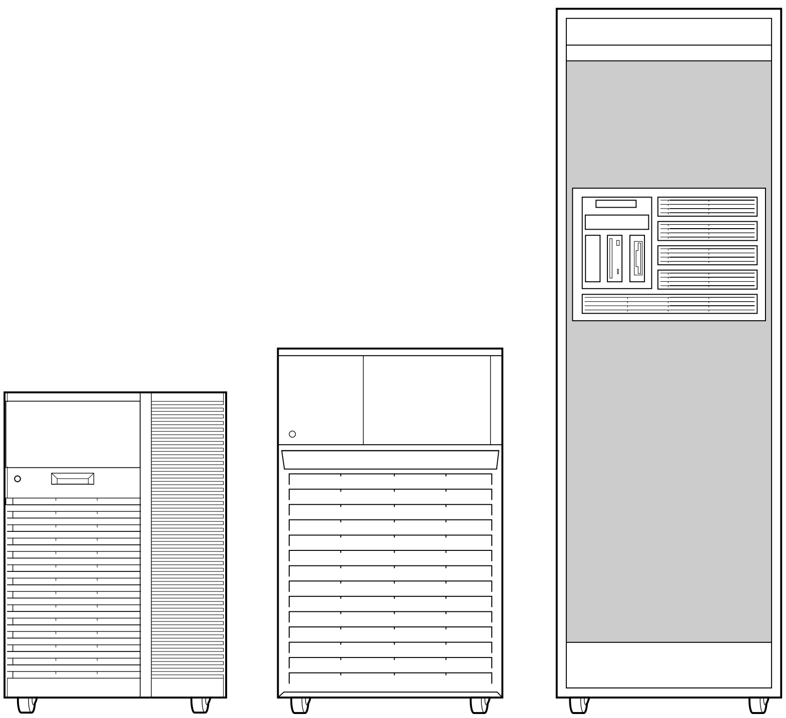
This guide describes the procedures and tests used to service AlphaServer systems. The following models are included in this guide (see Figure 1):

- AlphaServer 2000 (BA720 pedestal enclosure)
- AlphaServer 2100, formerly Model A500MP (BA740 pedestal enclosure)
- AlphaServer 2100 RM, formerly Model A500MP-R (BA741 rackmount enclosure)

Note

The AlphaServer 2100 CAB, formerly Model A600MP, uses the BA741 rackmount enclosure in the H9A10 (600 mm) cabinet. This guide covers service of the BA741 enclosure only.

Figure 1 AlphaServer Systems Included in this Guide



Intended Audience

This guide is intended for use by Digital Equipment Corporation service personnel and qualified self-maintenance customers.

Conventions

The following conventions are used in this guide.

Convention	Meaning
Return	A key name enclosed in a box indicates that you press that key.
Ctrl/*x*	Ctrl/*x* indicates that you hold down the Ctrl key while you press another key, indicated here by *x*. In examples, this key combination is enclosed in a box, for example, Ctrl/C.
lowercase	Lowercase letters in commands indicate that commands can be entered in uppercase or lowercase.
Warning	Warnings contain information to prevent personal injury.
Caution	Cautions provide information to prevent damage to equipment or software.
[ ]	In command format descriptions, brackets indicate optional elements.
console command abbreviations	Console command abbreviations must be entered exactly as shown.
`boot`	Console and operating system commands are shown in this special typeface.
italic type	Italic type in console command sections indicates a variable.
< >	In console mode online help, angle brackets enclose a placeholder for which you must specify a value.
{ }	In command descriptions, braces containing items separated by commas imply mutually exclusive items.

Related Documentation

- *AlphaServer 2000 Owner's Guide,* EK-400MP-OP
- *AlphaServer 2100 Series Owner's Guide,* EK-KN450-OP
- *AlphaServer 2100 RM Series Installation/Owner's Guide,* EK-KN450-RM
- *H9A10 (600 mm) Cabinet Installation and Owner's Guide,* EK-H9A10-IN
- *AlphaServer 2000/2100 Firmware Reference Guide,* EK-AXPFW-RM
- *DEC Verifier and Exerciser Tool User's Guide,* AA-PTTMA-TE
- *Guide to Kernel Debugging,* AA-PS2TA-TE
- *OpenVMS AXP Alpha System Dump Analyzer Utility Manual*
- *DECevent Translation and Reporting Utility for OpenVMS User and Reference Guide*

1 Troubleshooting Strategy

This chapter describes the troubleshooting strategy for AlphaServer systems.

- Section 1.1 provides questions to consider before you begin troubleshooting an AlphaServer system.
- Tables 1–1 through 1–5 provide a diagnostic flow for each of the categories of system problems.
- Section 1.2 lists the product tools and utilities.
- Section 1.3 lists available information services.

1.1 Troubleshooting the System

Before troubleshooting any system problem, check the site maintenance log for the system's service history. Be sure to ask the system manager the following questions:

- Has the system been used before and did it work correctly?
- Have changes to hardware or updates to firmware or software been made to the system recently?
- What is the state of the system—is the operating system running?

  If the operating system is down and you are not able to bring it up, use the console environment diagnostic tools, such as the power-up/diagnostic displays and ROM-based diagnostics (RBDs).

  If the operating system is running, use the operating system environment diagnostic tools, such as error logs, crash dumps, and exercisers (DEC VET).

1.1.1 Problem Categories

System problems can be classified into the following five categories. Using these categories, you can quickly determine a starting point for diagnosis and eliminate the unlikely sources of the problem.

1. Power problems (Table 1–1)
2. No access to console mode (Table 1–2)
3. Console-reported failures (Table 1–3)
4. Boot failures (Table 1–4)
5. Operating system-reported failures (Table 1–5)

Table 1–1 Diagnostic Flow for Power Problems

Symptom	Action
AlphaServer 2000 (BA720 Pedestal Enclosure)	
System does not power on.	
	• Check the power source and power cord. • Check that the system cover is in place. A safety interlock switch shuts off power to the system if the system cover is not properly secured. • If there are two power supplies, make sure both power supplies are plugged in. • Check the DC On/Off button setting on the operator control panel. • Check that the ambient room temperature is within environmental specifications (10–40°C, 50–104°F). • Check power configuration rules (Section 5.9.1). If you have two CPUs, you need two power supplies operating in full power mode. • Check that internal power supply cables are plugged in at both the power supply and system bus backplane (Section 5.9.1).
Power supply shuts down after approximately 5 seconds (fan failure).	Using a flashlight, look through the front (to the left of the internal StorageWorks shelf) to determine if the 6.75-inch and 4.5-in fans are spinning at power-up. A failure of either fan causes the system to shut down after approximately 5 seconds.

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Table 1–1 (Cont.) Diagnostic Flow for Power Problems

Symptom	Action
AlphaServer 2100 (BA740 Pedestal Enclosure)	
No AC power at system as indicated by AC OK LED on the power supply when the AC On /Off switch is set to "on." Note: Later revisions of the power supply do not have an AC On/Off switch or AC OK LED.	• Check the power source and power cord. • Check that the left side panel is properly secured. A safety interlock switch shuts off power to the system if the panel is removed. • If there are two power supplies, make sure both have the AC On/Off switch set to "on," or that both power supplies are plugged in (systems with no AC On/Off switches).
AC power is present, but system does not power on.	Check the DC On/Off button setting on the operator control panel. Check that the ambient room temperature is within environmental specifications (10–35°C, 50–95°F) and reset the AC On/Off switch.
Power supply shuts down after approximately 5 seconds (fan failure).	Using a flashlight, look through the front (to the left of the internal StorageWorks shelf) to determine if the 6.75-inch fan is spinning at power-up. A failure of the 6.75-inch fan causes the system to shut down after approximately 5 seconds.

(continued on next page)

Table 1–1 (Cont.) Diagnostic Flow for Power Problems

Symptom	Action
AlphaServer 2100 RM/CAB (BA741 Rackmount Enclosure)	
Fans do not spin up when the AC power cable is plugged into the power supply.	• Check the power source and power cord. • If there are two power supplies, make sure both are plugged in.
AC power is present, as indicated by spinning fans, but system does not power on.	Check the DC On/Off button setting on the operator control panel.
	Check that the ambient room temperature is within environmental specifications (10–35°C, 50–95°F).
Power supply shuts down after approximately 5 seconds (fan failure).	Check to see if both 6.75-inch fans are operating. A failure of either 6.75-inch fan causes the system to shut down after approximately 5 seconds.

Table 1–2 Diagnostic Flow for Problems Getting to Console Mode

Symptom	Action
Power-up screen is not displayed.	Check power-up/diagnostic display on the OCP (Section 2.1) for a failure during self-tests.
	Check that keyboard and monitor are properly connected and powered on.
	If the power up screen is not displayed, yet the system enters console mode when you press the Return key, check that the `console` environment variable is set correctly. If you are using a VGA console terminal, the console variable should be set to "graphics." If you are using a serial console terminal, the console variable should be set to "serial."
	If `console` is set to serial, the power-up screen is routed to the COM1 serial communication port (Section 5.10) and cannot be viewed from the VGA monitor.
	Try connecting a console terminal to the COM1 serial communication port (Section 5.10). If necessary use a MMJ-to-9-pin adapter (H8571-J). Check baud rate setting for console terminal and system. The system baud rate setting is 9600. When using the COM1 port, you must set the `console` environment variable to "serial."
	If the system has a customized NVRAM file, try powering up with the Halt button set to the "in" position. The NVRAM file will not be executed when powering up with the Halt button depressed.
	For certain situations, power up using the fail-safe loader (Section 2.6) to bypass the power-up script and get to a low-level console. From the fail-safe loader console, you can edit the nvram file, set and examine environment variables, and initialize drivers.

Table 1–3 Diagnostic Flow for Problems Reported by the Console Program

Symptom	Action
Power-up tests do not complete.	Use power-up/diagnostic display on the operator control panel (Section 2.1) and/or console terminal (Section 2.2) to determine error.
The system powers up to the "ash>" prompt.	Reinstall firmware. Refer to the procedure provided with the firmware update documentation.
Console program reports error: • OCP displays failure message at power-up • Halt button LED lights during power-up • Power-up screen includes error messages	Use power-up/diagnostic display on the operator control panel (Section 2.1) and/or console terminal (Section 2.2) to determine error. Use the `show fru` (Section 3.3.3) and `show error` (Section 3.3.4) commands to see if errors have been logged and to examine error information contained in serial control bus EEPROMs. Examine the console event log (enter the `cat el` command) or power-up screen (Section 2.2.2) to check for embedded error messages recorded during power-up. If power-up screen or console event log indicate problems with mass storage devices, or if storage devices are missing from the `show config` display, use the troubleshooting flow charts (Section 2.3) to determine the problem. If power-up screen or console event log indicate problems with EISA devices, or if EISA devices are missing from the `show config` display, use the troubleshooting flow chart (Section 2.4) to determine the problem. If power-up screen or console event log indicate problems with PCI devices, or if PCI devices are missing from the `show config` display, use the troubleshooting flow chart (Section 2.5) to determine the problem. Run RBD tests (Section 3.1) to verify problem.

Table 1–4 Diagnostic Flow for Boot Problems

Symptom	Action
System cannot find boot device.	Check system configuration for correct device parameters (node ID, device name, and so on). • For DEC OSF/1 and OpenVMS, use the `show config` and `show device` (Section 5.1). • For Windows NT, use the Display Hardware Configuration display and the Set Default Environment Variables display (Section 5.1).
	Check the system configuration for correct environment variable settings. • For DEC OSF/1 and OpenVMS, examine the auto_action, bootdef_dev, boot_osflags, and os_type environment variables (Section 5.1.4.4). • For Windows NT, examine the FWSEARCHPATH, AUTOLOAD, and COUNTDOWN environment variables (Section 5.1.4.4).
Device does not boot.	Check that the Halt button is not set to "in" (depressed). Run device tests (Section 3.1) to check that boot device is operating.

Table 1–5 Diagnostic Flow for Errors Reported by the Operating System

Symptom	Action
System is hung or has crashed.	Examine the crash dump file.
	Refer to *OpenVMS AXP Alpha System Dump Analyzer Utility Manual* for information on how to interpret OpenVMS crash dump files.
	Refer to the *Guide to Kernel Debugging* (AA–PS2TA–TE) for information on using the DEC OSF/1 Krash Utility.
	Use the `show error` command (Section 3.3.4) to examine error information contained in serial control bus EEPROMs (console environment error log).
Operating system is up.	Examine the operating system error log files to isolate the problem (Chapter 4).
	If the problem occurs intermittently, run an operating system exerciser, such as DEC VET, to stress the system.
	Refer to the *DEC Verifier and Exerciser Tool User's Guide* (AA–PTTMA–TE) for instructions on running DEC VET.

1.2 Service Tools and Utilities

This section lists the array of service tools and utilities available for acceptance testing, diagnosis, and serviceability and provides recommendations for their use.

Error Handling/Logging

DEC OSF/1, OpenVMS, and Microsoft Windows NT operating systems provide recovery from errors, fault handling, and event logging. The DECevent Translation and Reporting Utility for OpenVMS and Error Report Formatter (ERF) provides bit-to-text translation of event logs for interpretation. DEC OSF/1 uses uerf to present the same kinds of information.

RECOMMENDED USE: Analysis of error logs is the primary method of diagnosis and fault isolation. If the system is up, or you are able to bring it up, look at this information first. Refer to Chapter 4 for information on using error logs to isolate faults.

ROM-Based Diagnostics (RBDs)

Many ROM-based diagnostics and exercisers are embedded in AlphaServer systems. ROM-based diagnostics execute automatically at power-up and can be invoked in console mode using console commands.

RECOMMENDED USE: ROM-based diagnostics are the primary means of testing the console environment and diagnosing the CPU, memory, Ethernet, I/O buses, and SCSI and DSSI subsystems. Use ROM-based diagnostics in the acceptance test procedures when you install a system, add a memory module, or replace the following: CPU module, memory module, motherboard, standard I/O module, I/O bus device, or storage device. Refer to Chapter 3 for information on running ROM-based diagnostics.

Loopback Tests

Internal and external loopback tests are used to isolate a failure by testing segments of a particular control or data path. The loopback tests are a subset of the ROM-based diagnostics.

RECOMMENDED USE: Use loopback tests to isolate problems with the COM2 serial port, the parallel port, and Ethernet controllers. Refer to Chapter 3 for instructions on performing loopback tests.

Firmware Console Commands

Console commands are used to set and examine environment variables and device parameters, as well as to invoke ROM-based diagnostics and exercisers. For example, the `show memory`, `show configuration`, and `show device` commands are used to examine the configuration; the `set` (bootdef_dev, auto_action, and boot_osflags) commands are used to set environment variables; and the `cdp` command is used to configure DSSI parameters.

RECOMMENDED USE: Use console commands to set and examine environment variables and device parameters and to run RBDs. Refer to Section 5.1 for information on configuration-related firmware commands and Chapter 3 for information on running RBDs.

Operating System Exercisers (DEC VET)

The Digital Verifier and Exerciser Tool (DEC VET) is supported by the DEC OSF/1, OpenVMS, and Windows NT operating systems. DEC VET performs exerciser-oriented maintenance testing of both hardware and operating system.

RECOMMENDED USE: Use DEC VET as part of acceptance testing to ensure that the CPU, memory, disk, tape, file system, and network are interacting properly. Also use DEC VET to stress test the user's environment and configuration by simulating system operation under heavy loads to diagnose intermittent system failures.

Crash Dumps

For fatal errors, such as fatal bugchecks, DEC OSF/1 and OpenVMS operating systems will save the contents of memory to a crash dump file.

RECOMMENDED USE: Crash dump files can be used to determine why the system crashed. To save a crash dump file for analysis, you need to know proper system settings. Refer to the *OpenVMS AXP Alpha System Dump Analyzer Utility Manual* or the *Guide to Kernel Debugging* (AA–PS2TA–TE) for DEC OSF/1.

Recommended System Installation

The recommended system installation includes:

1. Hardware installation and acceptance testing. Acceptance testing includes running the `test` command.
2. Software installation and acceptance testing. For example, using OpenVMS Factory Installed Software (FIS), and then acceptance testing with DEC VET.

1.3 Information Services

Several information resources are available, including online information for servicers and customers, computer-based training, and maintenance documentation database services. A brief description of some of these resources follows.

Fast Track to Information

AlphaServer systems are shipped with a set of floppy disks called the "Fast Track to Information." Fast Track is an easy-to-navigate, electronic version of all of the information in the server's Owner's Guide.

You can install Fast Track on any personal computer or laptop computer running Microsoft Windows V3.1 or later or a Windows emulator. Follow the setup instructions on the label of the first floppy disk. You need to have approximately 4 megabytes available on your designated disk.

Future plans call for Fast Track to Information to be shipped with new systems on CD–ROM.

Fast Track Service Help File

The Troubleshooting and FRU sections of this service guide—including the FRU illustrations—are available in online format. You can download an AlphaServer help file named 210050-S.HLP from TIMA.

Training

Computer Based Training (CBT) and lecture lab courses are available from the Digital training center:

- AlphaServer 2100 Installation and Troubleshooting: EY-M915E
- Alpha Concepts
- DSSI Concepts: EY-9823E
- ISA and EISA Bus Concepts: EY-I113E-P0
- RAID Concepts: EY-N935E
- SCSI Concepts and Troubleshooting: EY-P841E, EY-N838E

Digital Assisted Services

Digital Assisted Services (DAS) offers products, services, and programs to customers who participate in the maintenance of Digital computer equipment. Components of Digital assisted services include:

- Spare parts and kits
- Diagnostics and service information/documentation
- Tools and test equipment
- Parts repair services, including Field Change Orders

DAS is described further in the “Fast Track to Information.”

2

Power-Up Diagnostics and Displays

This chapter provides information on how to interpret the power-up/diagnostic display on the operator control panel and console screen. In addition, a description of the power-up and firmware power-up diagnostics is provided as a resource to aid in troubleshooting.

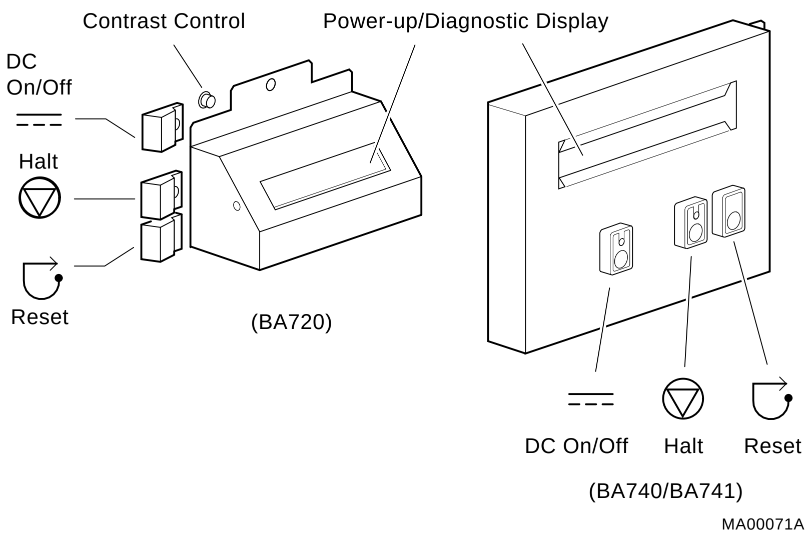
- Section 2.1 describes how to interpret the power-up/diagnostic display on the operator control panel.
- Section 2.2 describes how to interpret the power-up screen.
- Section 2.3 describes how to troubleshoot mass-storage problems indicated at power-up or storage devices missing from the `show config` display.
- Section 2.4 describes how to troubleshoot EISA bus problems indicated at power-up or EISA devices missing from the `show config` display.
- Section 2.5 describes how to troubleshoot PCI bus problems indicated at power-up or PCI devices missing from the `show config` display.
- Section 2.6 describes the use of the fail-safe loader.
- Section 2.7 describes how to interpret system LEDs.
- Section 2.8 describes the power-up sequence.
- Section 2.9 describes power-on self-tests.

2.1 Interpreting the Power-Up Display

The power-up/diagnostic display on the operator control panel (OCP) (Figure 2–1) displays the progress and result of self-tests during power-up.

The OCP power-up display is the primary diagnostic tool for troubleshooting "No Access to Console Mode" problems.

Figure 2–1 Operator Control Panel Power-Up/Diagnostic Display



Note

AlphaServer 2000 systems (BA720 enclosures) have a contrast control for the power-up/diagnostic display on the OCP. If power-up messages do not display on the OCP, adjust the contrast control for your viewing angle.

Refer to Tables 2–1 and 2–2 for information on interpreting the display.

Table 2–1 Interpreting OCP Power-Up Display

Message	Meaning
`TEST`	Displayed while system performs diagnostic tests and exercisers. The type of module under test, its slot number, and the currently executing test number are also displayed.
`NO MEM INSTALLED`	Displayed if you power up with no memory installed.
`FAIL module_type`	If an error is detected in the CPU, memory, or I/O, a failure message is displayed and the Halt button LED lights for a few seconds. The error is logged to the appropriate module via the serial control bus. In nearly all cases, the power-up tests continue. The `module_type` and slot number for the field replaceable unit (FRU) that failed, along with the test number (Table 2–2) that detected the error are also displayed. **Note** For AlphaServer 2000 series systems, which use single-inline memory modules (SIMMs), serial ROM power-up tests will terminate if one bank of good memory is not detected. The first two bits of bad memory (in hexadecimal) are displayed along with the FAIL MEM_nn display. Refer to Section 2.1.1 for instructions on isolating the failing SIMM or SIMMs. Module types and slot numbers: CPU_nn — CPU module (0–3; 0 or 1 for 2000 series systems) MEM_nn — Memory module (0–3; 0 or 1 for 2000 series systems) I/O_0 — Standard I/O module (I/O backplane for 2000 series systems) I/O_1 — Expansion I/O module (PCI)

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Table 2–1 (Cont.) Interpreting OCP Power-Up Display

Message	Meaning
`CPU STATUS`	Summary of CPU testing—The status of each CPU, starting with CPU0 is displayed: “P” — CPU passed “F” — CPU failed “–” — CPU not present
`STARTING CPU #`	The console is starting the primary CPU.
`TEST MEM BANK #`	The console is testing memory.
`PROBE I/O SUBSYS`	The console is checking the PCI and EISA bridges.
`SYSTEM RESET`	The Reset button has been pressed.
`Model x/xxx`	When system is under operating system control, the CPU variant (*x*) and the approximate CPU speed (*xxx*) are displayed unless you supply your own text using the ocp_text environment variable.

Table 2–2 Serial ROM Power-Up Test Description and Field Replaceable Units (FRUs)

Test Number	Description	Likely FRU
95	SROM unloaded, sync byte sent to the DECchip 21064 processor	CPU
91	Sync byte received from the DECchip 21064 processor	CPU
8d	First backup cache initialization	CPU
89	Backup cache data line test	CPU
85	Backup cache graycode test	CPU
81	DECchip 21064 processor ECC generation test	CPU
7d	Backup cache tag store test	CPU

(continued on next page)

Table 2–2 (Cont.) Serial ROM Power-Up Test Description and Field Replaceable Units (FRUs)

Test Number	Description	Likely FRU
79	I/O tests: system bus, PCI bus, EISA bus	CPU, standard I/O (I/O backplane for 2000-series systems), or motherboard (system bus motherboard for rackmount and 2000-series systems)[1]
75	Second backup cache initialization	CPU
0c	End of initial test sequence (CPU and all buses good)	CPU
18	Memory 0	MEM
16	Memory 1	MEM
14	Memory 2	MEM
12	Memory 3	MEM
07-CPU#	End of memory test (32 MB)	MEM
06	Start ESC configuration	I/O_0
05	End of ESC config/start FEPROM unload	I/O_0
04	End of FEPROM unload/start checking	I/O_0
03	End of checking, jump to unloaded console	I/O_0

(1) Use the `show error cpu` command to isolate the failing FRU. If an error log indicates that the CPU failed test number 7, the CPU module is faulty.

If no error is logged for test number 7, the standard I/O (or I/O backplane for 2000-series systems) is the likely module at fault. If replacing the standard I/O module does not solve the problem, the system bus motherboard is probably faulty.

For rackmount systems, which have a system bus motherboard and PCI/EISA daughter board, the system bus motherboard that contains the T2 (system bus to PCI bus bridge chip) is the backplane most likely to fail.

2.1.1 Isolating Failing SIMMs Reported by OCP Power-Up Display

For AlphaServer 2000 series systems, which use single-inline memory modules (SIMMs), serial ROM power-up tests will terminate if one bank of good memory is not detected and the console firmware cannot be loaded. The first two data bits of bad memory (in hexadecimal) are displayed along with the FAIL MEM_nn display on the OCP.

Using Table 2–3 you can find the corresponding SIMM position on the memory carrier module (Figure 2–2) for the failing data bits.

For example, the following OCP power-up display message indicates a bad SIMM at position J28.

```
FAIL MEM_00 01
```

The following OCP power-up display message indicates two bad SIMMs at positions J33 and J34.

```
FAIL MEM_00 1718
```

After determining the bad SIMMs, refer to Chapter 6 for instructions on replacing FRUs for AlphaServer 2000 series systems.

Note

Only two bad memory data bits at a time are captured by the system diagnostics. If more than two SIMMs are bad, you may need to repeat the SIMM isolation and replacement procedures until all bad SIMMs are replaced.

Table 2–3 Memory Data Bits in Error and Corresponding SIMM Position

Bit in Error–Failing SIMM							
00-J28	20-J28	40-J28	60-J32	80-J28	A0-J28	C0-J28	E0-J32
01-J28	21-J28	41-J28	61-J32	81-J28	A1-J28	C1-J28	E1-J32
02-J28	22-J28	42-J29	62-J32	82-J28	A2-J28	C2-J29	E2-J32
03-J28	23-J28	43-J29	63-J32	83-J28	A3-J28	C3-J29	E3-J32
04-J29	24-J29	44-J30	64-J33	84-J29	A4-J29	C4-J30	E4-J33
05-J29	25-J29	45-J30	65-J33	85-J29	A5-J29	C5-J30	E5-J33

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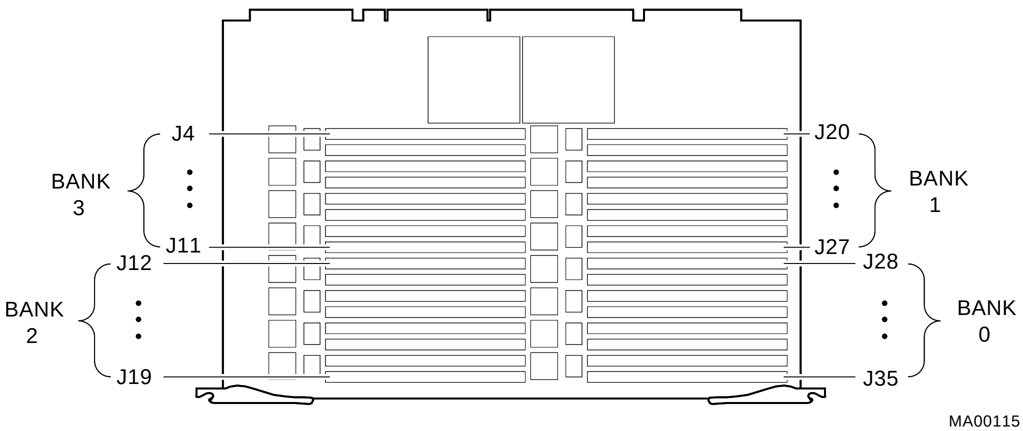
Table 2–3 (Cont.) Memory Data Bits in Error and Corresponding SIMM Position

Bit in Error–Failing SIMM							
06-J29	26-J29	46-J31	66-J33	86-J29	A6-J29	C6-J31	E6-J33
07-J29	27-J29	47-J31	67-J33	87-J29	A7-J29	C7-J31	E7-J33
08-J30	28-J30	48-J32	68-J34	88-J30	A8-J30	C8-J32	E8-J34
09-J30	29-J30	49-J32	69-J34	89-J30	A9-J30	C9-J32	E9-J34
0A-J30	2A-J30	4A-J33	6A-J34	8A-J30	AA-J30	CA-J33	EA-J34
0B-J30	2B-J30	4B-J33	6B-J34	8B-J30	AB-J30	CB-J33	EB-J34
0C-J30	2C-J31	4C-J34	6C-J35	8C-J31	AC-J31	CC-J34	EC-J35
0D-J30	2D-J31	4D-J34	6D-J35	8D-J31	AD-J31	CD-J34	ED-J35
0E-J30	2E-J31	4E-J35	6E-J35	8E-J31	AE-J31	CE-J35	EE-J35
0F-J30	2F-J31	4F-J35	6F-J35	8F-J31	AF-J31	CF-J35	EF-J35
10-J32	30-J32	50-J28	70-J28	90-J32	B0-J32	D0-J28	F0-J28
11-J32	31-J32	51-J28	71-J28	91-J32	B1-J32	D1-J28	F1-J28
12-J32	32-J32	52-J28	72-J28	92-J32	B2-J32	D2-J28	F2-J28
13-J32	33-J32	53-J28	73-J28	93-J32	B3-J32	D3-J28	F3-J28
14-J33	34-J33	54-J29	74-J29	94-J33	B4-J33	D4-J29	F4-J29
15-J33	35-J33	55-J29	75-J29	95-J33	B5-J33	D5-J29	F5-J29
16-J33	36-J33	56-J29	76-J29	96-J33	B6-J33	D6-J29	F6-J29
17-J33	37-J33	57-J29	77-J29	97-J33	B7-J33	D7-J29	F7-J29
18-J34	38-J34	58-J30	78-J30	98-J34	B8-J34	D8-J30	F8-J30
19-J34	39-J34	59-J30	79-J30	99-J34	B9-J34	D9-J30	F9-J30
1A-J34	3A-J34	5A-J30	7A-J30	9A-J34	BA-J34	DA-J30	FA-J30
1B-J34	3B-J34	5B-J30	7B-J30	9B-J34	BB-J34	DB-J30	FB-J30
1C-J35	3C-J35	5C-J31	7C-J31	9C-J35	BC-J35	DC-J31	FC-J31
1D-J35	3D-J35	5D-J31	7D-J31	9D-J35	BD-J35	DD-J31	FD-J31
1E-J35	3E-J35	5E-J31	7E-J31	9E-J35	BE-J35	DE-J31	FE-J31
1F-J35	3F-J35	5F-J31	7F-J31	9F-J35	BF-J35	DF-J31	FF-J31

Figure 2–2 AlphaServer 2000 Memory Module (Carrier) Layout



2.2 Power-Up Screen

During power-up self-tests the test status and result are displayed on the console terminal. Information similar the following should be displayed on the screen.

```
starting console on CPU 0
Testing Memory bank 0
Testing Memory bank 1
Configuring Memory Modules
probing hose 0, PCI
bus 0, slot 0 -- ewa -- DECchip 21040-AA
bus 0, slot 1 -- pka -- NCR 53C810
bus 0, slot 2 --     -- Intel 82375EB
bus 0, slot 7 -- ewb -- DECchip 21040-AA
probing hose 1, EISA
bus 0, slot 2 -- vga -- CPQ3011
bus 0, slot 4 -- era -- DEC4220
bus 0, slot 5 --     -- DEC2500
bus 0, slot 5 --     -- DEC2500
bus 0, slot 6 -- ewc -- DEC4250
probing hose 2, PCI
Memory Testing and Configuration Status
Module   Size    Base Addr   Intlv Mode  Intlv Unit  Status
------   -----   ---------   ----------  ----------  ------
  1       64MB   00000000      1-Way         0       Passed
Total Bad Pages 0
Testing the System
Testing the Disks (read only)
Testing the Network
AlphaServer 2100 Console T3.8-33, built on Oct 19 1994 at 12:22:36
P00>>>
```

Note

To stop the screen display from scrolling, enter Ctrl/S. To resume scrolling, enter Ctrl/Q.

DEC OSF/1 or OpenVMS Systems

DEC OSF/1 and OpenVMS are supported by the SRM firmware (see Section 5.1.1). The SRM console prompt is shown below:

```
P00>>>
```

Note

For systems with multiple CPUs, if CPU0 failed during power-up tests, or has an error logged to its EEPROM, the system will “failover” to another CPU. The CPU number of the CPU serving as the primary CPU is displayed in the SRM prompt; for example, `P01>>>` or `P02>>>`, and so on.

Windows NT Systems

Windows NT is supported by the ARC firmware (see Section 5.1.1). Systems using Windows NT power up to the ARC boot menu shown below.

```
ARC Multiboot Alpha AXP Version n.nn
Copyright (c) 1994 Microsoft Corporation
Copyright (c) 1994  Digital Equipment Corporation

Boot menu:

   Boot Windows NT
   Boot an alternate operating system
   Run a program
   Supplementary menu...

Use the arrow keys to select, then press Enter.
```

2.2.1 Multiprocessor Failover

AlphaServer systems support multiprocessor failover, which allows the system to power up and boot the operating system even if only one CPU is working.

During power-up or system reset, the serial ROM tests check for a good CPU, starting with CPU0, to serve as the primary CPU. The primary CPU is the only CPU that tests memory and reads the flash ROM code. If a CPU fails serial ROM tests, or if the CPU has an error logged to its serial control bus EEPROM, that CPU is disabled. The lowest numbered passing CPU serves as the primary CPU.

If all CPU modules fail their power-up diagnostics, then CPU0 will serve as the primary CPU.

If any of the CPUs fail during power-up, the halt button LED on the operator control panel lights for a few seconds and the CPU status message on the power-up/diagnostic display indicates which CPU failed (Table 2–1).

The following firmware commands can also be used to determine if a CPU failed power-up tests.

- `show fru` (Chapter 3)
- `show error` (Chapter 3)
- `show config` (Chapter 5)

Note

The CPU number of the CPU serving as the primary CPU is displayed in the SRM prompt; for example, `P01>>>` or `P02>>>`, and so on.

2.2.2 Console Event Log

AlphaServer systems maintain a console event log consisting of status messages received during power-on self-tests. If problems occur during power-up, standard error messages indicated by asterisks (***) may be embedded in the console event log. To display a console event log, use the `cat el` command.

Note

To stop the screen display from scrolling, enter Ctrl/S. To resume scrolling, enter Ctrl/Q.

You can also use the command, `more el`, to display the console event log one screen at at time.

The following examples show abbreviated console event logs that contain standard error messages:

❶ The first indicates a problem with the mouse driver.

❷ The second indicates that the Ethernet loopback test failed (possibly the result of a missing terminator or disconnection from a live network).

❸ The third indicates a failing SIMM on memory board 0.

```
P00>>> cat el
starting console on CPU 0
initialized idle PCB
initializing semaphores
initializing heap
   .
   .
   .
CPU 0 speed is 5.26 ns (190MHz)
access NVRAM
entering idle loop
Starting Memory Diagnostics
   .
   .
   .
initializing keyboard
** no mouse interrupts received **  ❶
   .
   .
   .
Change mode to Internal loopback.

*** Error (ewa0), Mop loop message timed out from: 08-00-2b-3d-63-10  ❷

*** List index: 0 received count: 0 expected count 1
   .
   .
   .
Change to Normal Operating Mode.
P00>>>

P00>>> cat el
starting console on CPU 0
initialized idle PCB
initializing semaphores
   .
   .
   .
Testing 1st 2MB(s) on memory module 0

***Error - Memory Board 0 ***  ❸
Failing address:     00000020
Bank Number:         0
ASIC ID:             1
Error Type:          0
Error Syndrome:      00000710
Failing SIMM module  J28
   .
   .
   .
P00>>>
```

2.3 Mass Storage Problems Indicated at Power-Up

Mass storage failures at power-up are usually indicated by read fail messages. Other problems are indicated by storage devices missing from the `show config` display.

- Table 2–4 provides information for troubleshooting fixed-media mass storage problems indicated at power-up or storage devices missing from the `show config` display.
- Table 2–5 provides information for troubleshooting removable-media storage problems indicated at power-up or storage devices missing from the `show config` display.
- Table 2–6 provides troubleshooting tips for AlphaServer systems that use the SWXCR-xx controller.

Use Tables 2–4, 2–5, and 2–6 to diagnose the likely cause of the problem.

Table 2–4 Fixed-Media Mass Storage Problems

Problem	Symptom	Corrective Action
Drive failure	Fault LED for drive is on (steady).	Replace drive.
Duplicate SCSI IDs (when removable-media bus is extended to StorageWorks shelf)	Drives with duplicate SCSI IDs are missing from the `show config` display.	Correct removable-media SCSI IDs.
SCSI ID set to 7 (reserved for host ID)	Valid drives are missing from the `show config` display. One drive may appear seven times on the configuration screen display.	Correct SCSI IDs.
Duplicate host IDs on a shared bus	Valid drives are missing from the `show config` display. One drive may appear seven times on the configuration screen display.	Change host ID through the pk*0_host_id environment variable (`set pk*0_host_id`).
Extra terminator	Devices produce errors or device IDs are dropped.	Check that bus is terminated only at beginning and end. Remove unnecessary terminators.
I/O module failure (if removable-media bus is extended to StorageWorks shelf) or PCI or EISA storage adapter option failure	Problems persist after eliminating the above problem sources.	Replace storage adapter module or standard I/O (I/O backplane for 2000-series systems).

Table 2–5 Removable-Media Mass Storage Problems

Problem	Symptom	Corrective Action
Drive failure	Fault LED for drive is on (steady).	Replace drive.
Duplicate SCSI IDs	Drives with duplicate SCSI IDs are missing from the `show config` display.	Correct SCSI IDs.
SCSI ID set to 7 (reserved for host ID)	Valid drives are missing from the `show config` display. One drive may appear seven times on the `show config` display.	Correct SCSI IDs.
Duplicate host IDs on a shared bus	Valid drives are missing from the `show config` display. One drive may appear seven times on the configuration screen display.	Change host ID through the pk*0_host_id environment variable (`set pk*0_host_id`).
Missing or loose cables	Activity LEDs do not come on. Drive missing from the `show config` display.	Remove device and inspect cable connections.
Terminator missing	Read/write errors in console event log; storage adapter port may fail.	Attach terminators as needed: internal SCSI terminator (12-41296-01) or external SCSI terminator (12-37004-04).
I/O module failure	Problems persist after eliminating the above problem sources.	Replace standard I/O module (I/O backplane for 2000-series systems) .

Table 2–6 Troubleshooting Problems with SWXCR-xx RAID Controller

Symptom	Action
Some RAID drives do not appear on the `show device d` display.	Valid configured RAID logical drives will appear as DRA0–DRA*n*, not as DK*n*. Configure the drives by running the RAID Configuration Utility (RCU), following the instructions in the *StorageWorks RAID Array 200 Subsystem Family Installation and Configuration Guide*, EK-SWRA2-IG. Reminder: several physical disks can be grouped as a single logical DRA*n* device.
Drives on the SWXCR controller power up with the amber Fault light on.	Whenever you move drives onto or off of the SWXCR controller, run the RAID Configuration Utility to set up the drives and logical units. Follow the instructions in the *StorageWorks RAID Array 200 Subsystem Family Installation and Configuration Guide.*
Image copy of DRA logical drive does not boot (OpenVMS AXP systems only).	If you copy the contents of a system disk to your RAID subsystem using the BACKUP/IMAGE command, for example, you will need to repeat several steps in the data device installation procedure, as described in the *StorageWorks RAID Array 200 Subsystem Family Software User's Guide for OpenVMS AXP*, AA-Q6WVA-TE, in order to make the second device a bootable device.

2.4 EISA Bus Problems Indicated at Power-Up

EISA bus failures at power-up are usually indicated by the following messages displayed during power-up:

```
EISA Configuration Error. Run the EISA Configuration Utility.
```

Run the EISA Configuration Utility (ECU) (Section 5.4) when this message is displayed. Other problems are indicated by EISA devices missing from the `show config` display.

Table 2–7 provides a table for troubleshooting EISA bus problems that persist after you run the ECU.

Table 2–7 EISA Troubleshooting

Step	Action
1	Confirm that the EISA module and any cabling are properly seated.
2	Run the ECU to: • Confirm that the system has been configured with the most recently installed controller. • See what the hardware jumper and switch setting should be for each ISA controller. • See what the software setting should be for each ISA and EISA controller. • See if the ECU deactivated (<>) any controllers to prevent conflict. • See if any controllers are locked (!), which limits the ECU's ability to change resource assignments.
3	Confirm that hardware jumpers and switches on ISA controllers reflect the settings indicated by the ECU. Start with the last ISA module installed.
4	Run ROM-based diagnostics for the type of option: • Storage adapter—Run `exer_read` to exercise the storage devices off the EISA controller option (Section 3.3.6). • Ethernet adapter—Run `nettest` to exercise an Ethernet adapter (Section 3.3.9).
5	Check for bad slot by moving the last installed controller to a different slot.
6	Call option manufacturer or support for help.

2.4.1 Additional EISA Troubleshooting Tips

The following tips can aid in isolating EISA bus problems.

- Peripheral device controllers need to be seated (inserted) carefully, but firmly, into their slot to make all necessary contacts. Improper seating is a common source of problems for EISA modules.
- The CFG files supplied with the option you want to install may not work on AlphaServer systems. Some CFG files call overlay files that are not required on this system or may reference inappropriate system resources, for example, BIOS addresses. Contact the option vendor to obtain the proper CFG file.
- Peripherals cannot share direct memory access (DMA) channels. Assignment of more than one peripheral to the same DMA channel can cause unpredictable results or even loss of function of the EISA module.

- Systems running Windows NT can assign shared interrupt lines (IRQs). DEC OSF/1 and OpenVMS do not allow shared interrupts.
- Not all EISA products work together. EISA is an open standard, and not every EISA product or combination of products can be tested. Violations of specifications may matter in some configurations, but do not in others.

  Manufacturers of EISA options often test the most common combinations and may have a list of ISA and EISA options that do not function in combination with particular systems. Be sure to check the documentation or contact the option vendor for the most up-to-date information.
- EISA systems will not function unless they are first configured using the ECU.
- The ECU will not notify you if the configuration program diskette is write-protected when it attempts to write the system configuration file (system.sci) to the diskette.

2.5 PCI Bus Problems Indicated at Power-Up

PCI bus failures at power-up are usually indicated by the inability of the system to see the device. Table 2–8 provides a table for troubleshooting PCI bus problems. Use the table to diagnose the likely cause of the problem.

Table 2–8 PCI Troubleshooting

Step	Action
1	Confirm that the PCI module and any cabling are properly seated.
2	Run ROM-based diagnostics for the type of option: • Storage adapter—Run `exer_read` to exercise the storage devices off the PCI controller option (Section 3.3.6). • Ethernet adapter—Run `nettest` to exercise an Ethernet adapter (Section 3.3.9).
3	Check for bad slot by moving the last installed controller to a different slot.
4	Call option manufacturer or support for help.

2.6 Fail-Safe Loader

The fail-safe loader (FSL) allows you to power up without initializing drivers or running power-up diagnostics.

Note

The fail-safe loader should be used only when a failure at power-up prohibits you from getting to the console program. You cannot boot an operating system from the fail-safe loader.

If a checksum error is detected when the SRM console is loading at power-up, the fail-safe loader is automatically loaded into memory and the system displays the FSL prompt `ash>`. If the system automatically powers up to the `ash>` prompt, reinstall firmware according to the instructions provided with the firmware.

Whenever the fail-safe loader console is activated, the power-up/diagnostic display on the operator control panel displays a FAIL I/O_00 message.

The FSL permits you to get to a console, with limited functionality, when one of the following is the cause of a problem getting to the console program under normal power-up:

- A power failure or accidental power down during a firmware upgrade
- An error in the nonvolatile nvram file
- An incorrect environment variable setting
- A driver error

Note

The FSL program, indicated by the `ash>` prompt, has limited functionality. A simple shell is indicated by the letters "ash" contained in the console prompt.

2.6.1 Fail-Safe Loader Functions

From the FSL program, you can:

- Edit the nvram file (using the `edit` command)
- Assign a correct value to an environment variable (using the `show` and `set` commands)
- Start individual drivers using the `init -driver ew` command to start the MOP driver or `init -driver dv` to start the floppy driver. The `init -driver 6` command in FSL mode starts all available drivers.

Note

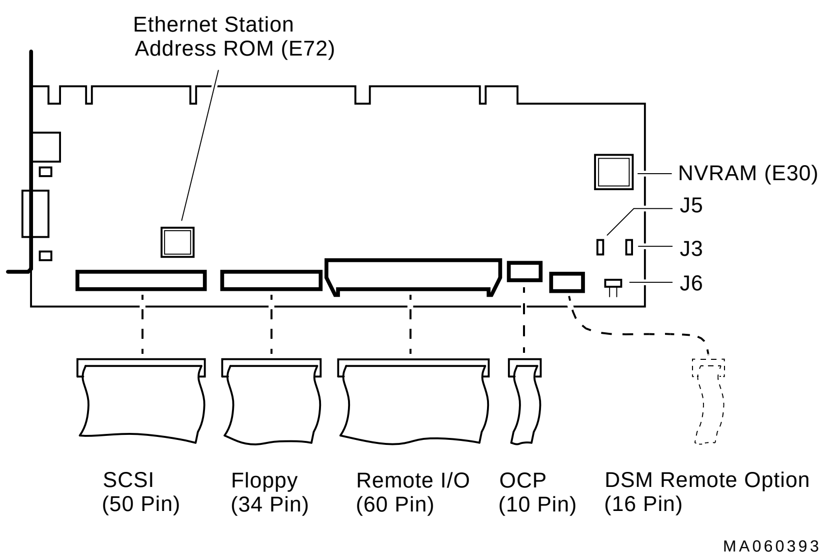
The nonvolatile file, nvram, is shipped from the factory with no contents. The customer can use the `edit` command to create a customized script or command file that is executed as the last step of every power-up.

2.6.2 Activating the Fail-Safe Loader

To activate the FSL:

1. Install jumper J6 on the standard I/O module (Figure 2–3). For 2000-series systems (BA720 enclosure), jumper J6 is located on the I/O backplane (Figure 2–4). The jumper is stored on one of the pins of the J6 jumper.
2. Turn on the system.
3. Use the FSL program (`ash>`) to make corrections, edit the nvram file, set environment variables, or initialize phase 6 drivers.
4. When you have finished, power down and remove the FSL jumper.

Figure 2–3 Fail-Safe Loader Jumper (J6) on the Standard I/O (BA740/BA741 Enclosures)

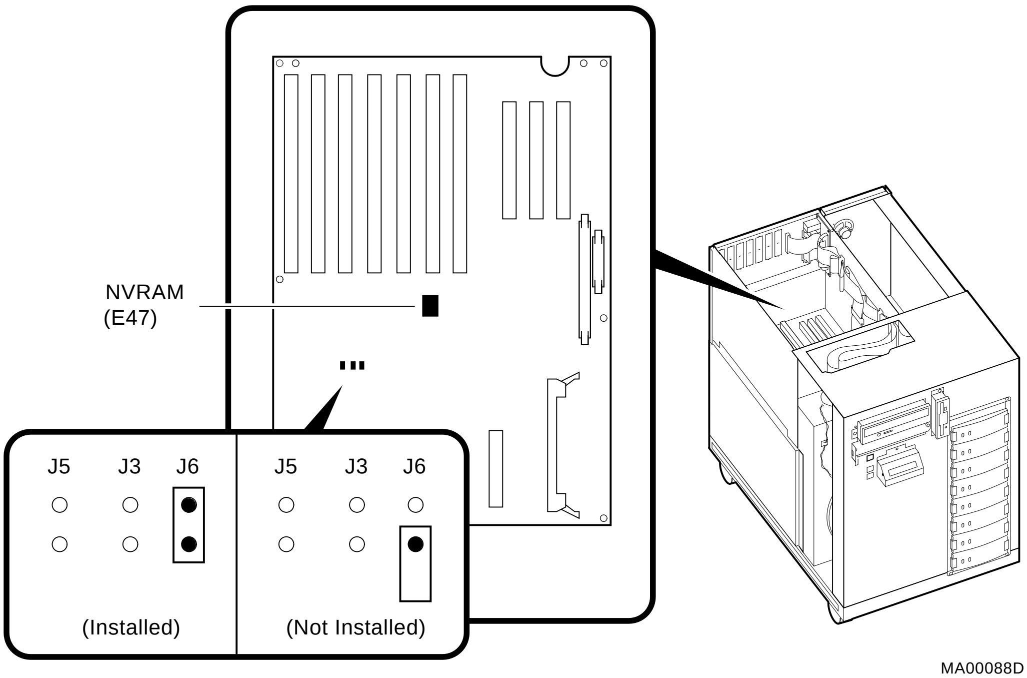


J3–Power supply mode: When installed, dual power supplies operate in redundant mode.

J5–Program voltage: Internal use only.

J6–Fail-Safe: When installed, selects the fail-safe loader firmware.

Figure 2–4 Fail-Safe Loader Jumper (J6) on the I/O Backplane (BA720 Enclosure)



J3–Power supply mode: When installed, dual power supplies operate in redundant mode.
J5–Program voltage: Internal use only.
J6–Fail-Safe: When installed, selects the fail-safe loader firmware.

2.7 Interpreting System LEDs

This section describes the function of system LEDs and what action to take when a failure is indicated. The system LEDs are used primarily to troubleshoot power problems and problems with boot devices. There are four types of system LEDs:

- Power LEDs
- Halt button LED at power-up
- Storage device LEDs
- I/O panel LEDs

2.7.1 Power Supply LEDs (BA740/BA741 Enclosures)

Power supply LEDs (Figures 2–5 and 2–6) indicate the status of the power supply.

Refer to Table 2–9 for information on interpreting the LEDs and determining what actions to take when a failure is indicated.

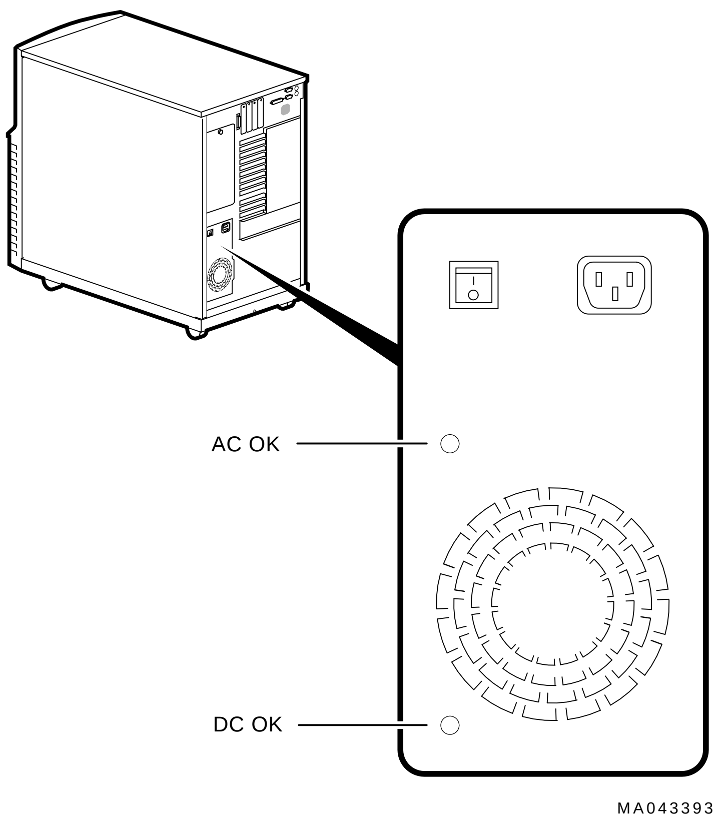
The following types of failures will cause the power supply to shut down the system:

- Fan failure (after 5 seconds)
- Overtemperature condition
- Blown power supply fuse

Note

The internal power supply fuse is not a serviceable part. Return to factory for service.

Figure 2–5 Power Supply LEDs (BA740 Enclosure)



Note

Later revisions of the power supply do not have an AC power switch or AC OK LED.

Figure 2–6 Power Supply LED (BA741 Enclosure)

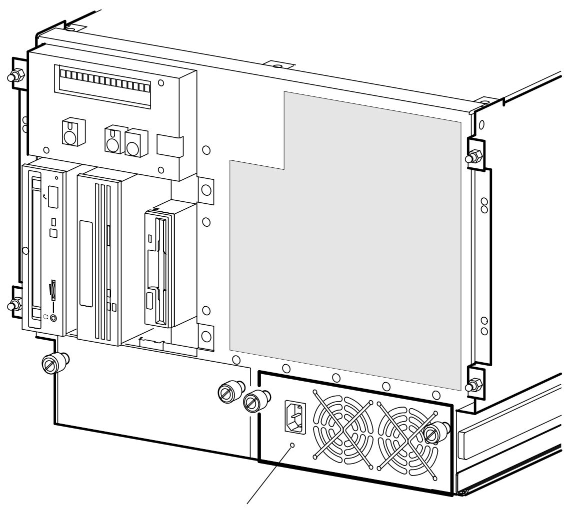


Table 2–9 Interpreting Power Supply LEDs

Indicator	Meaning	Action on Error
AC OK	When lit, indicates AC power is present and the AC On/Off switch is set to "on."	If AC power is not present, check the power source and power cord. If the system will not power up, check the DC On/Off button setting on the operator control panel. Make sure the air intake is unobstructed and that the room temperature is within environmental specifications (10–35°C, 50–95°F) and reset the AC On/Off switch. If the power supply shuts down after approximately 5 seconds, use a flashlight to look through the front of the system (to the left of the internal StorageWorks shelf) to determine if the 6.75-inch fan is spinning at power-up. A failure of the 6.75-inch fan will cause the system to shut down after approximately 5 seconds.
DC OK	When lit, indicates that all the DC output voltages are within specified tolerances.	

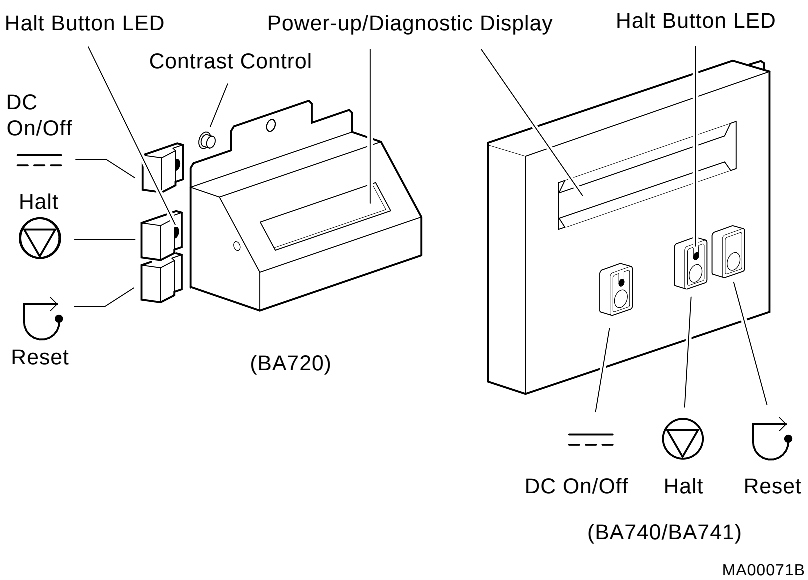
2.7.2 Halt Button LED (at power up)

During power-up, the console firmware checks for errors logged through the serial control bus. If an error is detected, the Halt button LED on the operator control panel lights.

If the Halt button LED comes on during power-up, use the `show fru` and `show error` commands (Chapter 3) to see what errors have been logged and to examine error information contained in serial control bus EEPROMs.

Figure 2–7 shows the location of the Halt button LED.

Figure 2–7 Halt Button



2.7.3 Storage Device LEDs

Storage device LEDs indicate the status of the device.

- Figure 2–8 shows the LEDs for disk drives contained in a StorageWorks shelf. A failure is indicated by the Fault light on each drive.
- Figure 2–9 shows the Activity LED for the floppy drive. This LED is on when the drive is in use.
- Figure 2–10 shows the Activity LED for the CD–ROM drive. This LED is on when the drive is in use.

For information on other storage devices, refer to the documentation provided by the manufacturer or vendor.

Figure 2–8 StorageWorks Disk Drive LEDs (SCSI)

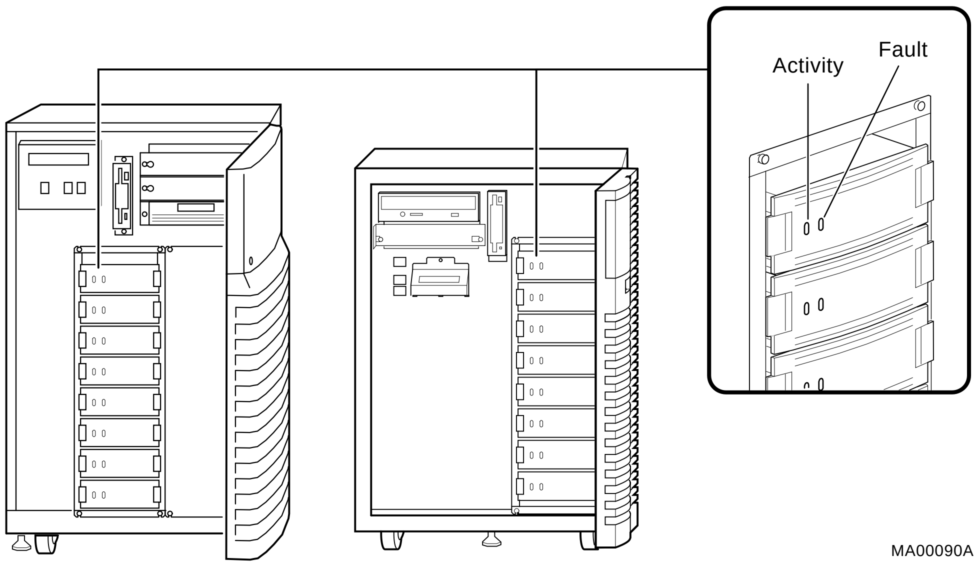


Figure 2–9 Floppy Drive Activity LED

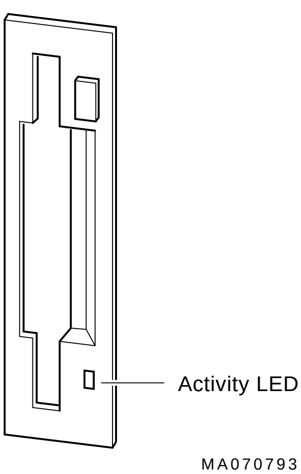
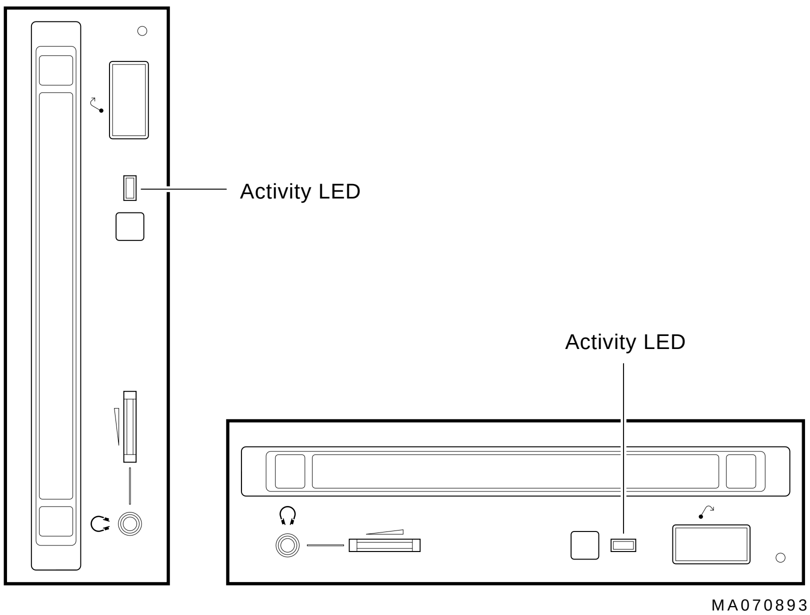


Figure 2–10 CD–ROM Drive Activity LED



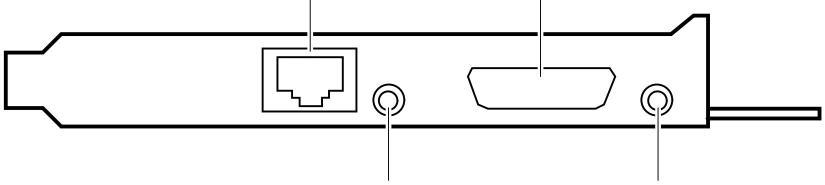
2.7.4 Standard I/O Panel LEDs (BA740/BA741 Enclosure)

The standard I/O panel LEDs (Figure 2–11) indicate which Ethernet port is currently selected, 10BASE-T or AUI.

Use the `ew*0_mode` environment variable to select the default Ethernet device type:

- aui — Sets the default Ethernet device to AUI.
- twisted — Sets the default Ethernet device type to 10BASE-T (twisted-pair).
- auto — Reads the device connected to the Ethernet port and sets the default to the appropriate Ethernet device type. This option is not implemented at Digital 2100 Server introduction.

Figure 2–11 Standard I/O Panel LEDs



2.8 Power-Up Sequence

During the AlphaServer power-up sequence, the power supplies are stabilized and the system is initialized and tested via the firmware power-on self-tests.

The power-up sequence includes the following:

- Power supply power-up:
  - AC power-up
  - DC power-up
- Two sets of power-on diagnostics:
  - Serial ROM diagnostics
  - Console firmware-based diagnostics

Caution

The BA740 pedestal enclosure will not power up if the left side panel is not securely attached. Removing the side panel will cause the system to shut down.

The BA720 pedestal enclosure will not power up if the system cover is not securely attached. Removing the system cover will cause the system to shut down.

2.8.1 AC Power-Up Sequence

The following power-up sequence occurs when AC power is applied to the system (system is plugged in) or, for BA740 enclosures with an AC On/Off switch, when the AC On/Off switch is set to "on;" or when electricity is restored after a power outage:

1. The front end of the power supply begins operation and energizes.
2. The power supply then waits for the DC power to be enabled.

For BA740 enclosures with power supply LEDs, the AC OK LED is illuminated when AC power is applied.

Note

For rackmount systems, you should hear the fans spin up when the system is plugged in (AC power applied).

For pedestal systems, the left side panel (BA740 enclosure) or system cover (BA720 enclosure) must be securely installed. A safety interlock prevents the system from being powered on with the panel or cover removed.

2.8.2 DC Power-Up Sequence

DC power is applied to the system with the DC On/Off button on the operator control panel.

A summary of the DC power-up sequence is provided below:

1. When the DC On/Off button is pressed, the power supply checks for a POK_H condition.
2. 12V, 5V, 3.3V, and -12V outputs are energized and stabilized. If the outputs do not come into regulation, the power-up is aborted and the power supply enters the latching-shutdown mode.
3. With a POK_H condition established and DC voltages stabilized, the power supply delivers a DCOK_H signal to the standard I/O and motherboard.

Note

AlphaServer 2000-series systems (BA720 enclosure) do not have a DCOK_H signal.

---

4. The standard I/O then generates the ASYNC_RESET_L. In the case of a full power supply configuration, each DCOK_H signal must be asserted; in the case of a redundant power supply configuration, either one of DCOK_H signals must be asserted.

Redundant:	POK_H = PS1_POK_H or PS2_POK_H
	DCOK_H = PS1_DCOK_H or PS2_DCOK_H
Full:	POK_H = PS1_POK_H and PS2_POK_H
	DCOK_H = PS1_DCOK_H and PS2_DCOK_H

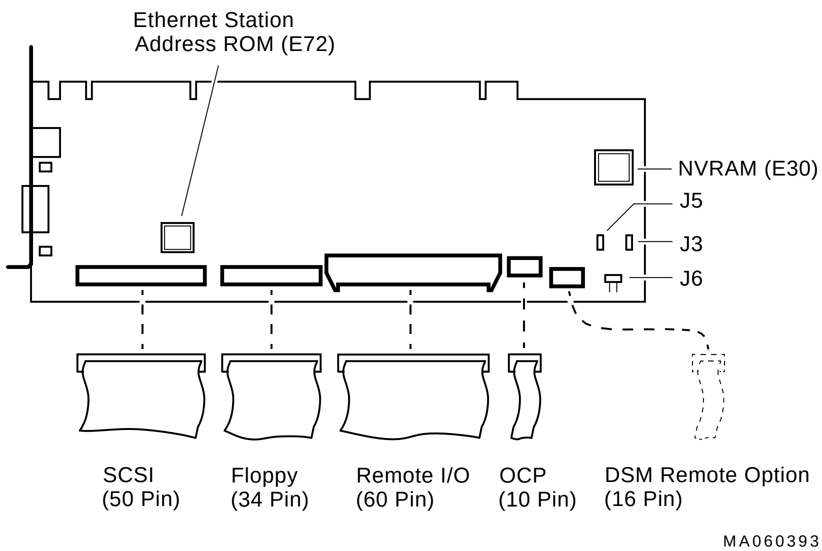
The power supply mode jumper (J3) on the standard I/O module (Figure 2–12) controls the mode of power supply operation. For 2000-series systems, J3 is located on the I/O backplane (Figure 2–13). With the jumper installed, the power supplies operate in redundant mode. Full power mode, with the jumper removed, is the default setting.

Note

Rackmount systems always use the redundant mode setting when two power supplies are used.

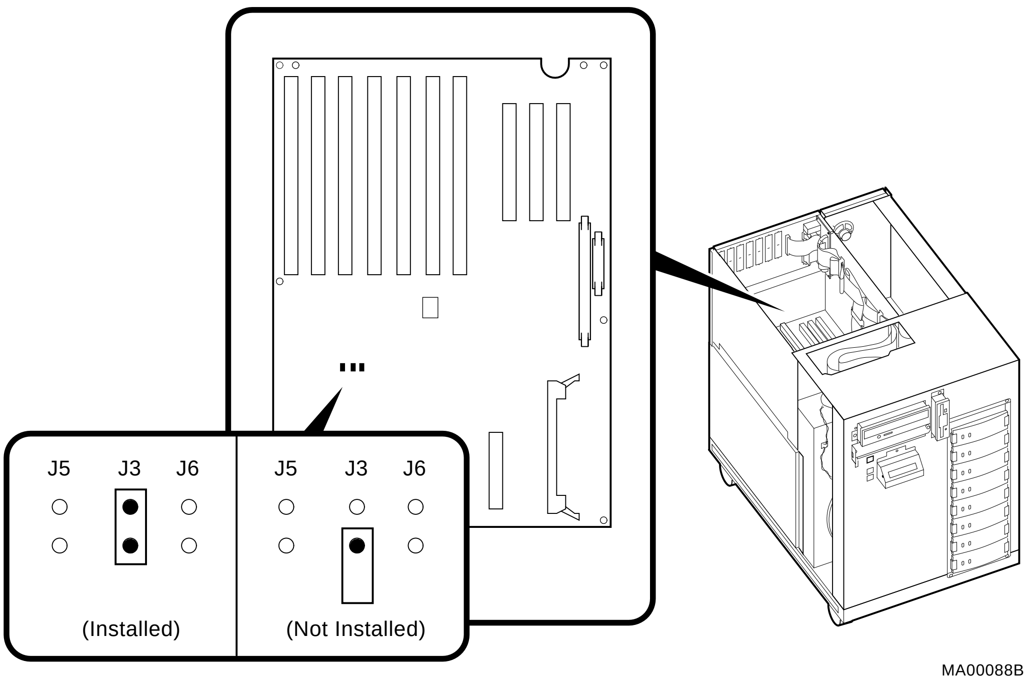
5. For systems with power supply LEDs, the DC OK LED on the power supply is lit. Firmware power-up diagnostics begin.

Figure 2–12 Power Supply Mode Jumper (J3) on the Standard I/O (BA740 /BA741 Enclosures)



J3–Power supply mode: When installed, dual power supplies operate in redundant mode.
J5–Program voltage: Internal use only.
J6–Fail-Safe: When installed, selects the fail-safe loader firmware.

Figure 2–13 Power Supply Mode Jumper (J3) on the I/O Backplane (BA720 Enclosure)



J3–Power supply mode: When installed, dual power supplies operate in redundant mode.
J5–Program voltage: Internal use only.
J6–Fail-Safe: When installed, selects the fail-safe loader firmware.

2.9 Firmware Power-Up Diagnostics

After successful completion of AC and DC power-up sequences, the processor performs its power-up diagnostics. These tests verify system operation, load the system console, and test the core system (CPU, memory, standard I/O or I/O backplane, and motherboard), including all boot path devices. These tests are performed as two distinct sets of diagnostics:

1. Serial ROM diagnostics—These tests are loaded from the serial ROM located on the CPU module into the CPU's instruction cache (I-cache). They check the basic functionality of the system and load the console code from the FEPROM on the standard I/O module (or I/O backplane for BA720 enclosures) into system memory.

Failures during these tests are indicated by the power-up/diagnostic display on the operator control panel. Diagnostic test and exerciser failures are also logged in EEPROM as TDD error logs via the serial control bus for CPU, memory, and standard I/O modules (or I/O backplane for BA720 enclosures).

2. Console firmware-based diagnostics—These tests are executed by the console code. They test the core system, including all boot path devices.

   Failures during these tests are reported to the console terminal via the power-up screen or console event log. Diagnostic test and exerciser failures are also logged in EEPROM as TDD or SDD error logs via the serial control bus for CPU, memory, and standard I/O modules.

2.9.1 Serial ROM Diagnostics

The serial ROM diagnostics are loaded into the CPU's instruction cache from the serial ROM on the CPU module. They test the system in the following order:

1. Test the CPU and backup cache located on the CPU module. If the backup cache fails testing, a CPU failure is indicated on the power-up/diagnostic display on the operator control panel (OCP), the error is logged to the serial control bus EEPROM, and remaining backup cache tests are completed.
2. Test the CPU module's system bus interface.
3. Test the system bus to PCI bus bridge and system bus to EISA bus bridge. If the PCI bridge fail or EISA bridge fail, a standard I/O (or I/O backplane for BA720 enclosures) failure is indicated on the power-up/diagnostic display on the OCP. The power-up tests continue despite these errors.
4. CPUs determine which CPU will serve as the primary CPU. Each CPU reads error log information from every CPU EEPROM. The lowest numbered passing CPU is selected as the primary CPU in a process called multiprocessor failover (Section 2.2.1). If all CPUs fail power-up diagnostics, then CPU0 is selected as the primary CPU. The primary CPU then takes control and completes the remaining steps.
5. Locate the largest memory module in the system and test the first 32 MB of memory on the module. Only the first 32 MB of memory are tested. If there is more than one memory module of the same size, the lowest numbered memory module (one closest to the CPU) is tested first.

   If the memory test fails, the next largest memory module in the system is tested. Testing continues until a good memory module is found. If a good memory module is not found, a memory failure is indicated on the power-up /diagnostic display on the OCP, and the power-up tests are terminated.
6. Check the access to the FEPROMs on the standard I/O module, or I/O backplane for BA720 enclosures.

7. The SRM console program is loaded into memory from the FEPROM on the standard I/O module (or I/O backplane for BA720 enclosures). A checksum test is executed for the console image. If the checksum test fails, the fail-safe loader (FSL) is automatically loaded into memory and the system displays the FSL prompt, `ash>`.

   If the checksum test passes, control is passed to the console code, and the console firmware-based diagnostics are run.

   While the console is being loaded into memory, CPUs with errors logged are disabled (if not the primary CPU). Working CPUs spin on mailbox (they continuously read the mailbox address).

2.9.2 Console Firmware-Based Diagnostics

Console firmware-based tests are executed once control is passed to the console code in memory. They check the system in the following order:

1. Perform a complete check of system memory. If a system has more than one memory module, the modules are checked in parallel.
2. Set memory interleave to maximize interleave factor across as many memory modules as possible (one, two, or four-way interleaving). During this time the console firmware is moved into backup cache on the primary CPU module. After memory interleave is set, the console firmware is moved back into memory.

   Steps 3–6 may be completed in parallel.

3. Start the I/O drivers for mass storage devices and tapes. At this time a complete functional check of the machine is made. After the I/O drivers are started, the console program continuously polls the bus for devices (approximately every 20 or 30 seconds).
4. Check that EISA configuration information is present in NVRAM for each EISA module detected and that no information is present for modules that have been removed.
5. Run exercisers on the drives currently seen by the system.

   Note

   This step does not ensure that all disks in the system will be tested or that any device drivers will be completely tested. Spin-up time varies for different drives, so not all disks may be on line at this point in the power-up. To ensure complete testing of disk devices, use the `test` command.

6. If the Halt button is set to “in” (depressed), the customized NVRAM script (if the customer has created one) is not executed.
7. Enter console mode or boot the operating system. This action is determined by the Halt button setting or `auto_action` environment variable.

   If the `os_type` environment variable is set to NT, the ARC console is loaded into memory, and control is passed to the ARC console.

3 Running System Diagnostics

This chapter provides information on how to run system diagnostics.

- Section 3.1 describes how to run ROM-based diagnostics, including error reporting utilities and loopback tests.
- Section 3.4 describes acceptance testing and initialization procedures.
- Section 3.5 describes the DEC VET operating system exerciser.

3.1 Running ROM-Based Diagnostics

ROM-based diagnostics (RBDs), which are part of the console firmware that is loaded from the FEPROM on the standard I/O module (or I/O backplane on BA720 enclosures), offer many powerful diagnostic utilities, including the ability to examine error logs from the console environment and run system- or device-specific exercisers.

AlphaServer RBDs rely on exerciser modules, rather than functional tests, to isolate errors. The exercisers are designed to run concurrently, providing a maximum bus interaction between the console drivers and the target devices.

The multitasking ability of the console firmware allows you to run diagnostics in the background (using the background operator "&" at the end of the command). You run RBDs by using console commands.

Note

ROM-based diagnostics, including the `test` command, are run from the SRM console (firmware used by OpenVMS and DEC OSF/1). If you are running Windows NT, refer to Section 5.1.2 for the steps used to switch between consoles.

RBD console commands do not log errors to the serial control bus EEPROMs. Errors are reported to the console terminal and/or the console event log.

3.2 Command Summary

Table 3–1 provides a summary of the diagnostic and related commands.

Table 3–1 Summary of Diagnostic and Related Commands

Command	Function	Reference
Acceptance Testing		
test	Quickly tests the core system. The `test` command is the primary diagnostic for acceptance testing and console environment diagnosis.	Section 3.3.1
Error Reporting		
clear_error	Clears error information logged through the serial control bus. The `show error` command displays errors logged to the serial control bus EEROMs.	Section 3.3.5
show error	Reports core system errors captured by test-directed diagnostics (TDD), via the RBDs, and symptom-directed diagnostics (SDD), via the operating system.	Section 3.3.4
show fru	Reports system bus module identification numbers and summary error information.	Section 3.3.3
Extended Testing/Troubleshooting		
exer_read	Tests a disk by performing random reads on the specified device.	Section 3.3.6
memexer	Exercises memory by running a specified number of memory tests. The tests are run in the background.	Section 3.3.7
memexer_mp	Tests memory in a multiprocessor system by running a specified number of memory exerciser sets. The tests are run in the background.	Section 3.3.8
net -ic	Initializes the MOP counters for the specified Ethernet port.	Section 3.3.11
net -s	Displays the MOP counters for the specified Ethernet port.	Section 3.3.10
nettest	Runs external loopback tests for specified EISA- or PCI-based Ethernet ports.	Section 3.3.9
sys_exer	Exercises core system. Runs tests concurrently.	Section 3.3.2

(continued on next page)

Table 3–1 (Cont.) Summary of Diagnostic and Related Commands

Command	Function	Reference
Loopback Testing		
test lb	Conducts loopback tests for COM2 and the parallel port in addition to quick core system tests.	Section 3.3.1
sys_exer lb	Conducts loopback tests for COM2 and the parallel port in addition to core system tests.	Section 3.3.2
nettest	Runs external or internal loopback tests for specified EISA- or PCI-based Ethernet ports.	Section 3.3.9
Diagnostic-Related Commands		
kill	Terminates a specified process.	Section 3.3.12
kill_diags	Terminates all currently executing diagnostics.	Section 3.3.12
show_status	Reports the status of currently executing test /exercisers.	Section 3.3.13

3.3 Command Reference

This section provides detailed information on the diagnostics commands and related commands.

3.3.1 test

The `test` command runs firmware diagnostics for the entire core system. The tests are run sequentially and the status of each subsystem test is displayed to the console terminal as the tests progress. If a particular device is not available to test, a message is displayed.

Note

By default, no write tests are performed on disk and tape drives. Media must be installed to test the floppy drive and tape drives.

The `test` script tests devices in the following order:

1. Memory tests (one pass)

Note

Certain memory errors that are reported by the OCP may not be reported by the ROM-based diagnostics. Always check the power-up/diagnostic display before running diagnostic commands.

---

2. Read-only tests: DK* disks, DR* disks, DU* disks, MK* tapes, DV* floppy
3. Console loopback tests if lb argument is specified: COM2 serial port and parallel port
4. VGA console tests—These tests are run only if the console environment variable is set to "serial." The VGA console test displays rows of the letter "H".
5. Network external loopback tests for EWA0—This test requires that the Ethernet port be terminated or connected to a live network; otherwise, the test will fail.

Synopsis:

test [lb]

Arguments:

[lb] The loopback option includes console loopback tests for the COM2 serial port and the parallel port during the test sequence.

Examples:

The system is tested, and the tests complete successfully.

```
P00>>> test
 Testing the Memory
Testing the DK* Disks(read only)
dkb600.6.0.2.1 has no media present or is disabled via the RUN/STOP switch
file open failed for dkb600.6.0.2.1
No DR* Disks available for testing
Testing the MK* Tapes(read only)
Testing the DV* Floppy Disks(read only)
file open failed for dva0.0.0.0.1
Testing the VGA(Alphanumeric Mode only)
Testing the EW* Network
P00>>>
```

The system is tested, and the system reports and error message. No network server responded to a loopback message. Ethernet connectivity on this system should be checked.

```
P00>>> test
Testing the Memory
Testing the DK* Disks(read only)
No DR* Disks available for testing
Testing the MK* Tapes(read only)
Testing the DV* Floppy Disks(read only)
Testing the VGA(Alphanumeric Mode only)
Testing the EW* Network

*** Error (ewa0), Mop loop message timed out from: 08-00-2b-3b-42-fd

*** List index: 7 received count: 0 expected count 2

P00>>>
```

3.3.2 sys_exer

The `sys_exer` command runs firmware diagnostics for the entire core system. The same tests that are run using the `test` command are run with `sys_exer`, only these tests are run concurrently and in the background. Nothing is displayed unless an error occurs.

Note

Some processes started using `sys_exer` are not stopped using the `kill` and `kill_diags` commands. Use the `init` command to terminate all sys_exer processes.

Because the sys_exer tests are run concurrently and indefinitely (until you stop them with the `init` command), they are useful in flushing out intermittent hardware problems.

Note

By default, no write tests are performed on disk and tape drives. Media must be installed to test the floppy drive and tape drives.

Certain memory errors that are reported by the OCP may not be reported by the ROM-based diagnostics. Always check the power-up/diagnostic display before running diagnostic commands.

Synopsis:

sys_exer [lb]

Arguments:

[lb]	The loopback option includes console loopback tests for the COM2 serial port and the parallel port during the test sequence.

Examples:

```
P00>>> sys_exer

P00>>>sys_exer
Exercising the Memory
Exercising the DK* Disks(read only)
Exercising the MK* Tapes(read only)
Exercising the Floppy(read only)
Exercising the VGA(Alphanumeric Mode only)
Exercising the EWA0 network

Type init in order to boot the operating system

P00>>> show_status

 ID       Program      Device       Pass  Hard/Soft Bytes Written  Bytes Read
-------- ----------- ------------ ------ --------- ------------- -------------
00000001        idle system           0     0     0             0             0
0000006f     memtest memory           1     0     0      35651584      35651584
00000070     memtest memory           1     0     0      35651584      35651584
00000077     memtest memory           1     0     0      37748736      37748736
0000007e    exer_kid dka0.0.0.1.0     0     0     0             0         69120
0000007f    exer_kid dka600.6.0.1     0     0     0             0         66560
00000093    exer_kid dva0.0.0.0.1     0     0     0             0             0
000000d5     nettest ewa0.0.0.0.0    13     0     0        308672        308672
P00>>> init
```

3.3.3 show fru

The `show fru` command reports FRU and error information for the following FRUs based on the serial control bus EEPROM data:

- CPU modules
- Memory modules
- I/O modules

For each of the above FRUs, the slot position, option, part, revision, and serial numbers, as well as any reported symptom-directed diagnostics (SDD) and test-directed diagnostics (TDD) event logs are displayed.

In addition, installed PCI and EISA modules are displayed with their respective slot numbers.

Synopsis:

show fru ([target [target . . .]])

Arguments:

[target] CPU{0,1,2,3}, mem{0,1,2,3}, io.

Example for AlphaServer 2100 Systems:

```
P00>>> show fru
  ➊      ➋        ➌              ➍        ➎               ➏
                                Rev                     Events  logged
 Slot   Option   Part#         Hw Sw   Serial#         SDD     TDD
   0    IO       B2110-AA      H2 0    KA427P0593      00      00
   2    CPU0     B2020-AA      B2 9    KA426C0457      00      00
   4    MEM0     B2021-BA      A1 0    ML34156292      00      00

 Slot   Option                 Hose 0, PCI

 Slot   Option                 Hose 1, EISA
   2    CPQ3011
   4    DEC4220

 Slot   Option                 Hose 2, PCI
P00>>>
```

➊ System bus slot number for FRU (slots 0–7 top to bottom)

Slot 0: Standard I/O module (dedicated EISA/PCI card cage slot)
Slot 1–3, 5: CPU modules
Slot 4–7: Memory modules

➋ Option name (I/O, CPU#, or MEM#)

➌ Part number of option

➍ Revision numbers (hardware and firmware)

❺ Serial number

❻ Events logged:

Numbers other than “00” indicate that errors have been logged.

> SDD: Number of symptom-directed diagnostic events logged by the serial ROM diagnostics at power up.
> TDD: Number of test-directed diagnostic events logged by the firmware diagnostics at power up.

Example for AlphaServer 2000 Systems:

```
P00>>> show fru
         ❶       ❷                ❸       ❹                ❺
                                  Rev                      Events logged
 Slot   Option  Part#           Hw Sw   Serial#          SDD     TDD
   0    IO      B2111-AA        H2 0    KA347DWV06       00      00
   2    CPU0    B2020-AA        B2 9    ML43400028       00      00
   3    MEM0    B2023-BA        A1 0    AY34915430       00      00

 Slot   Option                  Hose 0, PCI
   6    DECchip 21050-AA
   7    DECchip 21040-AA
   8    DECchip 21050-AA

 Slot   Option                  Hose 1, EISA
   1    ADP0001
   2    DEC4220
   3    DEC23F0
   5    DEC3002
   6    DEC4250
   7    CPQ3011

 Slot   Option                  Hose 2, PCI
P00>>>
```

❶ Option name (I/O, CPU#, or MEM#)

❷ Part number of option

❸ Revision numbers (hardware and firmware)

❹ Serial number

❺ Events logged:

Numbers other than “00” indicate that errors have been logged.

> SDD: Number of symptom-directed diagnostic events logged by the serial ROM diagnostics at power up.
> TDD: Number of test-directed diagnostic events logged by the firmware diagnostics at power up.

3.3.4 show error

The `show error` command reports error information based on the serial control bus EEPROM data. Both the operating system and the ROM-based diagnostics log errors to the serial control bus EEPROMs. This functionality provides the ability to generate an error log from the console environment.

A closely related command, `show fru` (Section 3.3.3), reports FRU and error information for FRUs.

Synopsis:

show error ([target [target . . .]])

Arguments:

[target]	CPU{0,1,2,3}, mem{0,1,2,3}, and io.

Memory Errors

Note

Certain memory errors that are reported by the OCP may not be reported by the ROM-based diagnostics. Always check the power-up/diagnostic display before running diagnostic commands.

Correctible errors are indicated by event type 00. If five or more correctible errors are logged for the same memory module, the specified SIMMs (AlphaServer 2000 systems) or module should be replaced.

For all unncorrectible errors, indicated by event types 01 and 10, you should replace the failing SIMM(s) (AlphaServer 2000 systems) or memory module.

Only two bad memory data bits at a time are captured by the system diagnostics. For AlphaServer 2000 systems: If more than two SIMMs are bad, you may need to repeat the SIMM isolation and replacement procedures until all bad SIMMs are replaced.

Memory Error Example:

```
P00>>> show error mem3
Test Directed Errors

No Entries Found

Symptom Directed Errors
 ❶         ❷               ❸              ❹          ❺         ❻         ❼
Entry   Fail Address   Bits/Syndrome   Bank #   ASIC #   Source   Event Type
  0     0be21e00         0cd2           1        1        1          00
  1     0be26b80         0cd2           1        1        1          00
  2     04224020         14,09          2        1        1          01
P00>>>
```

❶ Event log entry number

❷ Fail address—The zero-based module failing address. If the module is configured at base address zero, then the failing address is the offset to the failing DRAM.

❸ Bits/syndrome—First two failing bits (in hexadecimal) for uncorrectible errors; syndrome (in hexadecimal) for correctable errors. For SIMM memory (AlphaServer 2000 systems), the position (J#) for the corresponding failing SIMMs is also displayed.

❹ Bank number—The bank number of the failing DRAM.

❺ Asic number—The asic chip that detected the error.

❻ Source—The software or firmware that logged the error.

  0—SROM
  1—SRM firmware (RBDs)
  2—OSF
  3—VMS
  4—NT
  5–7—Reserved

❼ Event type:

  00—Data correctable
  01—Data uncorrectable
  10—Data uncorrectable (first two bits logged)
  11—Other (address and syndrome fields not valid)

CPU Errors

Note

Different CPU types cannot be used within the same system. Example: A KN450 CPU module and a KN460 CPU module cannot be used in the same system.

If an event is logged for any other test than test number 00, the CPU should be replaced. Event logs with just test number 00 do not indicate a bad CPU. Test number 00 indicates that a CPU failover occurred sometime in the past.

All systems must have a CPU module installed in system bus slot 2 (CPU0).

CPU Error Example:

```
P00>>> show error cpu0

CPU0 Module EEROM Event Log

Test Directed Errors
                                 ❶
Entry: 0  Test Number: 02       Subtest Number: 02
Parameter 1: 00000000,00000010
Parameter 2: ffffffff,ffffffff
Parameter 3: fffffeff,ffffffff

CPU Event Counters
C3_CA_NOACK     0
   .
   .
   .
C3_DT_PAR_E     0
C3_DT_PAR_O     0

B-Cache Correctable Errors

Entry   Syndrome        Offset L        Offset H        Count

No Entries Found
P00>>>
```

❶ Test Number—A test number other than 00 indicates the CPU should be replaced. Test number 00 indicates a CPU failover has occurred.

3.3.5 clear_error

The `clear_error` command clears error information logged to the serial control bus EEPROMs. The `show fru` command can be used to verify that errors have been cleared (the events logged columns will be set to zeroes).

Synopsis:

clear_error ([all, cpu0–3, mem0–3, io])

Arguments:

[target]	all, CPU{0,1,2,3}, mem{0,1,2,3}, and io.

Examples:

```
P00>>> clear_error all
P00>>>
```

3.3.6 exer_read

The `exer_read` command tests a disk by performing random reads of 2048 bytes on one or more devices. The exercisers are run in the background and nothing is displayed unless an error occurs.

The tests continue until one of the following conditions occurs:

1. All blocks on the device have been read for a passcount of d_passes (default is 1).
2. The exer_read process has been terminated via the `kill` or `kill_diags` commands, or Ctrl/C.
3. The specified time has elapsed.

To terminate the read tests, enter Ctrl/C, or use the `kill` command to terminate an individual diagnostic or the `kill_diags` command to terminate all diagnostics. Use the `show_status` display to determine the process ID when terminating an individual diagnostic test.

Synopsis:

exer_read [-sec seconds] [device_name device_name . . .]

Arguments:

[device_name]	One or more device names to be tested. The default is du*.*, dk*.*, and dr*.* to test all DSSI and SCSI disks and floppy drives that are on line. These drives may be on the native SCSI bus or connected to an EISA- or PCI-based controller.

Options:

[-sec seconds]	Number of seconds to run exercisers. If you do not enter the number of seconds, the tests will run until d_passes have completed (d_passes default is 1). If you want to test the entire disk, run at least one pass across the disk. If you do not need to test the entire disk, run the test for 5 or 10 minutes.

Examples:

```
P00>>> exer_read

failed to send command to pkc0.1.0.2.0
failed to send Read to dkc100.1.0.2.0


*** Hard Error - Error #5 -

Diagnostic Name        ID            Device  Pass  Test  Hard/Soft
31-JUL-1992
exer_kid         00000175       dkc100.1.0.2     0     0     1    0
14:54:18
Error in read of 0 bytes at location 014DD400 from device dkc100.1.0.2.0

*** End of Error ***
P00>>>
```

3.3.7 memexer

The `memexer` command tests memory by running a specified number of memory exercisers. The exercisers are run in the background and nothing is displayed unless an error occurs. Each exerciser tests all available memory in 2 x the backup cache size blocks for each pass.

Note

Certain memory errors that are reported by the OCP may not be reported by the ROM-based diagnostics. Always check the power-up/diagnostic display before running diagnostic commands.

To terminate the memory tests, use the `kill` command to terminate an individual diagnostic or the `kill_diags` command to terminate all diagnostics. Use the `show_status` display to determine the process ID when terminating an individual diagnostic test.

Synopsis:

memexer [number]

Arguments:

[number]	Number of memory exercisers to start. The default is 1.
	The number of exercisers, as well as the length of time for testing, depends on the context of the testing. Generally, running three to five exercisers for 15 minutes to 1 hour is sufficient for troubleshooting most memory problems.

Examples:

Example with no errors.

```
P00>>> memexer 4
P00>>> show_status

      ID      Program       Device   Pass Hard/Soft Bytes Written    Bytes Read
-------- ------------ ------------ ------ --------- ------------- -------------
00000001         idle       system      0    0    0             0             0
000000c7      memtest       memory      3    0    0     635651584      62565154
000000cc      memtest       memory      2    0    0     635651584      62565154
000000d0      memtest       memory      2    0    0     635651584      62565154
000000d1      memtest       memory      3    0    0     635651584      62565154
P00>>> kill_diags
P00>>>
```

Example with a memory compare error indicating bad SIMMs.

```
P00>>> memexer 4

*** Hard Error - Error #44 - Memory compare error

Diagnostic Name        ID            Device  Pass  Test  Hard/Soft   1-JAN-2066
memtest          000000c8              brd0     1     1     1    0     12:00:01
Expected value:  00000004
Received value:  80000001
Failing addr:    800001c

Failing SIMM module  J32
Failing SIMM module  J31

*** End of Error ***

P00>>> kill_diags
P00>>>
```

3.3.8 memexer_mp

The `memexer_mp` command tests memory cache coherency in a multiprocessor system by running a specified number of memory exerciser sets. A set is a memory test that runs on each processor checking alternate longwords. The exercisers are run in the background and nothing is displayed unless an error occurs.

Note

Certain memory errors that are reported by the OCP may not be reported by the ROM-based diagnostics. Always check the power-up/diagnostic display before running diagnostic commands.

To terminate the memory tests, use the `kill` command to terminate an individual diagnostic or the `kill_diags` command to terminate all diagnostics. Use the `show_status` display to determine the process ID when terminating an individual diagnostic test.

Synopsis:

memexer_mp [number]

Arguments:

[number] Number of memory exerciser sets to start. The default is 1.

The number of exercisers, as well as the length of time for testing, depends on the context of the testing. Generally, running two or three exercisers for 5 minutes is sufficient.

Examples:

```
P00>>> memexer_mp 2
P00>>> show_status
 ID       Program      Device       Pass  Hard/Soft Bytes Written  Bytes Read
-------- ------------ ------------ ------ --------- ------------- -------------
00000001         idle system          0    0    0             0             0
00000197      memtest memory         50    0    0      51380224      51380224
000001a1      memtest memory         49    0    0      50331648      50331648
000001c2      memtest memory         23    0    0      23068672      23068672
000001cc      memtest memory         19    0    0      18874368      18874368

P00>>> kill_diags
P00>>>
```

3.3.9 nettest

The `nettest` command can be used to run loopback tests for any EISA- or PCI-based Ethernet ports. It can also be used to test a port on a "live" network.

If the loopback tests are set to run continuously (-p pass_count set to 0), use the `kill` command (or Ctrl/C) to terminate an individual diagnostic or the `kill_diags` command to terminate all diagnostics. Use the `show_status` display to determine the process ID when terminating an individual diagnostic test.

Synopsis:

nettest [-mode port_mode] [-p pass_count] [port]

Arguments:

[port]	Specifies the Ethernet port on which to run the test; for example, ewa0 for the DECchip 21040-AA (TULIP) controller; or era0 for the LANCE chip controller.

Options:

[-p pass_count]	Specifies the number of times to run the test. If 0, then run continuously. The default value is 1. This is the number of passes for the diagnostic. Each pass sends the number of loop messages as set by the environment variable, `era*_loop_count`.
[-mode port_mode]	Specifies the mode to set the port adapter. • ex — external loopback, the default setting (requires a loopback connector or connection to a live network) • in — internal loopback (loopbacks are conducted within the chip only) Note: Not all network controllers support internal loopback protocol.

Testing an Ethernet Port:

```
P00>>> nettest ewa0 -p 0 &
P00>>> show_status

 ID       Program      Device       Pass  Hard/Soft Bytes Written  Bytes Read
-------- ------------ ------------ ------ --------- ------------- -------------
00000001         idle system           0    0    0             0             0
000000d5      nettest ewa0.0.0.0.0    13    0    0        308672        308672
P00>>> kill_diags
P00>>>
```

Testing an Ethernet Port on a Live Network:

1. Create a list of nodes for which to send MOP loopback packets from port era0.

```
P00>>>echo : 08-00-2B-E2-56-2A > ndbr/lp_nodes_era0
```

2. View the list of nodes.

```
P00>>>P00>>>cat ndbr/lp_nodes_era0
Node: 08-00-2b-e2-56-2a
```

3. Start the testing using the -mode nc flag to leave the port in the default state.

```
P00>>>nettest era0 -mode nc -p 0 &
```

4. View the status of the test.

```
P00>>>show_status

 ID       Program      Device       Pass  Hard/Soft Bytes Written  Bytes Read
-------- ------------ ------------ ------ --------- ------------- -------------
00000001         idle system           0    0    0             0             0
000000b5      nettest era0.0.0.4.1     7    0    0        322068        322000
```

5. Stop the testing.

```
P00>>>kill_diags
P00>>>
```

3.3.10 net-s

The `net-s` command displays the MOP counters for the specified Ethernet port.

Synopsis:

net-s ewa0

Examples:

```
P00>>> net -s ewa0

Status counts:
ti: 72 tps: 0 tu: 47 tjt: 0 unf: 0 ri: 70 ru: 0
rps: 0 rwt: 0 at: 0 fd: 0 lnf: 0 se: 0 tbf: 0
tto: 1 lkf: 1 ato: 1 nc: 71 oc: 0

MOP BLOCK:
 Network list size: 0

MOP COUNTERS:
Time since zeroed (Secs): 42

TX:
 Bytes: 0 Frames: 0
 Deferred: 1 One collision: 0 Multi collisions: 0
TX Failures:
 Excessive collisions: 0 Carrier check: 0 Short circuit: 71
 Open circuit: 0 Long frame: 0 Remote defer: 0
 Collision detect: 71

RX:
 Bytes: 49972 Frames: 70
 Multicast bytes: 0 Multicast frames: 0
RX Failures:
 Block check: 0 Framing error: 0 Long frame: 0
 Unknown destination: 0 Data overrun: 0 No system buffer: 0
 No user buffers: 0
P00>>>
```

3.3.11 net -ic

The `net-ic` command initializes the MOP counters for the specified Ethernet port.

Synopsis:

net -ic ewa0

Examples:

```
P00>>> net -ic ewa0
P00>>> net -s ewa0
Status counts:
ti: 72 tps: 0 tu: 47 tjt: 0 unf: 0 ri: 70 ru: 0
rps: 0 rwt: 0 at: 0 fd: 0 lnf: 0 se: 0 tbf: 0
tto: 1 lkf: 1 ato: 1 nc: 71 oc: 0

MOP BLOCK:
 Network list size: 0

MOP COUNTERS:
Time since zeroed (Secs): 3

TX:
 Bytes: 0 Frames: 0
 Deferred: 0 One collision: 0 Multi collisions: 0
TX Failures:
 Excessive collisions: 0 Carrier check: 0 Short circuit: 0
 Open circuit: 0 Long frame: 0 Remote defer: 0
 Collision detect: 0

RX:
 Bytes: 0 Frames: 0
 Multicast bytes: 0 Multicast frames: 0
RX Failures:
 Block check: 0 Framing error: 0 Long frame: 0
 Unknown destination: 0 Data overrun: 0 No system buffer: 0
 No user buffers: 0
P00>>>
```

3.3.12 kill and kill_diags

The `kill` and `kill_diags` commands terminate diagnostics that are currently executing .

- The `kill` command terminates a specified process.
- The `kill_diags` command terminates all diagnostics.

Synopsis:

kill_diags

kill [PID . . .]

Arguments:

[PID . . .]	The process ID of the diagnostic to terminate. Use the `show_status` command to determine the process ID.

3.3.13 show_status

The `show_status` command reports one line of information per executing diagnostic. The information includes ID, diagnostic program, device under test, error counts, passes completed, bytes written and read.

Many of the diagnostics run in the background and provide information only if an error occurs. Use the `show_status` command to display the progress of diagnostics.

The following command string is useful for periodically displaying diagnostic status information for diagnostics running in the background:

P00>>> while true;show_status;sleep n;done

Where *n* is the number of seconds between `show_status` displays.

Synopsis:

show_status

Examples:

```
P00>>> show_status

    ❶          ❷            ❸          ❹     ❺          ❻               ❼
 ID        Program      Device       Pass  Hard/Soft Bytes Written  Bytes Read
-------- ------------ ------------ ------ --------- ------------- -------------
00000001         idle system            0    0    0             0             0
0000006f      memtest memory            1    0    0      35651584      35651584
00000070      memtest memory            1    0    0      35651584      35651584
00000077      memtest memory            1    0    0      37748736      37748736
0000007e     exer_kid dka0.0.0.1.0      0    0    0             0         69120
0000007f     exer_kid dka600.6.0.1      0    0    0             0         66560
00000093     exer_kid dva0.0.0.0.1      0    0    0             0             0
000000d5      nettest ewa0.0.0.0.0     13    0    0        308672        308672
P00>>>
```

❶ Process ID

❷ Program module name

❸ Device under test

❹ Diagnostic pass count

❺ Error count (hard and soft): Soft errors are not usually fatal; hard errors halt the system or prevent completion of the diagnostics.

❻ Bytes successfully written by diagnostic

❼ Bytes successfully read by diagnostic

3.4 Acceptance Testing and Initialization

Perform the acceptance testing procedure listed below after installing a system or whenever adding or replacing the following:

CPU modules
Memory modules
Standard I/O module or I/O backplane
Motherboard or system bus motherboard
Daughter board (rackmount systems)
Storage devices
EISA or PCI options

1. Run the RBD acceptance tests using the `test` command.
2. If you have added, moved, or removed an EISA or ISA option, run the EISA Configuration Utility (ECU).
3. Bring up the operating system.
4. Run DEC VET to test that the operating system is correctly installed. Refer to Section 3.5 for information on DEC VET.

3.5 DEC VET

Digital's DEC Verifier and Exerciser Tool (DEC VET) software is a multipurpose system maintenance tool that performs exerciser-oriented maintenance testing. DEC VET runs on OpenVMS AXP, DEC OSF/1, and Windows NT operating systems. DEC VET consists of a manager and exercisers. The DEC VET manager controls the exercisers. The exercisers test system hardware and the operating system.

DEC VET supports various exerciser configurations, ranging from a single device exerciser to full system loading—that is, simultaneous exercising of multiple devices.

Refer to the *DEC Verifier and Exerciser Tool User's Guide* (AA–PTTMA–TE) for instructions on running DEC VET.

4 Error Log Analysis

This chapter provides information on how to interpret error logs reported by the operating system.

- Section 4.1 describes machine check/interrupts and how these errors are detected and reported.
- Section 4.2 describes the entry format used by the error formatters.
- Section 4.3 describes how to generate a formatted error log using the error formatters available with DEC OSF/1 and OpenVMS.
- Section 4.4 describes how to interpret the system error log using the bit-to-text translation to isolate the failing FRU.

4.1 Fault Detection and Reporting

Table 4–1 provides a summary of the fault detection and correction components of AlphaServer systems.

Generally, PALcode handles exceptions as follows:

- The PALcode determines the cause of the exception.
- If possible, it corrects the problem and passes control to the operating system for reporting before returning the system to normal operation.
- If error/event logging is required, control is passed through the system control block (SCB) to the appropriate exception handler.

Table 4–1 AlphaServer Fault Detection and Correction

Component	Fault Detection/Correction Capability
KN450/KN460 Processor Module	
DECchip 21064 and 21064A microprocessors	Contains error detection and correction (EDC) logic for data cycles. There are check bits associated for all data entering and exiting the 21064/A microprocessor. A single-bit error on any of the four longwords being read can be corrected (per cycle).
Backup cache (B-cache)	EDC check bits on the data store; and parity on the tag store and control store.
MS450/MS452 Memory Modules	
Memory module	EDC logic protects data by detecting and correcting up to 2 bits per DRAM chip per gate array. The four bits of data per DRAM are spread across two gate arrays (one for even longwords, the other for odd longwords).
Standard I/O Module or I/O Backplane	
I/O module or backplane	SCSI controller: SCSI data parity is generated. PCI Ethernet chip (AlphaServer 2100 systems): PCI data parity is generated. EISA to PCI bridge chip: PCI data parity is generated.
System Bus	
System bus	Longword parity on command, address, and data.
T2 System Bus to PCI Bus Bridge (on Motherboard MBD)	
System bus to PCI bus bridge chip	Longword parity on address and data.

4.1.1 Machine Check/Interrupts

The exceptions that result from hardware system errors are called machine check/interrupts. They occur when a system error is detected during the processing of a data request. There are three types of machine check/interrupts related to system events:

1. Processor machine check
2. System machine check
3. Processor-corrected machine check

The causes of each of the machine check/interrupts are as follows. The system control block (SCB) vector through which PALcode transfers control to the operating system is shown in parentheses.

Processor Machine Check (SCB: 670)

Processor machine check errors are fatal system errors that result in a system crash.

- The DECchip 21064 microprocessor detected one or more of the following uncorrectable data errors:
  - Uncorrectable B-cache data error
  - Uncorrectable memory data error (CU_ERR asserted)
  - Uncorrectable data from other CPU's B-cache (CU_ERR asserted)
- A B-cache tag or tag control parity error occurred
- Hard error was asserted in response to:
  - A system bus read data parity error
  - System bus timeouts (NOACK error bit asserted)—The bus responder detected a write data parity or command address parity error and did not acknowledge the bus cycle.

System Machine Check (SCB: 660)

A system machine check is a system-detected error, external to the DECchip 21064 microprocessor and possibly not related to the activities of the CPU. It occurs when C_ERROR is asserted on the system bus.

Fatal errors:

- The standard I/O module detected a system bus data parity error while serving as system bus commander:
  - System bus errors (NOACK error bit asserted)—The bus responder detected a write data parity or command address parity error and did not acknowledge the bus cycle
  - Uncorrectable data (CU_ERR asserted) from a responder on the system bus
  - PCI-reported address data or timeout errors
- Any system bus device detected a command/address parity error
- A bus responder detected a write data parity error
- Memory or standard I/O system bus gate array detected an internal error (SYNC error)

Nonfatal errors:

- A memory module corrected data
- Correctable B-cache errors were detected while the B-cache was providing data to the system bus (errors from other CPU)
- Duplicate tag store parity errors occurred

Processor-Corrected Machine Check (SCB: 630)

Processor-corrected machine checks are caused by B-cache errors that are detected and corrected by the DECchip 21064 microprocessor. These are nonfatal errors that result in an error log entry.

4.1.2 System Bus Transaction Cycle

In order to interpret error logs for system bus errors, you need a basic understanding of the system bus transaction cycle and the function of the commander, responder, and bystanders.

For any particular bus transaction cycle there is one commander (either CPU or standard I/O) that initiates bus transactions and one responder (memory, CPU, or I/O) that accepts or supplies data in response to a command/address from the system bus commander. A bystander is a system bus node (CPU, standard I/O, or memory) that is not addressed by a current system bus commander.

There are four system bus transaction types: read, write, exchange, and nut.

- Read and write transactions consist of a command/address cycle followed by two data cycles.

- Exchange transactions are used to replace the cache block when a cache block resource conflict occurs. They consist of a command/address cycle followed by four data cycles: two writes and two reads.
- Nut transactions consist of a command/address cycle and two dummy data cycles for which no data is transferred.

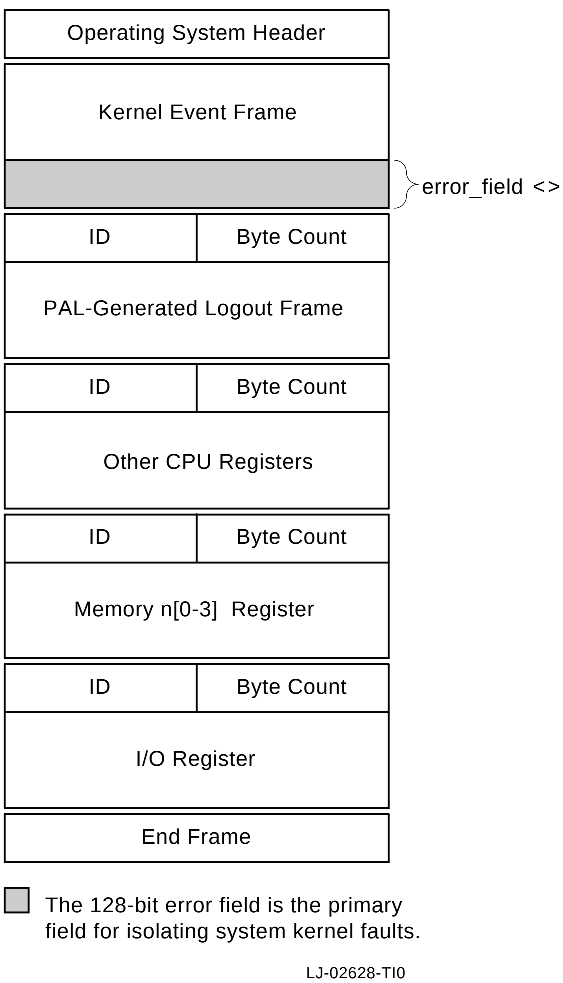
4.2 Error Logging and Event Log Entry Format

The DEC OSF/1 and OpenVMS error handlers can generate several entry types. All error entries, with the exception of correctable memory errors, are logged immediately. Entries can be of variable length based on the number of registers within the entry.

Each entry consists of an operating system header, kernel event frame, several device frames, and an end frame. Most entries have a PAL-generated logout frame, and may contain other CPU frames(0–3), memory (0–3), and I/O.

Figure 4–1 shows the general error log format used by the DECevent, ERF, and uerf error formatters.

Figure 4–1 Error Log Format



By examining the error fields (0–3) of the kernel event frame, you can isolate the failing system FRU for system faults reported by the operating system. One or more bits are set in the error fields as the result of the system error handling process. During the error handling process, errors are first handled by the appropriate PALcode error routine and then by the associated operating system error handler.

Section 4.4 describes how to interpret the error field to isolate to the FRU that is the source of the failure. Forthcoming fault management and error notification tools will key off of these error field bits.

4.3 Event Record Translation

Error formatters translate the entry into the format described in Section 4.2.

- Systems running OpenVMS can use the DECevent and ERF error formatters.
- Systems running DEC OSF/1 uses the uerf error formatter.

DECevent, ERF, and uerf provide bit-to-text translation for the kernel event frame.

Note

At product introduction, Microsoft Windows NT does not provide bit-to-text translation of system errors.

- Section 4.3.1 summarizes the commands used to translate the error log information for the OpenVMS operating system using DECevent.
- Section 4.3.2 summarizes the commands used to translate the error log information for the OpenVMS operating system using ERF.
- Section 4.3.3 summarizes the commands used to translate the error log for the DEC OSF/1 operating system.

4.3.1 OpenVMS Translation Using DECevent

The kernel error log entries are translated from binary to ASCII using the DIAGNOSE command. To invoke the error log utility, enter the DCL command DIAGNOSE.

Format:

DIAGNOSE/TRANSLATE [*qualifier*] [, . . .] [*infile*[, . . .]]

Example:

```
$ DIAGNOSE/TRANSLATE/SINCE=14-JUN-1994
```

For more information on generating error log reports using DECevent, refer to the *DECevent Translation and Reporting Utility for OpenVMS*.

DECevent bit-to-text translation highlights all error fields that are set, and other significant state. These are displayed in capital letters in the third column of the error log (see ❸ in Example 4–1). Otherwise, nothing is shown in the translation column.

Section 4.4.7 provides a sample DECevent-generated error log.

4.3.2 OpenVMS Translation Using ERF

The kernel error log entries are translated from binary to ASCII using the ANALYZE/ERROR command. To invoke the error log utility, enter the DCL command ANALYZE/ERROR_LOG.

Format:

ANALYZE_ERROR_LOG [/*qualifier(s)*] [*file-spec*] [, . . .]

Example:

```
$ ANALYZE/ERROR_LOG/INCLUDE=(CPU,MEMORY)/SINCE=TODAY
```

As shown in the above example, the OpenVMS error handler also supports the /INCLUDE qualifier, such that CPU and memory error entries can be translated selectively.

ERF bit-to-text translation highlights all error fields that are set, and other significant state. These are displayed in capital letters in the third column of the error log. Otherwise, nothing is shown in the translation column.

4.3.3 DEC OSF/1 Translation Using uerf

Error log information is written to /var/adm/binary.errlog. Use the following command to save the error log information by copying it to another file:

```
$ cp /var/adm/binary.errlog /tmp/errors_upto_today
```

To clear the error log file, use the following command:

```
$ cp /dev/null /var/adm/binary.errlog
```

To produce a bit-to-text translation of the error log file, use the following command:

```
$ uerf -f /tmp/errors_upto_today -R
```

To view all all error logs in reverse chronological order, use the following command:

```
$ uerf -R
```

For filtering of error logs, see the reference page (man page) for uerf on the system you are currently using:

```
$ man uerf
```

4.4 Interpreting System Faults

Use the following steps to determine the failing FRU when a system error is reported via an error log.

1. Examine the error fields of the kernel event frame.

   If a system error has been reported, one or more bits may be set for the error fields, 0–3, and their corresponding bit-to-text definition will be listed.

2. Using Table 4–2, find the entry that matches the set bit and bit-to-text to determine the most probable source of the fault listed in the third column. The field replaceable units (FRUs) for the core system are listed as follows:

   CPUnn — CPU module (0–3)
   MEMnn — Memory module (0–3)
   I/O_0 — Standard I/O module or I/O backplane
   I/O_1 — Expansion I/O module (PCI)
   PCInn — PCI modules (0–2)
   MBD — System bus motherboard, which contains the T2, system bus to PCI bus bridge chip.

3. If the table entry lists a note number along with the most probable failing module, refer to that note following Table 4–2.

   There are six possible notes, Note 1–Note 6. Each note provides a synopsis of the problem and additional information to consider for analysis.

Section 4.4.7 provides a sample DECevent-generated error log.

Table 4–2 Error Field Bit Definitions for Error Log Interpretation

Error Field Bits	Bit-to-Text Definition	Module/Notes
Quadword 0, error_field_0<63:0>, CPU0-Detected		
W0-Byte-0, CPU Machine Check Related Errors		
<0> C3_0_CA_NOACK	CPU_0 Bus Command No-Ack	CPU_0, Note 1
<1> C3_0_WD_NOACK	CPU_0 Bus Write Data No-Ack	CPU_0, Note 2
<2> C3_0_RD_PAR	CPU_0 Bus Read Data Parity Error	CPU_0, Note 3
<3> EV_0_C_UNCORR	CPU_0 Cache Uncorrectable	CPU_0, Note 4
<4> EV_0_TC_PAR	CPU_0 Cache Tag Control Parity Error	CPU_0
<5> EV_0_T_PAR	CPU_0 Cache Tag Parity Error	CPU_0
<6> C3_0_EV	CPU_0 CPU to System Bus Interface Data Error	CPU_0
<7> C3_0_RETRY_ FAILED	CPU_0 Retry Failed	CPU_0
W0-Byte-1, CPU Interrupt and Machine Check Related Errors		
<0> C3_0_C_UNCORR	CPU_0 Cache Uncorrectable (system bus interface detected)	CPU_0, Note 4
<1> C3_0_TC_PAR	CPU_0 Cache Tag Control Parity Error	CPU_0
<2> C3_0_T_PAR	CPU_0 Cache Tag Parity Error	CPU_0
<3> C3_0_C_CORR	CPU_0 Cache Correctable (system bus interface detected)	CPU_0
<4> EV_0_C_CORR	CPU_0 Cache Correctable (CPU detected)	CPU_0
<5> C3_0_SYN_1F	CPU_0 Cache Uncorrectable (0x1f Syndrome)	CPU_0

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Table 4–2 (Cont.) Error Field Bit Definitions for Error Log Interpretation

Error Field Bits	Bit-to-Text Definition	Module/Notes
Quadword 1, CPU1-Detected		
W1-Byte-0, CPU Machine Check Related Errors		
<0> C3_1_CA_NOACK	CPU_1 Bus Command No-Ack	CPU_1, Note 1
<1> C3_1_WD_NOACK	CPU_1 Bus Write Data No-Ack	CPU_1, Note 2
<2> C3_1_RD_PAR	CPU_1 Bus Read Parity Error	CPU_1, Note 3
<3> EV_1_C_UNCORR	CPU_1 Cache Uncorrectable (CPU detected)	CPU_1, Note 4
<4> EV_1_TC_PAR	CPU_1 Cache Tag Control Parity Error	CPU_1
<5> EV_1_T_PAR	CPU_1 Cache Tag Parity Error	CPU_1
<6> C3_1_EV	CPU_1 CPU to System Bus Interface Data Error	CPU_1
<7> C3_1_RETRY_ FAILED	CPU_1 Retry failed	CPU_1, MBD, or PCI target
W1-Byte-1, CPU Interrupt and Machine Check Related Errors		
<0> C3_1_C_UNCORR	CPU_1 Cache Uncorrectable (system bus interface detected)	CPU_1, Note 4
<1> C3_1_TC_PAR	CPU_1 Cache Tag Control Parity Error	CPU_1
<2> C3_1_T_PAR	CPU_1 Cache Tag Parity Error	CPU_1
<3> C3_1_C_CORR	CPU_1 Cache Correctable (system bus interface detected)	CPU_1
<4> EV_1_C_CORR	CPU_1 Cache Correctable (CPU detected)	CPU_1
<5> C3_1_SYN_1F	CPU_1 Cache Uncorrectable (0x1f Syndrome)	CPU_1

(continued on next page)

Table 4–2 (Cont.) Error Field Bit Definitions for Error Log Interpretation

Error Field Bits	Bit-to-Text Definition	Module/Notes
Quadword 2, CPU2-Detected		
W2-Byte-0, CPU Machine Check Related Errors		
<0> C3_2_CA_NOACK	CPU_2 Bus Command No-Ack	CPU_2, Note 1
<1> C3_2_WD_NOACK	CPU_2 Bus Write Data No-Ack	CPU_2, Note 2
<2> C3_2_RD_PAR	CPU_2 Bus Read Parity Error	CPU_2, Note 3
<3> EV_2_C_UNCORR	CPU_2 Cache Uncorrectable (CPU detected)	CPU_2, Note 4
<4> EV_2_TC_PAR	CPU_2 Cache Tag Control Parity Error	CPU_2
<5> EV_2_T_PAR	CPU_2 Cache Tag Parity Error	CPU_2
<6> C3_2_EV	CPU_2 CPU to System Bus Interface Data Error	CPU_2
<7> C3_2_RETRY_ FAILED	CPU_2 Retry failed	CPU_2
W2-Byte-1, CPU Interrupt and Machine Check Related Errors		
<0> C3_2_C_UNCORR	CPU_2 Cache Uncorrectable (system bus interface detected)	CPU_2, Note 4
<1> C3_2_TC_PAR	CPU_2 Cache Tag Control Parity Error	CPU_2
<2> C3_2_T_PAR	CPU_2 Cache Tag Parity Error	CPU_2
<3> C3_2_C_CORR	CPU_2 Cache Correctable (system bus interface detected)	CPU_2
<4> EV_2_C_CORR	CPU_2 Cache Correctable (CPU detected)	CPU_2
<5> C3_2_SYN_1F	CPU_2 Cache Uncorrectable (0x1f Syndrome)	CPU_2

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Table 4–2 (Cont.) Error Field Bit Definitions for Error Log Interpretation

Error Field Bits	Bit-to-Text Definition	Module/Notes
Quadword 3, CPU3-Detected		
W3-Byte-0, CPU Machine Check Related Errors		
<0> C3_3_CA_NOACK	CPU_3 Bus Command No-Ack	CPU_3, Note 1
<1> C3_3_WD_NOACK	CPU_3 Bus Write Data No-Ack	CPU_3, Note 2
<2> C3_3_RD_PAR	CPU_3 Bus Read Parity Error	CPU_3, Note 3
<3> EV_3_C_UNCORR	CPU_3 Cache Uncorrectable (CPU detected)	CPU_3, Note 4
<4> EV_3_TC_PAR	CPU_3 Cache Tag Control Parity Error	CPU_3
<5> EV_3_T_PAR	CPU_3 Cache Tag Parity Error	CPU_3
<6> C3_3_EV	CPU_3 CPU to System Bus Interface Data Error	CPU_3
<7> C3_3_RETRY_ FAILED	CPU_3 Retry failed	CPU_3
W3-Byte-1, CPU Interrupt and Machine Check Related Errors		
<0> C3_3_C_UNCORR	CPU_3 Cache Uncorrectable (system bus interface detected)	CPU_3, Note 4
<1> C3_3_TC_PAR	CPU_3 Cache Tag Control Parity Error	CPU_3
<2> C3_3_T_PAR	CPU_3 Cache Tag Parity Error	CPU_3
<3> C3_3_C_CORR	CPU_3 Cache Correctable (system bus interface detected)	CPU_3
<4> EV_3_C_CORR	CPU_3 Cache Correctable (CPU detected)	CPU_3
<5> C3_3_SYN_1F	CPU_3 Cache Uncorrectable (0x1f Syndrome)	CPU_3

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Table 4–2 (Cont.) Error Field Bit Definitions for Error Log Interpretation

Error Field Bits	Bit-to-Text Definition	Module/Notes
Quadword 1, error_field_1<63:0> — I/O as Commander (bus errors that the T2 system bus to EISA bus bridge chip can detect while the I/O module is commander)		
W0-Byte-0, External Cause		
<0> IO_CA_NOACK	T2 detected Bus Command/Add No-Ack	MBD or responder, Note 1
<1> IO_WD_NOACK	T2 detected Bus Write Data No-Ack	MBD or responder, Note 2
<2> IO_RD_PAR	T2 detected Bus Read Parity Error	MBD or target, Note 3
<3> IO_CB_UNCORR	Data received by T2 is corrupted	Target, Note 5
W0-Byte-1, Internal Cause		
<0> PCI_WR_PAR	T2 - PCI Write Data Parity Error	I/O
<1> PCI_ADD_PAR	T2 - PCI Address Parity Error	I/O
<2> PCI_RD_PAR	T2 - PCI Read Data Parity Error	I/O
<3> PCI_DEV_PAR	T2 - PCI Parity Error	I/O
<4> PCI_SYS_ERR	T2 - PCI System Error	I/O
<5> PCI_TIMEOUT	T2 - PCI Timeout Error	I/O
<6> PCI_NMI	T2 - PCI NMI Asserted	I/O

(continued on next page)

Table 4–2 (Cont.) Error Field Bit Definitions for Error Log Interpretation

Error Field Bits	Bit-to-Text Definition	Module/Notes
Quadword 1, error_field_0<63:0>, Responder Errors		
W0-Byte-0, Command/Address Parity Error Detected		
<0> C3_0_CA_PAR	CPU_0 Command/Address Parity Error	CPU_0, Note 1
<1> C3_1_CA_PAR	CPU_1 Command/Address Parity Error	CPU_1, Note 1
<2> MEM0_CA_PAR	MEM_0 Command/Address Parity Error	MEM_0, Note 1
<3> MEM1_C3_2_CA_PAR	MEM_1 or CPU_2 Command/Address Parity Error	MEM_1, CPU2, Note 1
<4> MEM2_CA_PAR	MEM_2 Command/Address Parity Error	MEM_2, Note 1
<5> MEM3_CA_PAR	MEM_3 Command/Address Parity Error	MEM_3, Note 1
<6> IO_CA_PAR	I/O Command/Address Parity Error	I/O_0, Note 1
<7> EXT_IO_C3_3_CA_PAR	External I/O or CPU3 Command/Address Parity Error	I/O_1, CPU3, Note 1
W0-Byte-1, System Bus Interface Write Data Parity Errors		
<0> C3_0_WD_PAR	CPU_0 Write Data Parity Error	CPU_0, Note 2
<1> C3_1_WD_PAR	CPU_1 Write Data Parity Error	CPU_1, Note 2
<2> MEM0_WD_PAR	MEM_0 Write Data Parity Error	MEM_0, Note 2
<3> MEM1_C3_2_WD_PAR	MEM_1 or CPU2 Write Data Parity Error	MEM_1, CPU2 Note 2
<4> MEM2_WD_PAR	MEM_2 Write Data Parity Error	MEM_2, Note 2
<5> MEM3_WD_PAR	MEM_3 Write Data Parity Error	MEM_3
<6> IO_WD_PAR	I/O Write Data Parity Error	I/O_0
<7> EXT_IO_C3_3_WD_PAR	External I/O Write Data Parity Error	I/O_1

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Table 4–2 (Cont.) Error Field Bit Definitions for Error Log Interpretation

Error Field Bits	Bit-to-Text Definition	Module/Notes
W1-Byte-0, Memory Uncorrectable Errors		
<0> MEM0_UNCORR	MEM_0 Uncorrectable Error	MEM_0
<1> MEM1_UNCORR	MEM_1 Uncorrectable Error	MEM_1
<2> MEM2_UNCORR	MEM_2 Uncorrectable Error	MEM_2
<3> MEM3_UNCORR	MEM_3 Uncorrectable Error	MEM_3
W1-Byte-1, Memory Correctable Errors		
<0> MEM0_CORR	MEM_0 Correctable Error	MEM_0
<1> MEM1_CORR	MEM_1 Correctable Error	MEM_1
<2> MEM2_CORR	MEM_2 Correctable Error	MEM_2
<3> MEM3_CORR	MEM_3 Correctable Error	MEM_3
<4> MEM0_COR_DIS	MEM_0 EDC Correction Disabled	MEM_0
<5> MEM1_COR_DIS	MEM_1 EDC_Correction Disabled	MEM_1
<6> MEM2_COR_DIS	MEM_2 EDC_Correction Disabled	MEM_2
<7> MEM3_COR_DIS	MEM_3 EDC_Correction Disabled	MEM_3
W2-Byte-0, Sync Errors (the two gate arrays are not working together)		
<0> MEM0_SYNC_Error	MEM_0 Chip Sync Error	MEM_0
<1> MEM1_SYNC_Error	MEM_1 Chip Sync Error	MEM_1
<2> MEM2_SYNC_Error	MEM_2 Chip Sync Error	MEM_2
<3> MEM3_SYNC_Error	MEM_3 Chip Sync Error	MEM_3
<4> IO_BUSSYNC	I/O Module System Bus Sync Error	MBD

(continued on next page)

Table 4–2 (Cont.) Error Field Bit Definitions for Error Log Interpretation

Error Field Bits	Bit-to-Text Definition	Module/Notes
Miscellaneous Flags		
W3-Byte-0, CPU-Specific (in context of CPU that is reporting the error)		
<0> EV_SYN_1F	CPU Reported Syndrome 0x1f	Note 4
<1> Reserved	Reserved SBZ	
<2> DT_PAR	Duplicate Tag Store Parity Error	This CPU
<3> EV_HARD_ERROR	CPU Cycle Aborted with HARD ERROR	
W3-Byte-1, Event Correlation Flags		
<0> C3_MEM_R_ERROR	CPU error caused by memory	Note 4
<1> IO_MEM_R_ERROR	I/O error caused by memory	
<2> C3_OCPU_ADD_ MATCH	CPU error caused by other CPU	Note 4
<3> MIXED_ERRORS	Mixed errors (no correlation)	
Quadword 3, error_field_3<63:0>, PCI and EISA Errors		
W0-Byte-0, PCI 0 Status Reported Errors		
<0> PCI_0_Parr_ Detected_as_Master	PCI 0 Data Parr Detected While Bus Master	PCI0 or MBD
<1> PCI_0_SIG_Target_ Abort	PCI 0 Aborted with Target-Abort While Target	PCI0 or MBD
<2> PCI_0_REC_Target_ Abort	PCI 0 Received Target-Abort While Target	PCI0 or MBD
<3> PCI_0_REC_Master_ Abort	PCI 0 Cycle Terminated with Master-Abort While Master	PCI0 or MBD
<4> PCI_0_SIG_System_ Error	PCI 0 Signaled System Error	PCI0 or MBD
<5> PCI_0_Detected_ Parity_Error	PCI 0 Detected Parity Error	PCI0 or MBD

(continued on next page)

Table 4–2 (Cont.) Error Field Bit Definitions for Error Log Interpretation

Error Field Bits	Bit-to-Text Definition	Module/Notes
W0-Byte-1, PCI 1 Status Reported Errors		
<0> PCI_1_Parr_ Detected_as_Master	PCI 1 Data Parr Detected While Bus Master	PCI1 or MBD
<1> PCI_1_SIG_Target_ Abort	PCI 1 Aborted with Target-Abort While Target	PCI1 or MBD
<2> PCI_1_REC_Target_ Abort	PCI 1 Received Target-Abort While Master	PCI1 or MBD
<3> PCI_1_REC_Master_ Abort	PCI 1 Cycle Terminated with Master-Abort While Master	PCI1 or MBD
<4> PCI_1_SIG_System_ Error	PCI 1 Signaled System Error	PCI1 or MBD
<5> PCI_1_Detected_ Parity_Error	PCI 1 Detected Parity Error	PCI1 or MBD
W1-Byte-0, PCI 2 Status Reported Errors		
<0> PCI_2_Parr_ Detected_as_Master	PCI 2 Data Parr Detected While Bus Master	PCI2 or MBD
<1> PCI_2_SIG_Target_ Abort	PCI 2 Aborted with Target-Abort While Target	PCI2 or MBD
<2> PCI_2_REC_Target_ Abort	PCI 2 Aborted with Target-Abort While Master	PCI2 or MBD
<3> PCI_2_REC_Master_ Abort	PCI 2 Cycle Terminated with Master-Abort While Master	PCI2 or MBD
<4> PCI_2_SIG_System_ Error	PCI 2 Signaled System Error	PCI2 or MBD
<5> PCI_2_Detected_ Parity_Error	PCI 2 Detected Parity Error	PCI2 or MBD

(continued on next page)

Table 4–2 (Cont.) Error Field Bit Definitions for Error Log Interpretation

Error Field Bits	Bit-to-Text Definition	Module/Notes
W2-Byte-0, PCI Ethernet Chip (TULIP) Status Reported Errors		
<0> TULIP_PARR_ Detected_as_Master	TULIP Parr Detected While Bus Master	I/O_0
<1> TULIP_SIG_Target_ Abort	TULIP Aborted with Target-Abort While Target	I/O_0
<2> TULIP_REC_Target_ Abort	TULIP Aborted with Target-Abort While Master	I/O_0
<3> TULIP_REC_Master_ Abort	TULIP Cycle Terminated with Master-Abort While Master	I/O_0
<4> TULIP_SIG_System_ Error	TULIP Signaled System Error	I/O_0
<5> TULIP_Detected_ Parity_Error	TULIP Detected Parity Error	I/O_0
W2-Byte-1, SCSI Controller (NCR) Status Status Reported Errors		
<0> NCR_PARR_ Detected_as_Master	NCR Data Parr Detected While Bus Master	I/O_0
<1> NCR_SIG_Target_ Abort	NCR Aborted with Target-Abort While Target	I/O_0
<2> NCR_REC_Target_ Abort	NCR Aborted with Target-Abort While Master	I/O_0
<3> NCR_REC_Master_ Abort	NCR Cycle Terminated with Master-Abort While Master	I/O_0
<4> NCR_SIG_System_ Error	NCR Signaled System Error	I/O_0
<5> NCR_Detected_ Parity_Error	NCR Detected Parity Error	I/O_0

(continued on next page)

Table 4–2 (Cont.) Error Field Bit Definitions for Error Log Interpretation

Error Field Bits	Bit-to-Text Definition	Module/Notes
W3-Byte-0, PCI–EISA Bridge, PCI Status Reported Errors		
<0> PCEB_PARR_ Detected_As_Master	PCEB Data Parr Detected While Bus Master	I/O_0
<2> PCEB_SIG_Target_ Abort	PCEB Aborted with Target-Abort While Target	I/O_0
<3> PCEB_REC_Master_ Abort	PCEB Cycle Terminated with Master-Abort While Master	I/O_0
<4> PCEB_SIG_System_ Error	PCEB Signaled System Error	I/O_0
<5> PCEB_Detected_ Parity_Error	PCEB Detected Parity Error	I/O_0
W3-Byte-1, EISA System Component (ESC) Reported Errors		
<0> ESC_PCI_PERR_ Detected	ESC Detected PCI Perr	I/O_0
<1> ESC_EISA_Timeout	ESC Detected EISA Bus Time-Out	I/O_0
<2> ESC_EISA_IOCHK	ESC Detected EISA IOCHK	I/O_0
<3> ESC_FAIL-SAFE	ESC Fail-Safe Timer Expired	I/O_0

4.4.1 Note 1: System Bus Address Cycle Failures

Synopsis:

System bus address cycle failures can be reported by the bus commander, responders, or both:

- By commander: _CA_NOACK—Bus Command Address No-Ack

  Commander did not receive an acknowledgment command/address. Probable causes are:

  - A programming error, software fault (addressed nonexistent address)
  - A bus buffer failure on the bus commander

- By responders: _CA_PAR—Bus Command/Address Parity Error

  Responder detected a parity error during the command/address cycle. The bus was corrupted by commander module (I/O or CPU), backplane, or responder module (I/O, memory, or CPU).

Analysis:

> **Note**
>
> All bus nodes check command/address parity during the command/address cycle.

- _CA_NOACK errors without respective command/address parity errors are most likely caused by problems in the bus commander, such as programming errors, address generation, and the like. You should consider the context of the error; for example, a software fault may cause the system to crash each time you run a particular piece of software.
- _CA_NOACK errors with all responders reporting command/address parity errors are most likely caused by a bus commander failure or bus failure.
- _CA_PAR errors, without respective command/address NOACKs, are most likely the result of a failing buffer within the device reporting the isolated CA_PAR error.

4.4.2 Note 2: System Bus Write-Data Cycle Failures

Synopsis:

System Bus Write Data failures can be reported by the bus commander, responders, or both.

- By commander: _WD_NOACK—Write-Data No-Ack

  Commander did not receive an acknowledgment to write-data cycle. A bus buffer failure on the bus commander is the probable cause.
- By responders: _WD_PAR—Write-Data Parity Error

  Responder detected a parity error during the write-data cycle. The bus was corrupted by commander module (I/O or CPU), backplane, or responder module (I/O, memory, or CPU).

Analysis:

> **Note**
>
> Only the addressed bus responder checks write-data parity.

- _WD_NOACK (write-data NOACK) errors without respective WD_PAR (write-data parity) errors are most likely caused by problems in the bus commander. However, there is a small probability that the responder could be at fault.

Examine the commander's command trap register to identify the respective responder.

- _WD_NOACK errors with the responder reporting _WD_PAR errors could indicate a failure with either device.
- _WD_PAR errors without respective _WD_NOACK would require two failures to occur:

  1. Bad data received by responder
  2. A valid response was received when one should not have been sent.

  The failing module could be either partner in the transfer.

4.4.3 Note 3: System Bus Read Parity Error

Synopsis:

System bus read-data failures are reported only by the bus commander.

- By commander: _RD_PAR error—Read-data parity error.

  The bus commander (device reporting _RD_PAR) detected a parity error on data received from the system bus.

Analysis:

Note

Only the bus commander checks write-data parity on bus reads.

- The failure could be caused by either the bus commander or responder. The failing data's address is captured in the commander's bus trap register.
- A system bus read parity error can result as a side effect of a command/address NOACK.

4.4.4 Note 4: Backup Cache Uncorrectable Error

Synopsis:

Data from the backup cache is either delivered to the DECchip 21064 microprocessor or the system bus interface chip is corrupted.

Analysis:

The failing module is the CPU reporting the failure, except:

- If EV_SYN_1F (“CPU reported syndrome 0x1f”) or C3_SYN_1F (“C3 reported syndrome 0x1f”) bits are set in the error field, known bad data was supplied to the CPU from another source (either memory or the other CPU).
  - If C3_MEM_R_ERROR (“CPU error caused by memory”) bit is set, examine MEMn_UNCORR (“MEM_n Uncorrectable Error”) or MEMn_SYNC_Error (“MEM_n Chip Sync Error”) to identify which memory was the source of the error.
  - If C3_OCPU_ADD_MATCH (“CPU error caused by other CPU”) is set, the other CPU caused the error.
- If other error bits associated with the CPU reporting the error are also set, it is likely that the fault is associated with this CPU module.

4.4.5 Note 5: Data Delivered to I/O Is Known Bad

Synopsis:

IO_CB_UNCORR—I/O module received data identified as bad from system bus.

Analysis:

Check to see if the following bits are set for the error field:

MEMn_UNCORR (“MEM_n Uncorrectable Error”)
MEMn_SYNC_Error (“MEM_n Chip Sync Error”)
CPUn_XXXXXX errors (“CPU_n xxx... error”)

4.4.6 Note 6: Multi-Event Analysis of Command/Address Parity, Write-Data Parity, or Read-Data Parity Errors

Analysis:

Because command/address, read-data, and write-data share the backplane and bus transverse, problems with these components can be seen as failures in any of these cycles. It may be possible to identify the failing module by examining several failure entries and drawing a conclusion as to the failing module.

- Are the parity errors always associated with the same responder?

  If so, the fault is most likely with the responder.
- Are the read-parity errors always associated with the same commander?

  If so, the fault is most likely with the commander.
- Is one module never reporting or associated with an error?

If so, this module could be corrupting the bus.

4.4.7 Sample System Error Report (DECevent)

Example 4–1 provides an abbreviated DECevent-generated error log entry for a processor machine check, SCB 670 (❶). Error field 0 (❷), has one bit set. The corresponding bit-to-text translation (❸) is provided in the third column.

Example 4–1 DECevent-Generated Error Log Entry Indicating CPU Error

```
******************************** ENTRY    1 ********************************

Logging OS                       3. OpenVMS AXP
OS version                          X5OJ-FT3
Event sequence number            2.
Timestamp of occurrence             22-JUN-1994 17:46:03
System uptime in seconds        79.
VMS error mask            x00000000
VMS flags                     x0000
Host name
AXP HW model                        AlphaServer 2100
System type register      x00000009
Unique CPU ID             x00000002
mpnum                     x000000FF
mperr                     x000000FF

Event validity                  -1. Unknown validity code
Event severity                  -1. Unknown severity code
Entry type                       2.
Major Event class                1. CPU
AXP Device Type                  0.

CPU Minor class                  1. Machine check (670 entry) ➊

Entry Byte Count          x00000420
frame revision                x0000
scb vector                    x0670  processor machine check
severity                      x0000  field not valid
cpu id                        x0000
error count                   x0001
fail code                     x0000  field not valid
error field0 ➋           x0000000000000005
                                     CPU_0 Bus Command No-Ack ➌
                                     CPU_0 Bus Parity Error
error field1              x0000000000000000
error field2              x0008000000000000
                                     CPU cycle aborted with HARD ERROR
error field3              x0000000000000000

frame id                  x00000002  MC 670 Frame
        .
        .
        .
```

5 System Configuration and Setup

This chapter provides configuration and setup information for AlphaServer systems and system options.

- Section 5.1 describes how to examine the system configuration using the console firmware.
  - Section 5.1.1 describes the function of the two firmware interfaces used with AlphaServer systems.
  - Section 5.1.2 describes how to switch between firmware interfaces.
  - Sections 5.1.3 and 5.1.4 describe the commands used to examine system configuration for each firmware interface.
- Section 5.2 describes the system bus configuration.
- Section 5.3 describes the function of the standard I/O module or I/O backplane.
- Section 5.4 describes the EISA bus.
- Section 5.5 describes how ISA options are compatible on the EISA bus.
- Section 5.6 describes the EISA Configuration Utility (ECU).
- Section 5.7 describes the PCI bus.
- Section 5.8 describes how to configure and install SCSI drives in the system.
- Section 5.9 describes power supply configurations.
- Section 5.10 describes the console port configurations.

5.1 Verifying System Configuration

Figures 5–1 through 5–3 illustrate the system architecture for each AlphaServer system.

- Figure 5–1 shows the AlphaServer 2000-series system, which uses the BA720 pedestal enclosure.
- Figure 5–2 shows the AlphaServer 2100-series system, which uses the BA740 pedestal enclosure.
- Figure 5–3 shows AlphaServer 2100 RM/CAB systems, which use the BA741 rackmount enclosure.

Figure 5–1 System Architecture: AlphaServer 2000 (BA720 Enclosure)

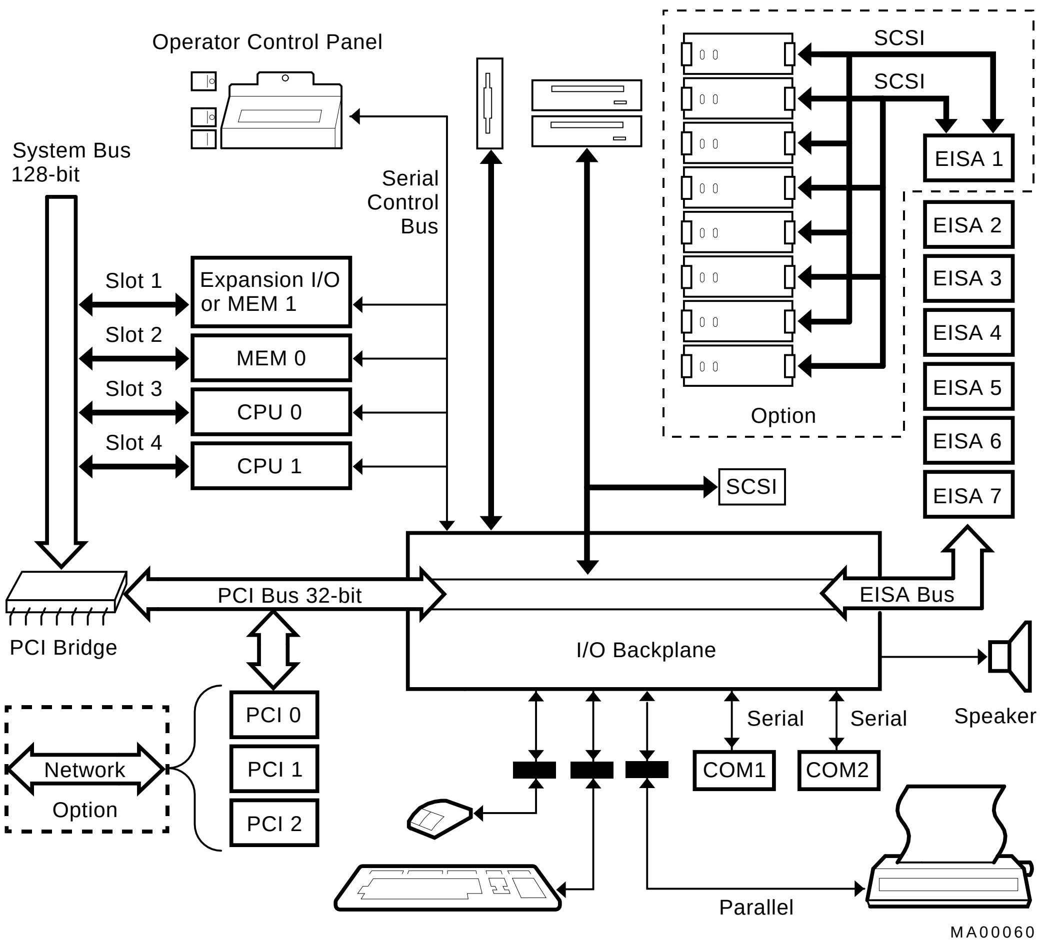


Figure 5–2 System Architecture: AlphaServer 2100 (BA740 Enclosure)

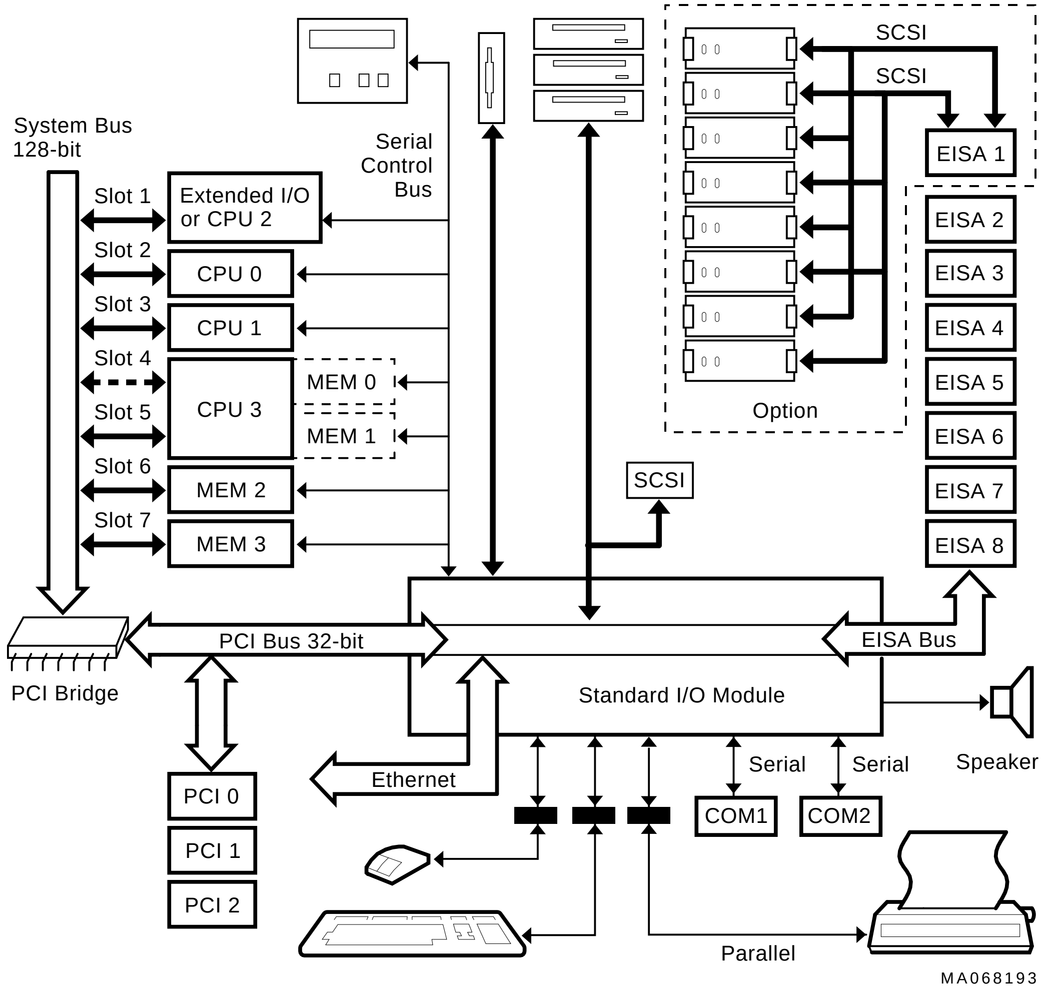
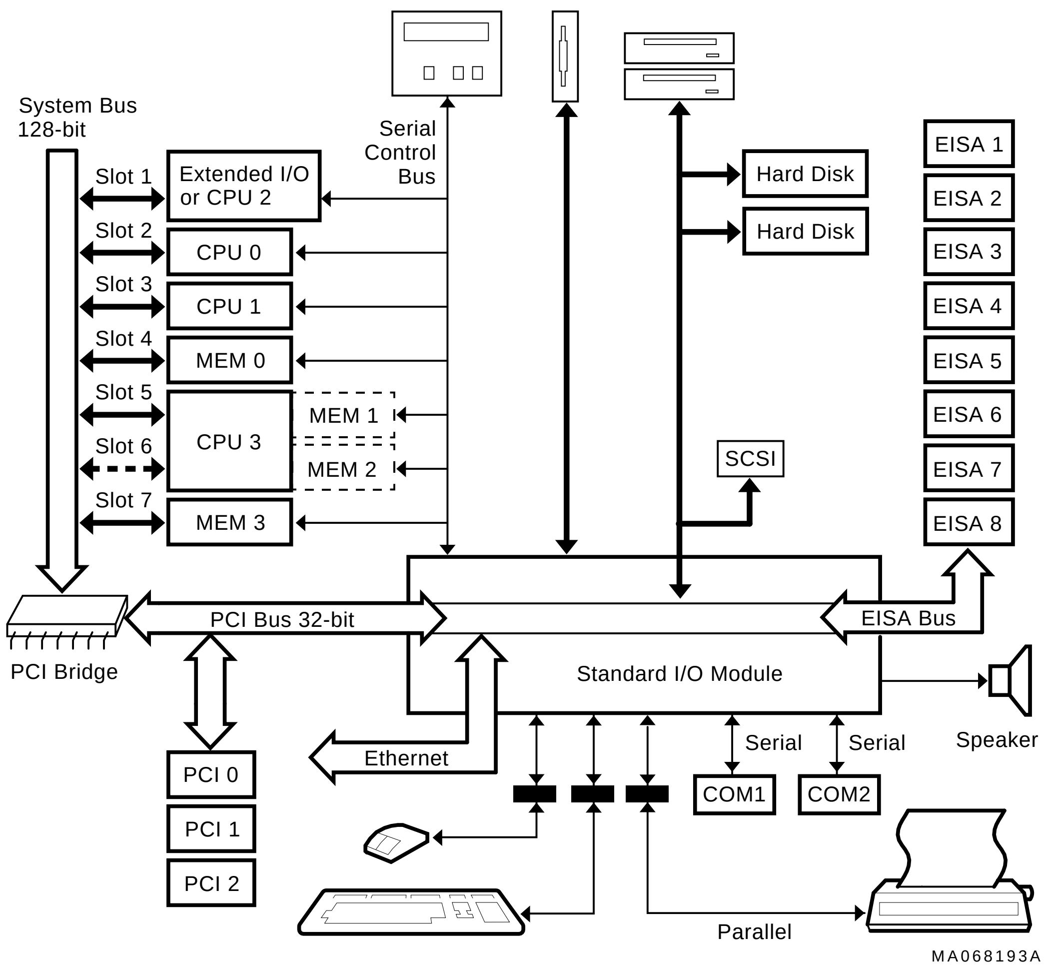


Figure 5–3 System Architecture: AlphaServer 2100 RM and 2100 CAB (BA741 Enclosure)



5.1.1 System Firmware

At product introduction system firmware provides support for the following operating systems:

- DEC OSF/1 and OpenVMS AXP are supported under the SRM command line interface, which can be serial or graphical. The SRM firmware is in compliance with the *Alpha System Reference Manual* (SRM).
- Windows NT is supported under the ARC menu interface, which is graphical. The ARC firmware is in compliance with the *Advanced RISC Computing Standard Specification* (ARC).

The console firmware provides the data structures and callbacks available to booted programs defined in both the SRM and ARC standards.

SRM Command Line Interface

Systems running DEC OSF/1 or OpenVMS access the SRM firmware via a command line interface (CLI). The CLI is a UNIX style shell that provides a set of commands and operators, as well as a scripting facility. It allows you to configure and test the system, examine and alter system state, and boot the operating system.

The only thing that you cannot do from the SRM command line interface is run the EISA Configuration Utility (ECU) or Raid Configuration Utility (RCU). To run the ECU, you must enter the `ecu` command. This will boot the ARC firmware and the ECU software. For more information about running the ECU, refer to Section 5.6.

ARC Menu Interface

Systems running Windows NT access the ARC console firmware via menus that are used to configure, boot the system, run the EISA Configuration Utility (ECU), run the RAID Configuration Utility (RCU), or set environment variables.

There are several tasks that you cannot perform from the ARC menu interface. However, you can perform these tasks from the SRM console command line interface. The table below describes the task, the SRM command used to perform that task, and where to find more information about the SRM command.

Table 5–1 SRM-Only Console Tasks

Task	Command	Reference
Test the system (other than self-tests at system startup)	All system tests and exercisers	Chapter 3

Examine and verify options that are recognized by the system	`show config`
	`show device`
	`show mem`
	`show fru`
		Section 5.1.4

Set or change some environment variables, notably the following: • Ethernet device type • Speed for Fast SCSI devices	`set ew*o_mode` `set pk*0_fast`	Table 5–5

5.1.2 Switching Between Interfaces

For a few procedures it is necessary to switch from one console interface to the other.

- The `test` command is run from the SRM interface.
- The EISA Configuration Utility (ECU) and the RAID Configuration Utility (RCU) are run from the ARC interface.

Switching from SRM to ARC

Two SRM console commands are used to switch to the ARC console:

- The `arc` command loads the ARC firmware and switches to the ARC menu interface.
- The `ecu` command loads the ARC firmware and then boots the ECU diskette.

Switching from ARC to SRM

Switch from the ARC console to the SRM console as follows:

1. From the Boot menu, select the Supplementary menu.
2. From the Supplementary menu, select "Set up the system."
3. From the Setup menu, select "Switch to OpenVMS or OSF console." This allows you to select your operating system console.
4. Select your operating system, then press enter on "Setup menu."

5. When the “Power-cycle the system to implement the change” message is displayed, press the Reset button. Once the console firmware is loaded and device drivers are initialized, you can boot the operating system.

5.1.3 Verifying Configuration: ARC Menu Options for Windows NT

The following ARC menu options are used for verifying system configuration on Windows NT systems:

- `Display hardware configuration` (Section 5.1.3.1)—Lists the ARC device names for devices installed in the system.
- `Set default environment variables` (Section 5.1.3.2)—Allows you to select values for Windows NT firmware environment variables.

5.1.3.1 Display Hardware Configuration

The hardware configuration display lists the ARC firmware device names of the boot devices installed in the system.

Table 5–2 lists the steps to view the Display hardware configuration display.

Table 5–2 Listing the ARC Firmware Device Names

Step	Action	Result
1	If necessary, access the Supplementary menu.	The system displays the Supplementary menu.
2	Choose Display hardware configuration and press Enter.	The system displays the hardware configuration display.

Table 5–3 describes the meaning of these device names.

Note

The available boot devices display does not list tape drives or network devices.

Table 5–3 ARC Firmware Device Names

Name	Description
multi(0)key(0)keyboard(0) multi(0)serial(0) multi(0)serial(1)	The multi( ) devices are located on the system module. These devices include the keyboard port and the serial line ports.
eisa(0)video(0)monitor(0) eisa(0)disk(0)fdisk(0)	The eisa( ) devices are provided by devices on the EISA bus. These devices include the monitor and the floppy drive.
scsi(0)disk(0)rdisk(0) scsi(0)cdrom(4)fdisk(0)	The scsi( ) devices are SCSI disk or CD–ROM devices. These examples represent SCSI devices on SCSI bus A. The disk drive is set to SCSI ID 0 and the CD–ROM drive is set to SCSI ID 4. Both devices have logical unit numbers of 0.

Example:

```
Available hardware devices:

eisa(0)video(0)monitor(0)
multi(0)key(0)keyboard(0)
eisa(0)disk(0)fdisk(0)
scsi(0)disk(0)rdisk(0)
scsi(0)cdrom(4)fdisk(0)
multi(0)serial(0)
multi(0)serial(1)

Press any key to continue...

Supported disk and video cards:

NCR 810
AHA 174X
BIOS-equipped Video Cards

Press any key to continue...
```

5.1.3.2 Set Default Variables

The Set default environment variables option of the Setup menu sets and displays the default Windows NT firmware environment variables.

Caution

Do not edit or delete the default firmware Windows NT environment variables. This can result in corrupted data or make the system inoperable. To modify the values of the environment variables, use the menu options on the "Set up the system" menu.

Table 5–4 lists and explains the default ARC firmware environment variables.

Table 5–4 ARC Firmware Environment Variables

Variable	Description
A:	The default floppy drive. The default value is eisa( )disk( )fdisk( ).
AUTOLOAD	The default startup action, either YES (boot) or NO or undefined (remain in Windows NT firmware).
CONSOLEIN	The console input device. The default value is multi( )key( )keyboard( )console( ).
CONSOLEOUT	The console output device. The default value is eisa( )video( )monitor( )console( ).
COUNTDOWN	The default time limit in seconds before the system boots automatically when AUTOLOAD is set to yes. The default value is 10.
DISABLEPCIPARITY-CHECKING	Disables parity checking on the PCI bus in order to prevent machine check errors that can occur if the PCI device has not properly set the parity on the bus. The default value is FALSE—PCI parity checking is enabled.
FLOPPY	The capacity of the default floppy drive, either 1 (1.2 MB), 2 (1.44 MB), or 3 (2.88 MB).
FLOPPY2	The capacity of an optional second floppy drive, either N (not installed), 1, 2, or 3.

(continued on next page)

Table 5–4 (Cont.) ARC Firmware Environment Variables

Variable	Description
FWSEARCHPATH	The search path used by the Windows NT firmware and other programs to locate particular files. The default value is the same as the SYSTEMPARTITION environment variable value.
TIMEZONE	The time zone in which the system is located. This variable accepts ISO/IEC9945-1 (POSIX) standard values.

Note

The operating system or other programs, for example, the ECU, may create either temporary or permanent environment variables for their own use. Do not edit or delete these environment variables.

5.1.4 Verifying Configuration: SRM Console Commands for DEC OSF/1 and OpenVMS

The following SRM console commands are used to verify system configuration on DEC OSF/1 and OpenVMS systems:

- `show config` (Section 5.1.4.1)—Displays the buses on the system and the devices found on those buses.
- `show device` (Section 5.1.4.2)—Displays the devices and controllers in the system.
- `show memory` (Section 5.1.4.3)—Displays main memory configuration.
- `set` and `show` (Section 5.1.4.4)—Set and display environment variable settings.

5.1.4.1 show config

The `show config` command displays all devices found on the system bus, PCI bus, and EISA bus. You can use the information in the display to identify target devices for commands such as `boot` and `test`, as well as to verify that the system sees all the devices that are installed.

The configuration display includes the following:

- Core system status:

  CPU, memory, standard I/O or I/O backplane are shown with the results of power-up tests: P (pass) or F (fail)

- Hose 0, Bus 0, 32-bit PCI:
  - Slot 0 = Ethernet adapter (ewa0)—(not present on 2000-series systems, BA720 enclosures)
  - Slot 1 = SCSI controller on standard I/O or I/O backplane, along with storage drives on the bus.
  - Slot 2 = EISA to PCI bridge chip
  - Slots 3–5 = Reserved
  - Slots 6–8 = Correspond to PCI card cage slots: PCI0, PCI1, and PCI2. In the case of storage controllers, the devices off the controller are also displayed.

- Hose 1, Bus 0, EISA:

  Slot numbers correspond to to EISA card cage slots (1–8) or (1–7 for 2000-series systems, BA720 enclosures). In the case of storage controllers, the devices off the controller are also displayed.

- Hose 2, Bus 0, PCI:

  Reserved for future expansion.

For more information on device names, refer to Section 5.1.4.2, show device.

Synopsis:

show config

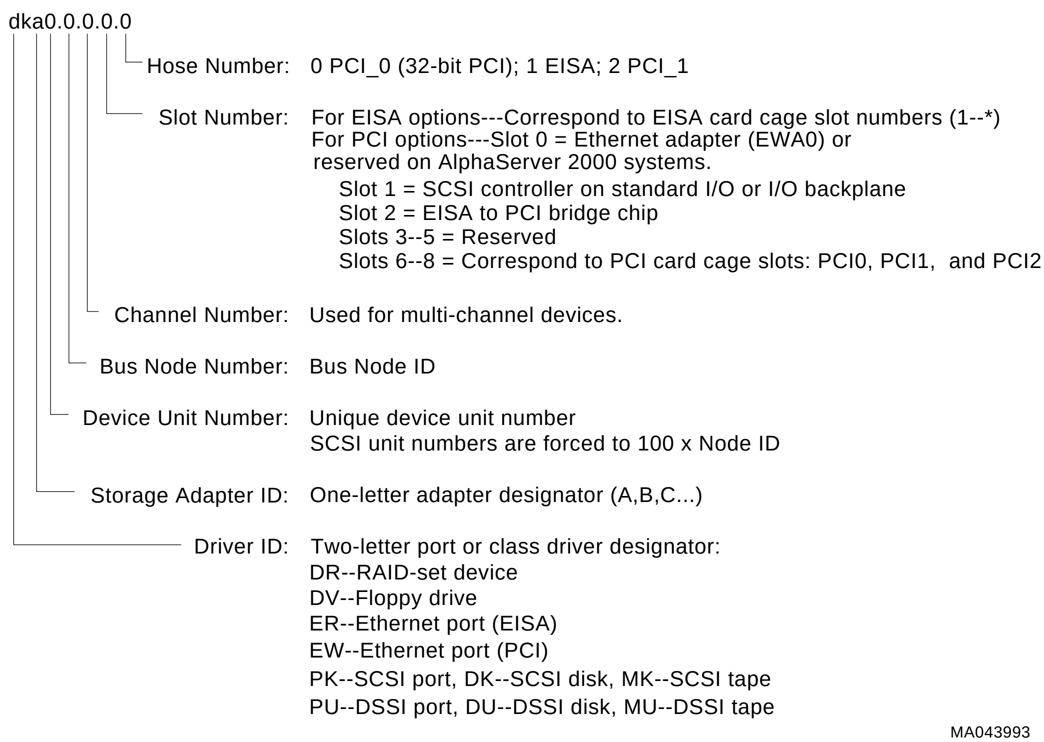
Example Using AlphaServer 2100 System:

```
P00>>> show config

                        Digital Equipment Corporation
                           AlphaServer 2100 4/200

SRM Console T3.8-33             VMS PALcode X5.48-64, OSF PALcode X1.35-42

Component       Status          Module ID
CPU 0              P            B2020-AA DECchip (tm) 21064-3
Memory 1           P            B2021-BA  64 MB
I/O                             B2110-AA
                                dva0.0.0.0.1            RX26

 Slot   Option                  Hose 0, Bus 0, PCI
   0    DECchip 21040-AA        ewa0.0.0.0.0            08-00-2B-E2-56-2A
   1    NCR 53C810              pka0.7.0.1.0            SCSI Bus ID 7
                                dka0.0.0.1.0            RZ26L
                                dka600.6.0.1.0          RRD43
                                mka400.4.0.1.0          TLZ06
                                mka500.5.0.1.0          TZK11
   2    Intel 82375EB                                   Bridge to Hose 1, EISA
   7    DECchip 21040-AA        ewb0.0.0.7.0            08-00-2B-3F-5B-D7


 Slot   Option                  Hose 1, Bus 0, EISA
   2    CPQ3011
   4    DEC4220                 era0.0.0.4.1            08-00-2B-3C-B2-52
   5    DEC2500
   6    DEC4250                 ewc0.0.0.6.1            08-00-2B-3A-C5-DC

 Slot   Option                  Hose 2, Bus 0, PCI
P00>>>
```

5.1.4.2 show device

The `show device` command displays the devices and controllers in the system. The device name convention is shown in Figure 5–4.

Figure 5–4 Device Name Convention



Synopsis:

show device [device_name]

Arguments:

[device_name] The device name or device abbreviation. When abbreviations or wildcards are used, all devices that match the type are displayed.

Examples:

```
>>> show device
    ❶                          ❷        ❸                      ❹     ❺
dka0.0.0.1.0               DKA0                          RZ25L  0006
dka100.1.0.1.0             DKA100                        RZ25L  0006
dka600.6.0.1.0             DKA600                        RRD43  2893
dva0.0.0.0.1               DVA0                          RX26
mka500.5.0.1.0             MKA500                        TLZ06  0435
ewa0.0.0.0.0               EWA0              08-00-2B-3B-42-FD
pka0.7.0.1.0               PKA0                  SCSI Bus ID 7
>>> show device dk pk
dka0.0.0.1.0               DKA0                          RZ25L  0006
dka100.1.0.1.0             DKA100                        RZ25L  0006
dka600.6.0.1.0             DKA600                        RRD43  2893
dva0.0.0.0.1               DVA0                          RX26
mka500.5.0.1.0             MKA500                        TLZ06  0435
pka0.7.0.1.0               PKA0                  SCSI Bus ID 7
>>>
```

❶ Console device name:

❷ Operating system device name:

- For an allocation class of zero: NODENAME$DIA*u*

  NODENAME is a unique node name and *u* is the unit number. For example, R7BUCC$DIA0.

- For a nonzero allocation class:

  $ALLCLASS$DIA*u*

  ALLCLASS is the allocation class for the system and devices, and *u* is a unique unit number. For example, 1DIA0.

❸ Node name (alphanumeric, up to 6 characters)

❹ Device type

❺ Firmware version (if known)

5.1.4.3 show memory

The `show memory` command displays information for each memory module in the system.

Synopsis:

`show memory`

Examples:

```
>>> show memory
  ❶       ❷       ❸          ❹           ❺          ❻
Module   Size    Base Addr   Intlv Mode  Intlv Unit  Status
------   -----   ---------   ----------  ----------  ------
  0       64MB   00000000      1-Way         0       Passed

Total Bad Pages 0 ❼
>>>
```

❶ Module slot number

❷ Size of memory module

❸ Base or starting address of memory module

❹ Interleave mode—number of modules interleaved (1–4-way interleaving)

❺ Interleave unit number

❻ Status (passed, failed, or not configured)

❼ Number of bad pages in memory (8 KB/page)

5.1.4.4 Setting and Showing Environment Variables

The environment variables described in Table 5–5 are typically set when you are configuring a system.

Synopsis:

set [-default] [-integer] -[string] envar value

Note

Whenever you use the `set` command to reset an environment variable, you must initialize the system to put the new setting into effect. You initialize the system by entering the `init` command or pressing the Reset button.

show envar

Arguments:

envar	The name of the environment variable to be modified.
value	The value that is assigned to the environment variable. This may be an ASCII string.

Options:

-default	Restores variable to its default value.
-integer	Creates variable as an integer.
-string	Creates variable as a string (default).

Examples:

```
>>> set bootdef_dev eza0
>>> show bootdef_dev
eza0
>>> show auto_action
boot
>>> set boot_osflags 0,1
>>>
```

Table 5–5 Environment Variables Set During System Configuration

Variable	Attributes	Function
auto_action	NV,W	The action the console should take following an error halt or powerfail. Defined values are: BOOT—Attempt bootstrap. HALT—Halt, enter console I/O mode. RESTART—Attempt restart. If restart fails, try boot. No other values are accepted. Other values result in an error message and variable remains unchanged.
bootdef_dev	NV	The device or device list from which booting is to be attempted, when no path is specified on the command line. Set at factory to disk with Factory Installed Software; otherwise null.
boot_file	NV,W	The default file name used for the primary bootstrap when no file name is specified by the `boot` command. The default value when the system is shipped is NULL.

Key to variable attributes:

NV —- Nonvolatile. The last value saved by system software or set by console commands is preserved across system initializations, cold bootstraps, and long power outages.
W —- Warm nonvolatile. The last value set by system software is preserved across warm bootstraps and restarts.

(continued on next page)

Table 5–5 (Cont.) Environment Variables Set During System Configuration

Variable	Attributes	Function
boot_osflags	NV,W	Default additional parameters to be passed to system software during booting if none are specified by the `boot` command. **OpenVMS:** On the OpenVMS AXP operating system, these additional parameters are the root number and boot flags. The default value when the system is shipped is NULL. **DEC OSF/1:** The following parameters are used with the DEC OSF/1 operating system: a — Autoboot. Boots /vmunix from bootdef_dev, goes to multiuser mode. Use this for a system that should come up automatically after a power failure. s — Stop in single-user mode. Boots /vmunix to single-user mode and stops at the # (root) prompt. i — Interactive boot. Request the name of the image to boot from the specified boot device. Other flags, such as -kdebug (to enable the kernel debugger), may be entered using this option. D — Full dump, implies "s" as well. By default, if DEC OSF/1 V2.1 crashes, it completes a partial memory dump. Specifying "D" forces a full dump at system crash. Common settings are a, autoboot; and Da, autoboot; but create full dumps if the system crashes.

Key to variable attributes:

NV —- Nonvolatile. The last value saved by system software or set by console commands is preserved across system initializations, cold bootstraps, and long power outages.
W —- Warm nonvolatile. The last value set by system software is preserved across warm bootstraps and restarts.

(continued on next page)

Table 5–5 (Cont.) Environment Variables Set During System Configuration

Variable	Attributes	Function
console	NV	Sets the device on which power-up output is displayed. GRAPHICS—Sets the power-up output to be displayed at a graphics terminal or device connected to the VGA module at the rear of the system. SERIAL—Sets the power-up output to be displayed on the device that is connected to the COM1 port at the rear of the system.
ew*0_mode	NV	Sets the Ethernet controller to the default Ethernet device type. aui—Sets the default Ethernet device to AUI. twisted—Sets the default Ethernet device to 10BASE-T (twisted-pair). auto—Reads the device connected to the Ethernet port and sets the default to the appropriate Ethernet device type. (This option is not implemented at product introduction.)
ocp_text	NV	Allows you to create an OCP message that displays when power-up diagnostics are completed. The default value is the CPU speed. Enter a message of up to 16 characters. Reset the system or enter the `init` command after setting ocp_text to activate new message.
os_type	NV	Sets the default operating system. "vms" or "osf"—Sets system to boot the SRM firmware. "nt"—Sets system to boot the ARC firmware.

Key to variable attributes:

NV —- Nonvolatile. The last value saved by system software or set by console commands is preserved across system initializations, cold bootstraps, and long power outages.
W —- Warm nonvolatile. The last value set by system software is preserved across warm bootstraps and restarts.

(continued on next page)

Table 5–5 (Cont.) Environment Variables Set During System Configuration

Variable	Attributes	Function
pk*0_fast	NV	Enables fast SCSI devices on a SCSI controller to perform in standard or fast mode. 0—Sets the default speed for devices on the controller to standard SCSI. If a controller is set to standard SCSI mode, both standard and Fast SCSI devices will perform in standard mode. 1—Sets the default speed for devices on the controller to Fast SCSI mode. Devices on a controller that connect to both standard and Fast SCSI devices will automatically perform at the appropriate rate for the device, either fast or standard mode.
pk*0_host_id	NV	Sets the controller host bus node ID to a value between 0 and 7. 0–7—Assigns bus node ID for specified host adapter.

Key to variable attributes:

NV —- Nonvolatile. The last value saved by system software or set by console commands is preserved across system initializations, cold bootstraps, and long power outages.
W —- Warm nonvolatile. The last value set by system software is preserved across warm bootstraps and restarts.

Note

Whenever you use the `set` command to reset an environment variable, you must initialize the system to put the new setting into effect. Initialize the system by entering the `init` command or pressing the Reset button.

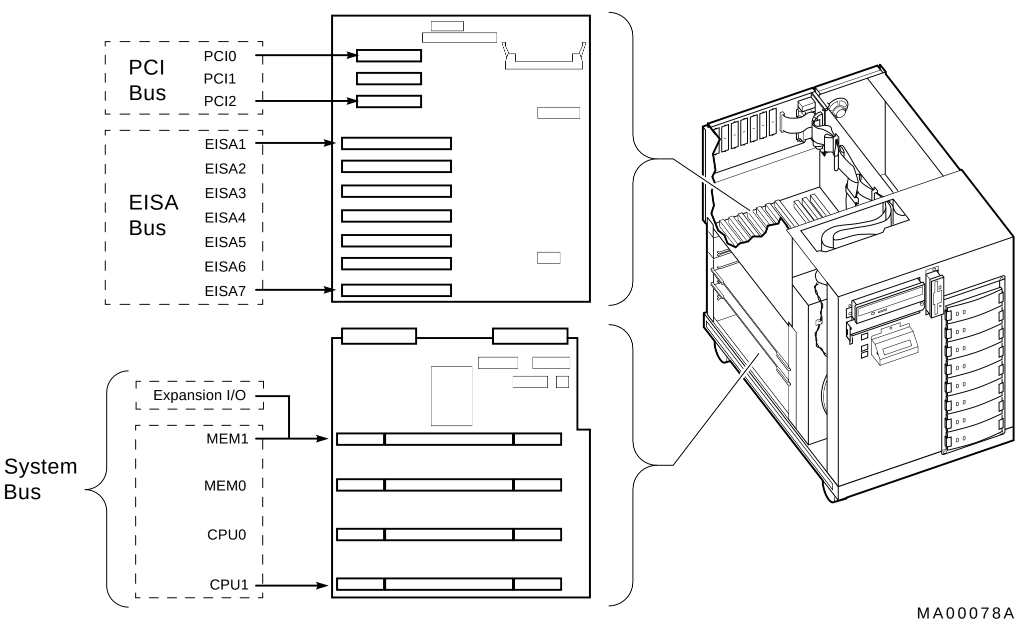
5.2 System Bus Options

The system bus interconnects the CPUs, memory modules, and the optional PCI extended I/O module.

- Figure 5–5 shows the location of the system bus and card cages for 2000-series systems, which use the BA720 enclosure.

- Figure 5–6 shows the location of the system bus and card cage for 2100-series systems, which use the BA740 enclosure.
- Figure 5–7 shows the location of the system bus and card cages for 2100 RM and 2100 CAB-series systems, which use the BA741 enclosure.

Figure 5–5 Card Cages and Bus Locations, Pedestal (BA720)



Note

Use of an expansion I/O option eliminates MEM1.

Figure 5–6 Card Cage and Bus Locations, Pedestal (BA740)

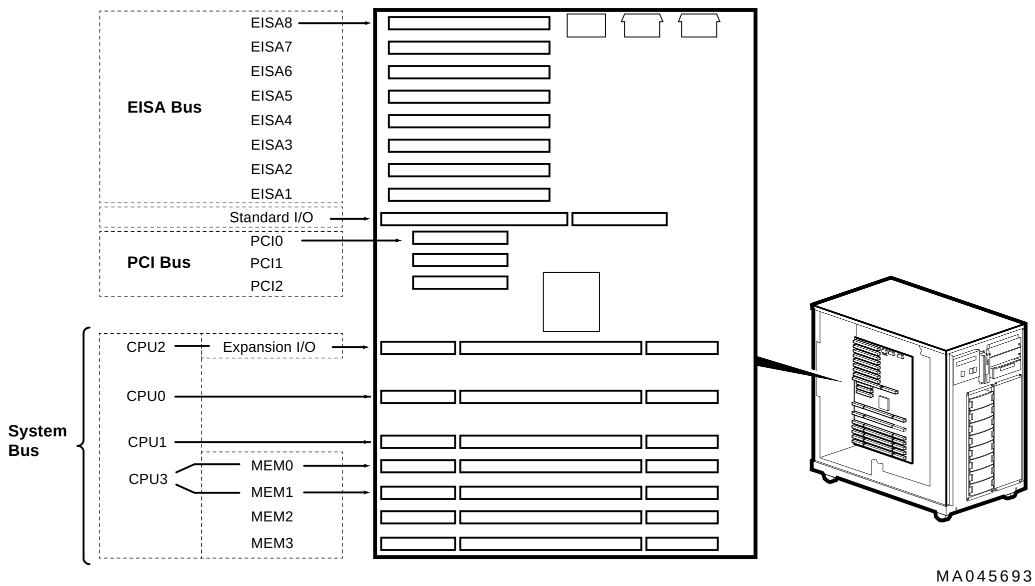
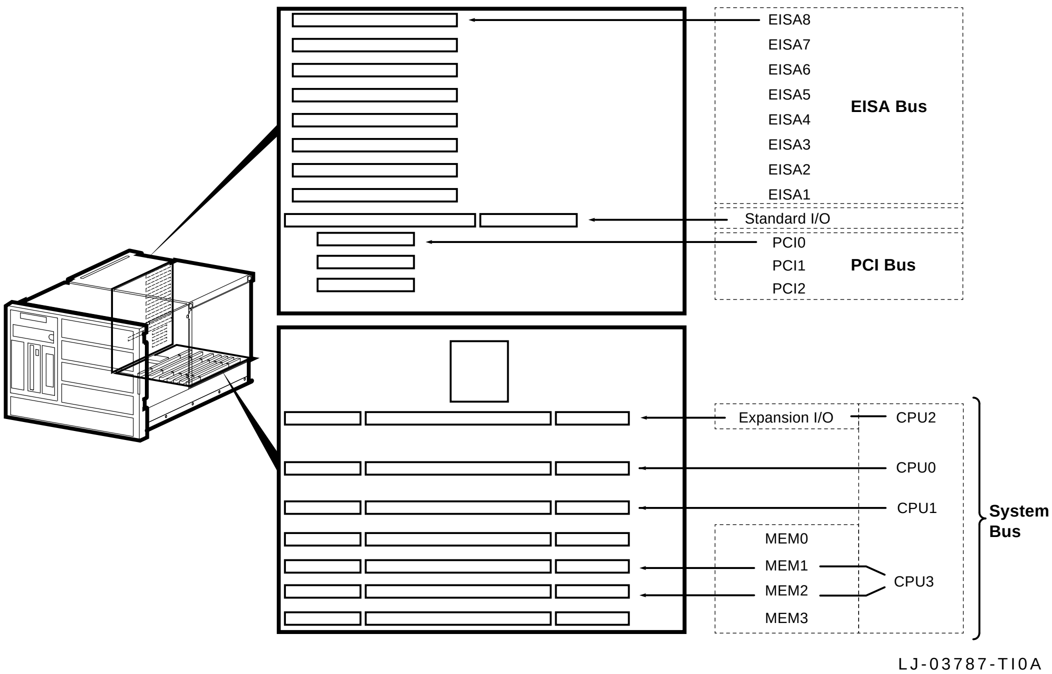


Figure 5–7 Card Cages and Bus Locations, Rackmount (BA741)



5.2.1 CPU Modules

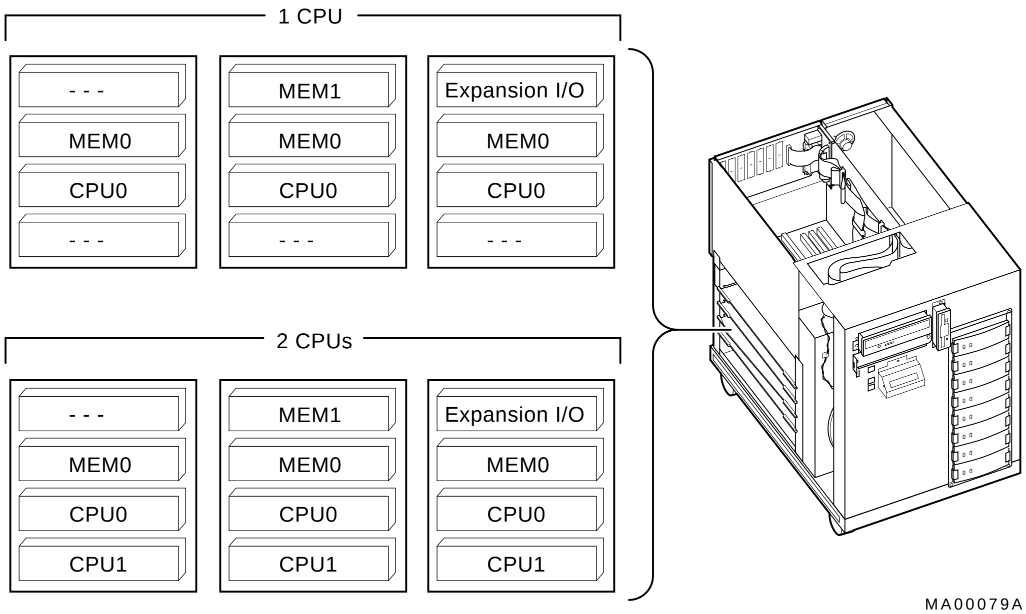
AlphaServer 2100/2100 RM/2100 CAB-series systems (BA740/BA741 enclosures) can support up to four CPUs in a symmetric multiprocessing (SMP) configuration.

AlphaServer 2000-series systems (BA720 enclosures) can support up to two CPUs in an SMP configuration. The following rules relate to SMP configurations:

- Systems using BA740 and BA741 enclosures must have a CPU module installed in system bus slot 2 (CPU 0).
- Systems using BA720 enclosures must have a CPU module installed in system bus slot 3 (CPU 0).
- Systems with more than two CPUs displace extended PCI expansion or memory module capacity as shown in Figures 5–8 through 5–10.
- AlphaServer 2100-series (BA740 enclosure) systems with more than two CPUs require a second power supply.

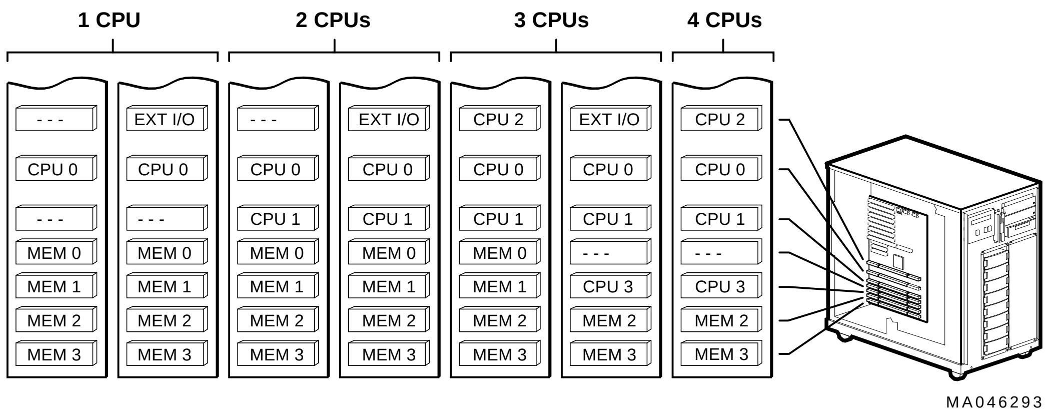
- AlphaServer 2000-series (BA720 enclosure) systems with more than one CPU require a second power supply.

Figure 5–8 System Bus Configurations According to Number of CPUs, Pedestal (BA720)



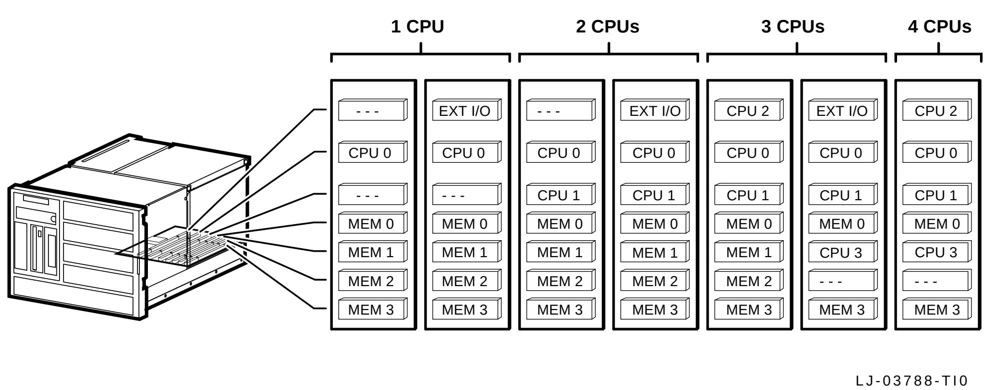
Warning: CPU and memory modules have parts that operate at high temperatures. Wait two minutes after power is removed before handling these modules.

Figure 5–9 System Bus Configurations According to Number of CPUs, Pedestal (BA740)



Warning: CPU and memory modules have parts that operate at high temperatures. Wait two minutes after power is removed before handling these modules.

Figure 5–10 System Bus Configurations According to Number of CPUs, Rackmount (BA741)



Warning: CPU and memory modules have parts that operate at high temperatures. Wait two minutes after power is removed before handling these modules.

5.2.2 Memory Modules, Pedestal (BA720) Systems

The standard AlphaServer 2000 system comes with 64 megabytes of installed memory. It can be configured with a maximum of 640 megabytes using two memory modules: one fully populated module with 4-megabyte SIMMs (single in-line memory modules) and one fully populated module with 16-megabyte SIMMs.

SIMM Characteristics

You can install up to four banks of memory per module, using industry-standard JEDEC, 72-pin SIMMs in either of two types:

- 1 megabyte x 36-bit, 70 nanoseconds or faster
- 4 megabyte x 36-bit, 70 nanoseconds or faster

Caution

The maximum height SIMM that will fit in the AlphaServer 2000 systems is 1.1 inches. Be sure to make a note of this requirement before you purchase SIMMs for your system.

Memory Upgrades

To increase your system memory, you can order memory add-on packages and additional memory modules. The memory modules and add-on packages available from Digital are as follows:

MS452-AA	32-megabyte memory module (SIMM carrier with eight 4-megabyte SIMMs)
MS452-BA	128-megabyte memory module (SIMM carrier with eight 16-megabyte SIMMs)
MS452-UA	32-megabtye memory add-on package (eight 4-megabtye SIMMs for MS452-AA)
MS452-UB	128-megabyte memory add-on package (eight 16-megabyte SIMMs for MS452-BA)

Ordering Additional Memory

Table 5–6 shows how to order additional memory. The first section of the table shows how to upgrade in increments to a maximum memory of 256 megabytes, using the MS452-AA memory module and the MS452-UA add-on package. The second section shows how to upgrade in increments to a maximum memory of 640 megabytes, using the MS452-AA and MS452-BA memory modules and the MS452-UA and MS452-UB add-on packages.

For example, to upgrade to 256 megabytes in small increments, order five MS452-UA add-on packages, plus one MS452-AA memory module. To upgrade to 256 megabytes in large increments, order two MS452-UA add-on packages, plus one MS452-BA memory module.

Table 5–6 Memory Upgrade Paths

	Order Quantities Shown	
Total Memory Desired (Max.256 MB)	**MS452-UA**	**MS452-AA**
96 MB	1	0
128 MB	2	0
160 MB	2	1
192 MB	3	1
256 MB	5	1

	Order Quantities Shown		
Total Memory Desired (Max. 640 MB)	**MS452-UA**	**MS452-BA**	**MS452-UB**
96 MB	1	0	0
128 MB	2	0	0
256 MB	2	1	0
384 MB	2	1	1
640 MB	2	1	3

Memory Configuration Rules

Observe the following rules when configuring memory on AlphaServer 2000-series systems:

- You cannot mix 4-megabyte SIMMs and 16-megabyte SIMMs on an individual module.
- Fill your first memory module to capacity before adding memory to the second module.
- The second memory module can be filled with 1, 2, or 4 banks of SIMMs. The second memory module cannot be filled with 3 banks of memory.
- Maximum memory is 640 megabytes using: One fully-populated module with 4-megabyte SIMMs and one fully populated module with 16-megabyte SIMMs.
- The maximum height for SIMMs in the AlphaServer 2000 system is 1.1 inches.

For more information, refer to *AlphaServer 2000 Series MS452 Memory Module Installation and Upgrade,* EK-MS452-IN, which ships with the memory module and upgrade packages.

5.2.3 Memory Modules, Pedestal (BA740) and Rackmount (BA741) Systems

Large pedestal and rackmount systems, 2100/2100R/2200, can support up to four memory modules (for a maximum memory capacity of 2 GB). A minimum of one memory module is required.

Memory is available in three variations:

- 80-ns memory modules:
  - MS450–BA (B2021–BA) 64-MB, 80-ns memory
  - MS450–CA (B2021–CA) 128-MB, 80-ns memory
  - MS451–CA (B2022–CA) 512-MB, 80-ns memory

5.2.4 Expansion I/O (PCI)

Two additional PCI slots can be added in place of a CPU or memory module. The expansion I/O module provides two PCI slots:

- For BA740 pedestal and BA741 rackmount enclosures, an expansion I/O module can be added to the system in place of a CPU module in system bus slot 1, CPU2.

- For the BA720 pedestal enclosure, an expansion I/O module can be added to the system in place of a memory module in slot system bus slot 1.

Note

Expansion I/O is planned for future enhancement.

5.3 Standard I/O Module (BA740/BA741 Enclosures) or I/O Backplane (BA720 Enclosure)

The standard I/O module (BA740/BA741 enclosures) and I/O backplane (BA720 enclosures) provides a standard set of I/O functions. The standard I/O module resides in a dedicated slot (I/O) in the EISA/PCI bus card cage and is required in 2100/2100R/2200-series systems.

The standard I/O module and I/O backplane provide:

- A Fast SCSI-2 controller chip that supports up to seven drives.
- The firmware console subsystem on 1 MB of Flash ROM.
- An Ethernet controller with AUI and twisted-pair connectors (standard I/O module only—not present on the I/O backplane).
- A floppy drive controller.
- Two serial ports with full modem control and the parallel port.
- The keyboard and mouse interface.
- The speaker interface.
- PCI-to-EISA bridge chip set.
- Time-of-year (TOY) clock

5.4 EISA Bus Options

The EISA bus (Extended Industry Standard Architecture bus) is a 32-bit industry standard I/O bus. EISA is a superset of the well-established ISA bus. EISA was designed to accept newer 32-bit components while still remaining compatible with older 8-bit and 16-bit cards.

EISA offers performance of up to 33 MB/sec for bus masters and DMA devices. Up to eight EISA or ISA modules can reside in the EISA bus portion of the card cage (Up to seven EISA or ISA modules for AlphaServer 2000 systems). All slots are bus master slots. EISA slots can be filled in any order.

Warning: For protection against fire, only modules with current-limited outputs should be used.

5.5 ISA Bus Options

The ISA bus (Industry Standard Architecture) is an industry-standard, 16-bit I/O bus. The EISA bus is a superset of the well-established ISA bus and has been designed to be backward compatible with 16-bit and 8-bit architecture. Therefore, ISA modules can be used in AlphaServer systems, provided the operating system supports the device.

Up to eight ISA (or EISA) modules can reside in the EISA bus portion of the card cage. Refer to Section 5.6 for information on using the EISA Configuration Utility (ECU) to configure ISA options.

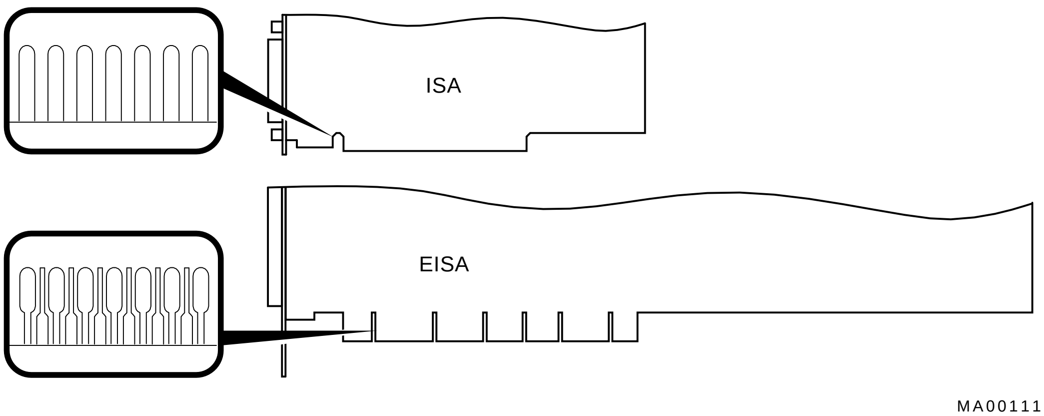
Warning: For protection against fire, only modules with current-limited outputs should be used.

5.5.1 Identifying ISA and EISA options

By examining the contacts of the option board you can determine if a board is EISA or ISA (Figure 5–11):

- ISA boards have one row of contacts and no more than one gap.
- EISA boards have two interlocking rows of contacts with several gaps.

Figure 5–11 ISA and ISA Boards



5.6 EISA Configuration Utility

Whenever you add, remove, or move an EISA or ISA board in the system, you will need to run a utility called the EISA Configuration Utility (ECU). Each EISA or ISA board has a corresponding configuration (CFG) file, which describes the characteristics and the system resources required for that option. The ECU uses the CFG file to create a conflict-free configuration. The ECU is a menu-based utility that provides online help to guide you through the configuration process. The ECU is run from the ARC menu interface.

The ECU is supplied on the System Configuration Diskette shipped with the system. You should make a backup copy of the system configuration diskette and keep the original in a safe place. Use the backup copy when you are configuring the system. The system configuration diskette must have the volume label SYSTEMCFG.

Note

The CFG files supplied with the option you want to install may not work on this system if the option is not supported. Before you install and option, check that the system supports the option.

5.6.1 Before You Run the ECU

Before running the ECU:

1. Install EISA option(s). (You install ISA boards after you run the ECU.)

   For information about installing a specific option, refer to the documentation for that option.

2. Familiarize yourself with the utility.

   You can find more information about the ECU by reading the ECU online help. To read the online help, start the ECU (refer to Section 5.6.2). Online help for the ECU is located under Step 1, "Important EISA Configuration Information."

3. Familiarize yourself with the configuration procedure for the system:

   - If you are configuring an EISA bus that contains only EISA options, refer to Table 5–7.

   - If you are configuring an EISA bus that contains both ISA an EISA options, refer to Table 5–8.

4. Locate the ECU diskette for your operating system. Make a copy of the diskette and keep the original in a safe place. Use the backup copy for configuring options.

   - ECU Diskette DECpc AXP (AK-PYCJ*-CA) for Windows NT

   - ECU Diskette DECpc AXP (AK-Q2CR*-CA) for DEC OSF/1 and OpenVMS

   The ECU diskette is shipped in the accessories box with the system.

5.6.2 How to Start the ECU

Complete the following steps to run the ECU:

1. Invoke the console firmware.

   - **For systems running Windows NT**—Shut down the operating system or power up to the console Boot menu.

   - **For systems running OpenVMS or DEC OSF/1**—Shut down the operating system and press the Halt button or power up with the Halt button set to the "in" position. When the console prompt >>> is displayed, set the halt button to the "out" position.

2. Start ECU as follows:

   - **For systems running Windows NT**—Select the following menus:

     a. From the Boot menu, select the Supplementary menu.

     b. From the Supplementary menu, select the Setup menu. Insert the ECU diskette for Windows NT (AK-PYCJ*-CA) into the floppy drive.

     c. From the Setup menu, select "Run EISA configuration utility from floppy." This boots the ECU program.

   - **For systems running OpenVMS or DEC OSF/1**—Start the ECU as follows:

     a. Insert the ECU diskette for OpenVMS or DEC OSF/1 (AK-Q2CR*-CA) into the floppy drive.

     b. Enter the `ecu` command.

        The systems displays "loading ARC firmware." Loading the ARC firmware takes approximately 2 minutes. When the firmware is done loading, the ECU program is booted.

3. Complete the ECU procedure according to the guidelines provided in the following sections.

   - If you are configuring an EISA bus that contains only EISA options, refer to Table 5–7.

Note

If you are configuring only EISA options, do not perform Step 2 of the ECU, "Add or remove boards." (EISA boards are recognized and configured automatically.)

   - If you are configuring an EISA bus that contains both ISA and EISA options, refer to Table 5–8.

4. After you have saved configuration information and exited from the ECU:

   - **For systems running Windows NT**—Remove the ECU diskette from the floppy drive and boot the operating system.

   - **For systems running OpenVMS or DEC OSF/1**—Remove the ECU diskette from the floppy drive. Return to the SRM console firmware as follows:

     a. From the Boot menu, select the Supplementary menu.

b. From the Supplementary menu, select “Set up the system.” The Setup menu is then displayed.

c. From the Setup menu, select “Switch to OpenVMS or OSF console.”

d. Select your operating system console, then press Enter on “Setup menu.”

e. When the “Power-cycle the system to implement the change” message is displayed, press the Reset button. (Do not press the DC On/Off button.) Once the console firmware is loaded and device drivers are initialized, you can boot the operating system.

5. Verify that the new options are configured correctly.

5.6.3 Configuring EISA Options

EISA boards are recognized and configured automatically. Study Table 5–7 for a summary of steps to configure an EISA bus that contains no ISA options. Review Section 5.6.1. Then run the ECU as described in Section 5.6.2.

Note

It is not necessary to run Step 2 of the ECU, “Add or remove boards.” (EISA boards are recognized and configured automatically.)

Table 5–7 Summary of Procedure for Configuring EISA Bus (EISA Options Only)

Step	Explanation
Install EISA option.	Use the instructions provided with the EISA option.
Power up and run ECU.	If the ECU locates the required CFG configuration files, it displays the main menu. The CFG file for the option may reside on a configuration diskette packaged with the option or may be included on the system configuration diskette. **Note** It is not necessary to run Step 2 of the ECU, “Add or remove boards.” (EISA boards are recognized and configured automatically.)
View or Edit Details (optional).	The "View or Edit Details" ECU option is used to change user-selectable settings or to change the resources allocated for these functions (IRQs, DMA channels, I/O ports, and so on). This step is not required when using the board’s default settings.
Save your configuration and restart the system.	The "Save and Exit" ECU option saves your configuration information to the system’s nonvolatile memory.
Return to the SRM console (DEC OSF/1 and OpenVMS systems only) and restart the system.	Refer to step 4 of Section 5.6.2 for operating-system-specific instructions.

5.6.4 Configuring ISA Options

ISA boards are configured manually, whereas EISA boards are configured through the ECU software. Study Table 5–8 for a summary of steps to configure an EISA bus that contains both EISA and ISA options. Review Section 5.6.1. Then run the ECU as described in Section 5.6.2.

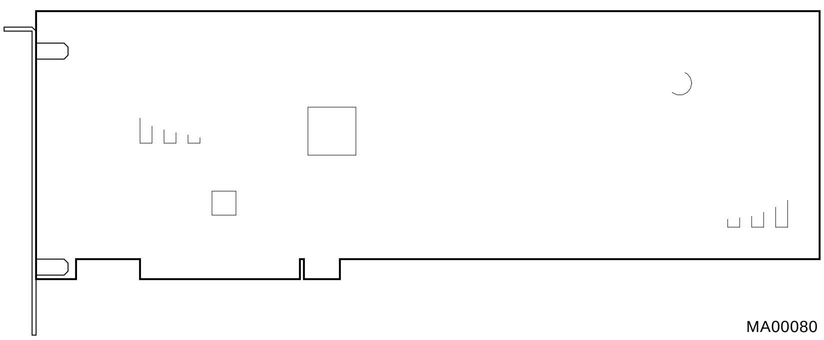
Table 5–8 Summary of Procedure for Configuring EISA Bus with ISA Options

Step	Explanation
Install or move EISA option. Do not install ISA boards.	Use the instructions provided with the EISA option. ISA boards are installed after the configuration process is complete.
Power up and run ECU.	If you have installed an EISA option, the ECU needs to locate the CFG file for that option. This file may reside on a configuration diskette packaged with the option or may be included on the system configuration diskette.
Add the ISA board to the configuration list.	Use the "Add or Remove Boards" ECU option to add the CFG file for the ISA option and to select an acceptable slot for the option.
	The CFG file for the option may reside on a configuration diskette packaged with the option or may be included on the system configuration diskette.
	If you cannot find the CFG file for the ISA option, select the generic CFG file for ISA options from the configuration diskette.
View or Edit Details (optional).	The "View or Edit Details" ECU option is used to change user-selectable settings or to change the resources allocated for these functions (IRQs, DMA channels, I/O ports, and so on). This step is not required when using the board's default settings.
Examine and set required switches to match the displayed settings.	The "Examine Required Switches" ECU option displays the correct switch and jumper settings that you must physically set for each ISA option. Although the ECU cannot detect or change the settings of ISA boards, it uses the information from the previous step to determine the correct switch settings for these options.
	Physically set the board's jumpers and switches to match the required settings.
Save your configuration and turn off the system.	The "Save and Exit" ECU option saves your configuration information to the system's nonvolatile memory.
Return to the SRM console (DEC OSF/1 and OpenVMS systems only) and turn off the system.	Refer to step 4 of Section 5.6.2 for information about returning to the console.
Install ISA board and turn on the system.	Use the instructions provided with the ISA option.

5.7 PCI Bus Options

PCI (Peripheral Component Interconnect) is an industry-standard expansion I/O bus that is the preferred bus for high-performance I/O options. The AlphaServer supports 32-bit PCI options. At product production there are three slots for 32-bit PCI options. A PCI board is shown in Figure 5–12.

Figure 5–12 PCI Board



Install PCI boards according to the instructions supplied with the option. PCI boards require no additional configuration procedures; system automatically recognizes the boards and assigns the appropriate system resources.

Warning: For protection against fire, only modules with current-limited outputs should be used.

5.8 SCSI Buses

A Fast SCSI-2 adapter on the standard I/O module (BA740/BA741 enclosures) or I/O backplane (BA720 enclosures) provide a single-ended SCSI bus for AlphaServer systems.

All tabletop or rackmounted SCSI-2 devices are supported via EISA- or PCI-based SCSI adapters. Use the following rules to determine if a device can be used on your system:

- The device must be supported by the operating system. Consult the software product description or hardware vendor.
- No more than seven devices can be on any one SCSI-2 controller, and each must have a unique SCSI ID.

- The entire SCSI bus length, from terminator to terminator, must not exceed 6 meters for single-ended SCSI-2 at 5 MB/sec, or 3 meters for single-ended SCSI-2 at 10 MB/sec.
  - For BA720 pedestal enclosures, the internal cabling for the removable media bus is 2.6 meters; therefore, the maximum length for external expansion is 3.4 meters.
  - For BA740 pedestal enclosures, the internal cabling for the removable media bus is 2.5 meters; therefore, the maximum length for external expansion is 3.5 meters.
  - For BA741 rackmount enclosures, the internal cabling for the removable media and internal disk-drives is 2.0 meters; therefore, the maximum length for external expansion is 4.0 meters.

5.8.1 Internal SCSI Bus, Pedestal (BA720) Systems

The Fast SCSI-2 adapter on the I/O backplane supports up to two 5.25-inch, internal half-height removable-media devices.

This bus can be extended to a StorageWorks shelf or an external expander to support up to seven drives.

The BA720 pedestal supports an internal StorageWorks shelf that can support up to eight SCSI disk drives in a dual-bus configuration.

Note

Extending the SCSI bus into the internal StorageWorks shelf forecloses the option to expand the bus externally.

5.8.2 Internal SCSI Bus, Pedestal (BA740) Systems

The Fast SCSI-2 adapter on the standard I/O module supports the internal removable-media devices:

- Up to three 5.25-inch, half-height devices

or

- One 5.25-in. full-height device and one 5.25-in. half-height device

This bus can be extended to a StorageWorks shelf or an external expander to support up to seven drives.

The BA740 pedestal supports up to two internal StorageWorks shelves (option number BA35E-AA) that can each support up to eight SCSI disk drives in a dual-bus configuration.

Note

Extending the SCSI bus into the internal StorageWorks shelf forecloses the option to expand the bus externally.

5.8.3 Internal SCSI Bus, Rackmount (BA741) Systems

The Fast SCSI-2 adapter on the standard I/O module supports the internal SCSI drives:

One or two hard disk drives and up to two 5.25-inch, half-height devices

This bus can be extended to a rack-mounted StorageWorks shelf or to an external expander to support up to seven drives.

5.8.4 Installing Removable Media Devices, Pedestal (BA720/BA740) Systems

Figure 5–13 shows how to install 5.25-inch, half-height devices in the removable-media compartment for BA720 enclosures.

Figure 5–14 shows how to install 5.25-inch, half-height or full-height devices in the removable-media compartment for BA740 enclosures.

Use the screws (4 flat-head screws per drive) that are provided with the system. The screws are in a plastic bag taped to the unused storage bracket.

Be sure that you set the device's node ID so that there are no duplicates, as each device must have a unique node ID. Nodes 0–6 are available for drives, and node 7 is reserved for the host adapter. For information on device switch settings, refer to the documentation supplied with the device.

Figure 5–13 Installing Removable Media, Pedestal (BA720) Systems

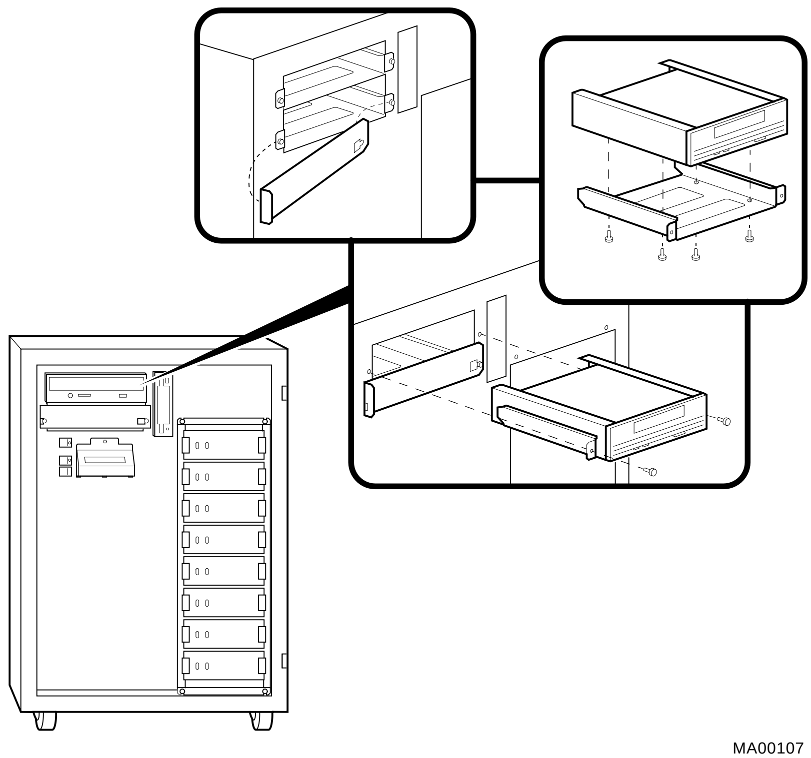
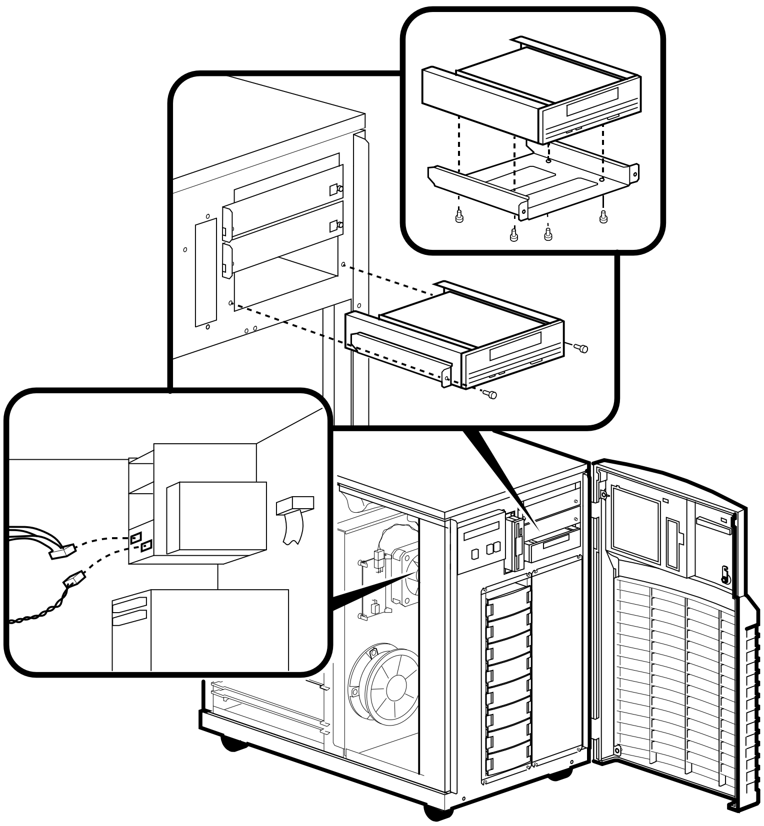


Figure 5–14 Installing Removable Media, Pedestal (BA740) Systems



5.8.5 Configuring the Removable Media Bus, Pedestal (BA720/BA740) Systems

The removable-media bus can be configured to extend into an internal StorageWorks shelf or to allow expansion from the SCSI connector on the bulkhead at the rear of the enclosure:

- When the bus is not extended into an internal StorageWorks shelf, the internal SCSI terminator (12-41296-01) is required, as shown in Figure 5–15 for BA720 enclosures, and Figure 5–16 for BA740 enclosures.

  External expansion from the back of the enclosure is available in this configuration. If the bus is not expanded, be sure the external SCSI terminator (12-37004-04) is in place.

- When the bus is configured to extend into an internal StorageWorks shelf (Figure 5–15 for BA720 enclosures; Figure 5–16 for BA740 enclosures), the bus must be terminated at the bulkhead connector using the external SCSI terminator (12-37004-04).

  External expansion from the back of the enclosure is not allowed in this configuration, as it would violate SCSI bus length rules.

Figure 5–15 Removable-Media Bus Configurations, Pedestal (BA720)

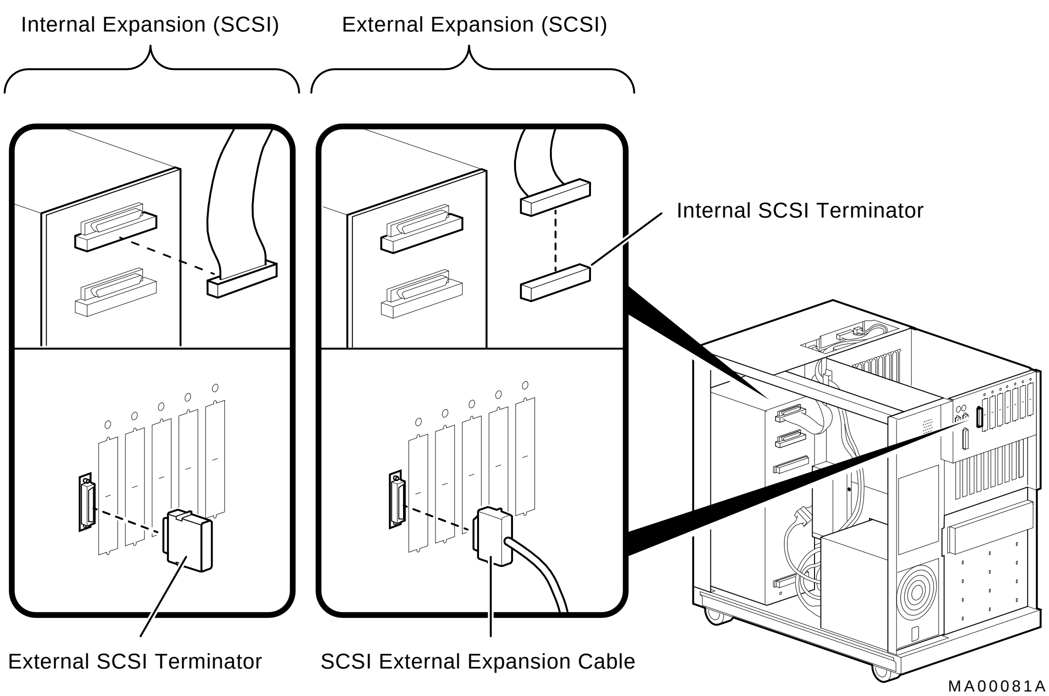
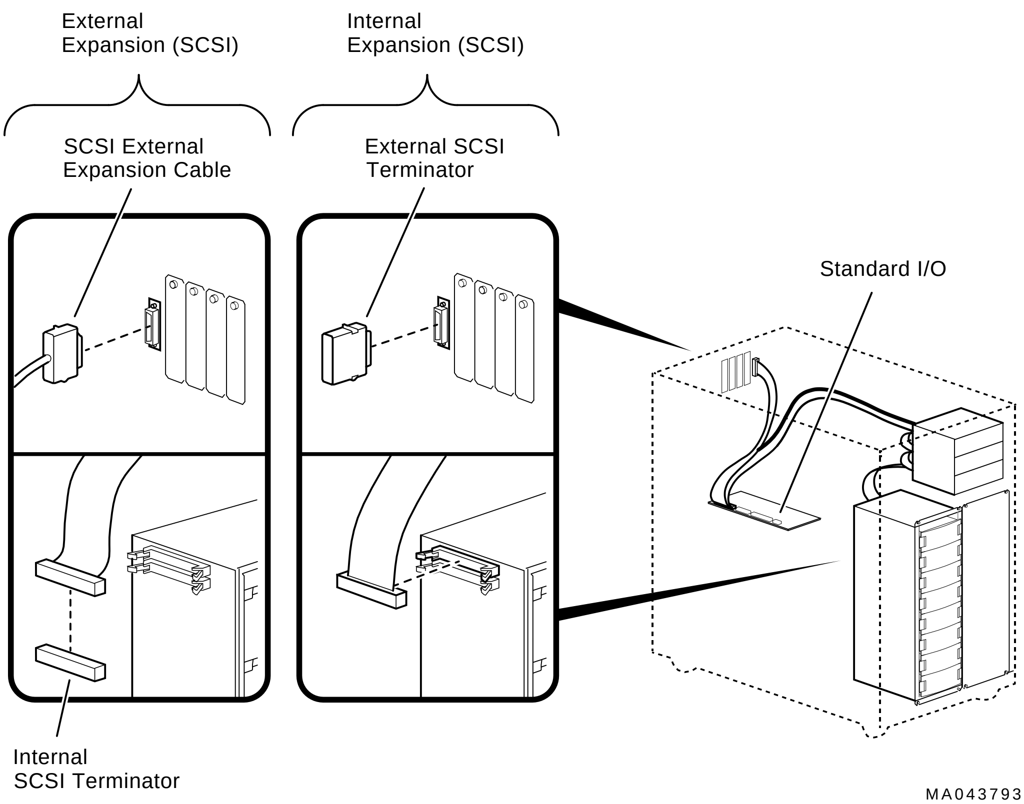


Figure 5–16 Removable-Media Bus Configurations, Pedestal (BA740)



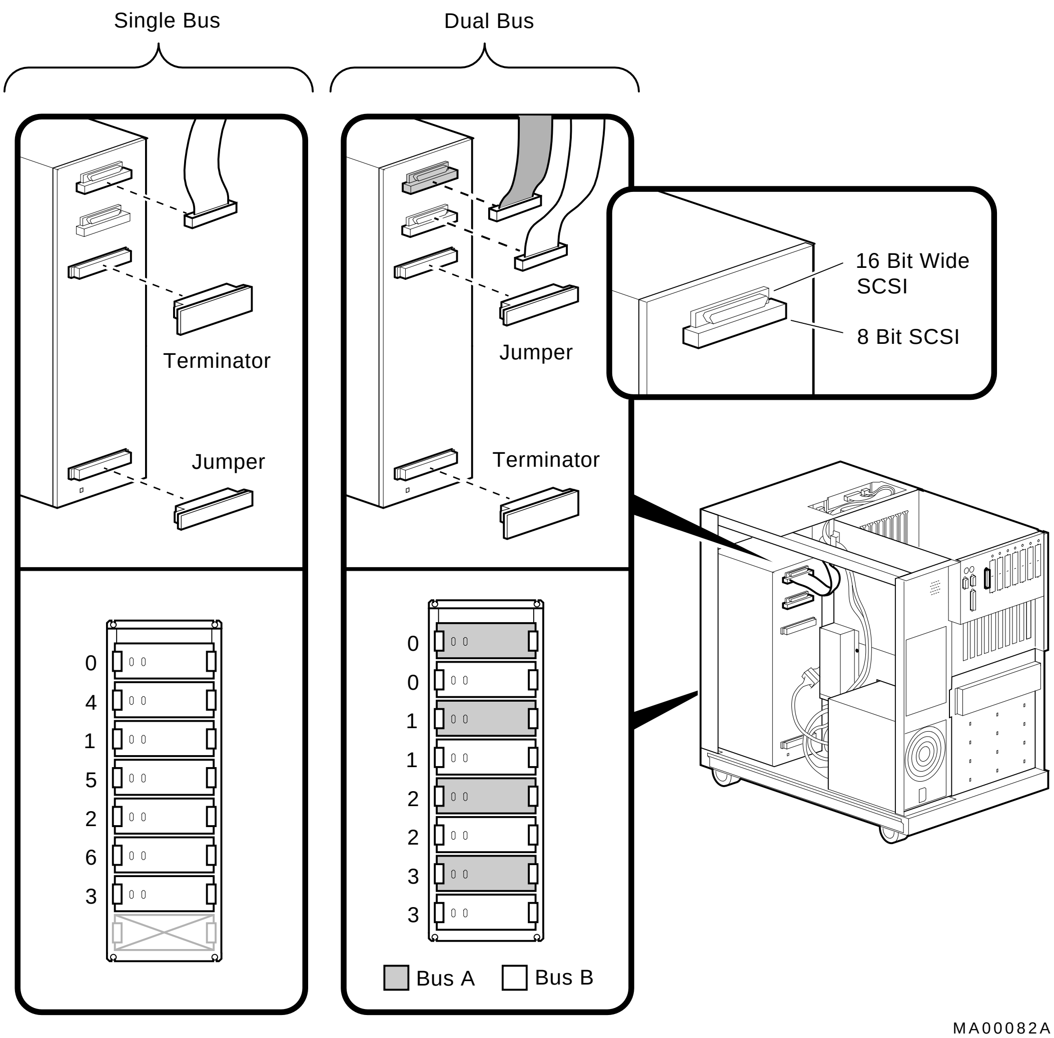
5.8.6 Internal StorageWorks Shelves, Pedestal (BA720/BA740) Systems

The backplane of the internal StorageWorks shelf supplies the drive's SCSI node ID according to the location of the drive within the storage shelf. Each internal StorageWorks shelf can be configured in one of two ways:

- Single bus — Up to seven drives, each with a unique node ID. In this configuration, the bottom slot is not used.
- Dual bus — Up to four pair of drives (node IDs 0–3, top to bottom).

For BA720 enclosures, the storage shelf configuration is controlled by the position of the terminator (BA35X-ME) and jumper (MA35X-MF) as shown in Figure 5–17.

Figure 5–17 Internal StorageWorks Configuration (BA720)



For BA740 enclosures, the storage shelf configuration is controlled by the position of the terminator (BA35X-MB) and jumper (BA35X-MC) as shown in Figure 5–18.

Figure 5–18 Internal StorageWorks Configuration (BA740)

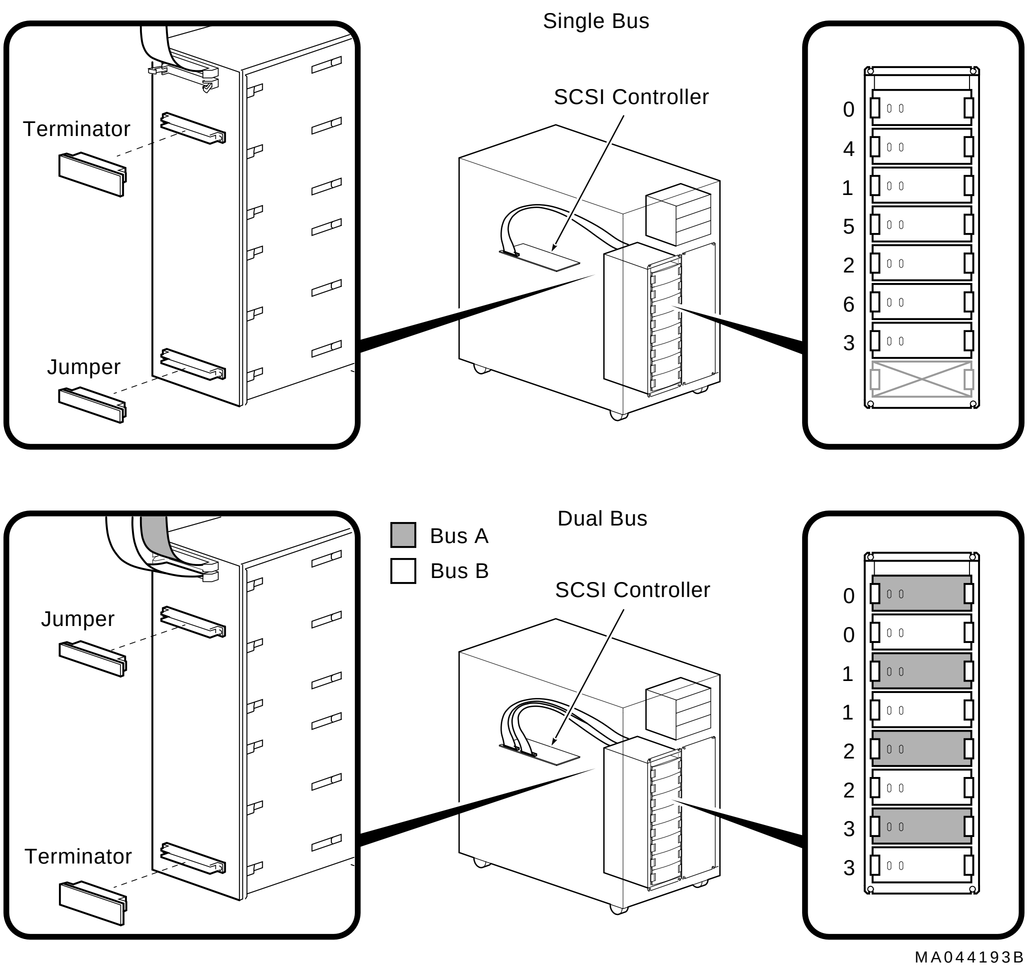


Figure 5–19 shows the SCSI cable routing from an SWXCR-xx controller to the internal StorageWorks shelf for BA720 enclosures.

Figure 5–19 Preferred SCSI Cable Routing: SWXCR-xx to Internal StorageWorks Shelf (BA720)

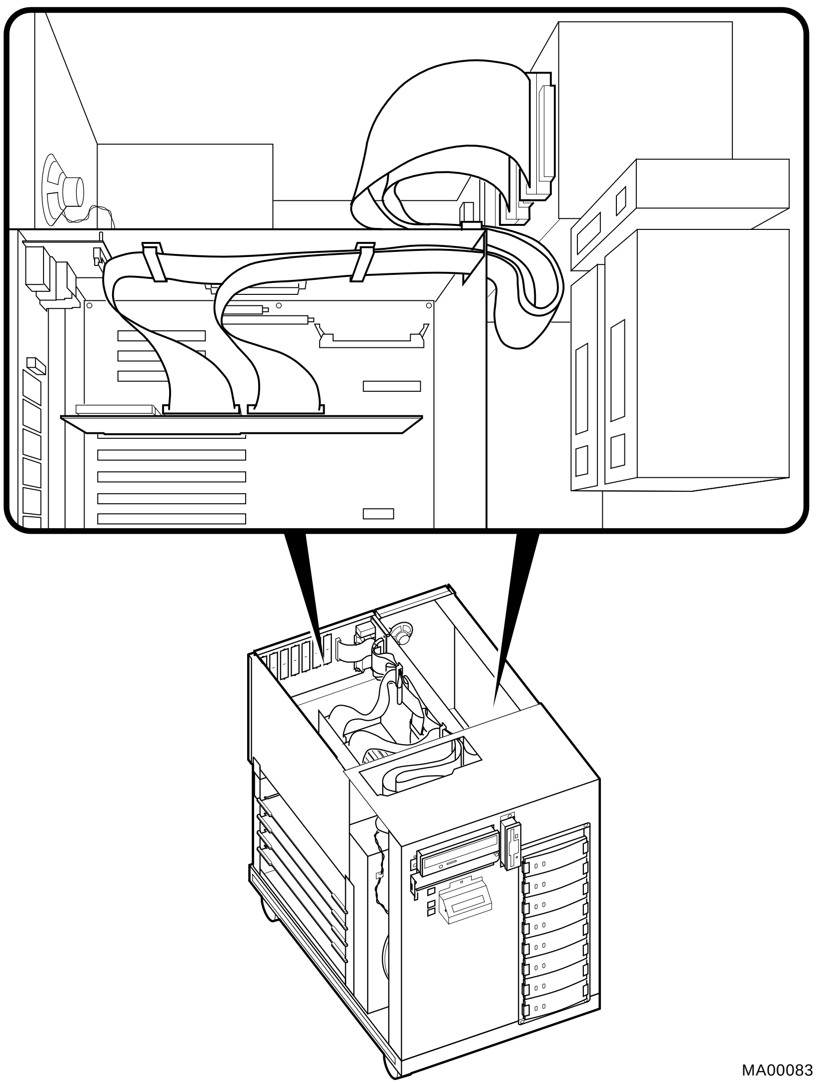
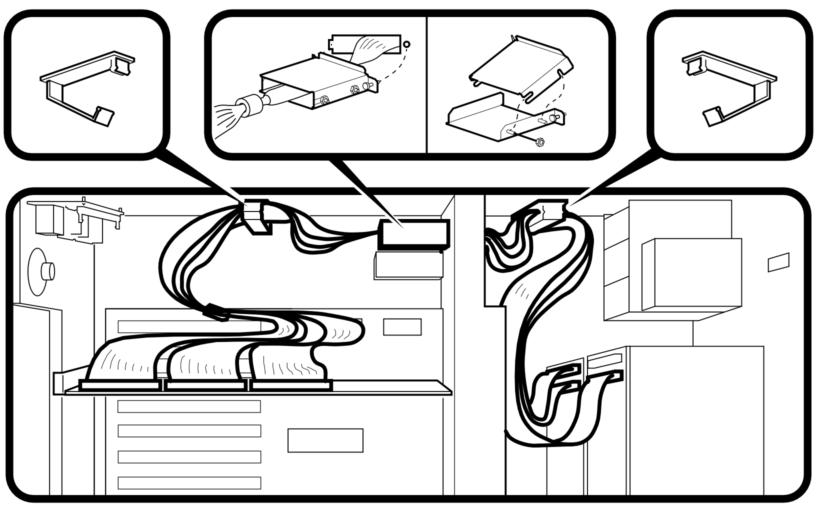


Figure 5–20 shows the SCSI cable routing from an SWXCR-xx controller to internal StorageWorks shelves for BA740 enclosures.

Figure 5–20 Preferred SCSI Cable Routing: SWXCR-xx to Internal StorageWorks Shelves (BA740)



5.8.7 Installing StorageWorks Fixed-Disks, Pedestal (BA720/BA740)

If the StorageWorks drives are plugged into an SWXCR-xx controller, you can "hot swap" drives, that is, you can install or replace drives without first shutting down the operating system or powering down the server hardware. For more information, see *StorageWorks RAID Array 200 Subsystem Family Installation and Configuration Guide*, EK-SWRA2-IG.

If the StorageWorks drives are not plugged into an SWXCR-xx controller, you will need to shut down the operating system before swapping a drive. However, you will not need to power down the server before installing the drive.

Installation Procedure

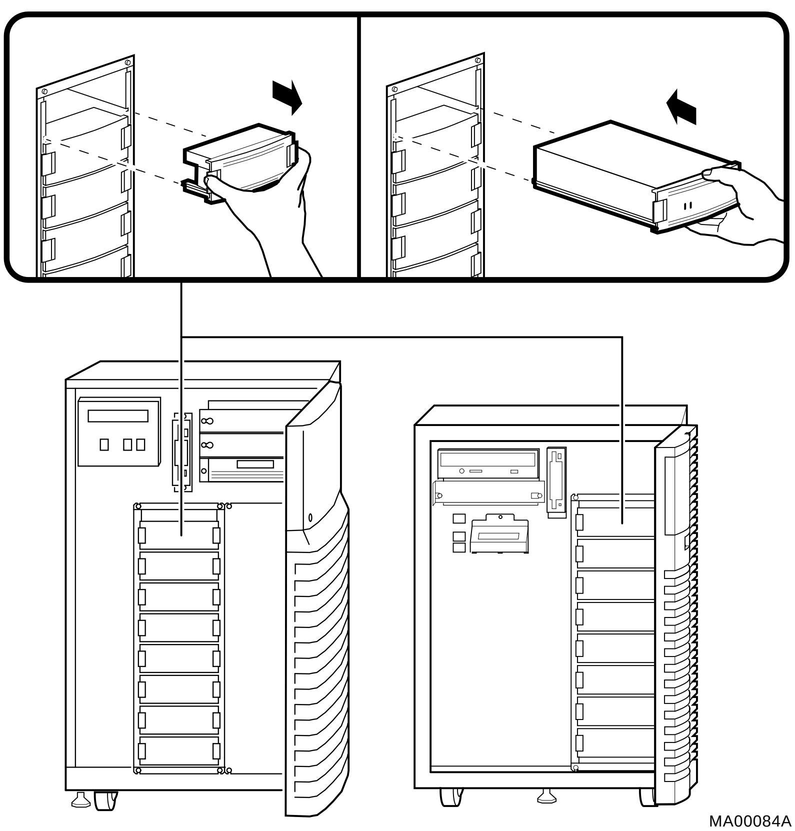
To install a StorageWorks disk drive:

1. If the StorageWorks drives are plugged into an SWXCR-xx controller, go to step 2. If your drives are not plugged into an SWXCR-xx controller, shut down the operating system before you go to step 2.

2. Remove a blank bezel by pressing the two mounting tabs and pull the bezel out of the shelf.
3. Insert the hard-disk drive into the guide slots and push it in until the tabs lock in place.

Figure 5–21 shows how to install hard-disk drives in a StorageWorks shelf.

Figure 5–21 Installing Hard-Disk Drives, Pedestal (BA720/BA740)



5.8.8 Installing Removable Media Devices, Rackmount (BA741) Systems

Figure 5–22 shows how to install 5.25-in. half-height devices in the removable-media compartment. Use the screws (M3 x 6 mm, flathead) supplied in the accessories kit to mount the drives.

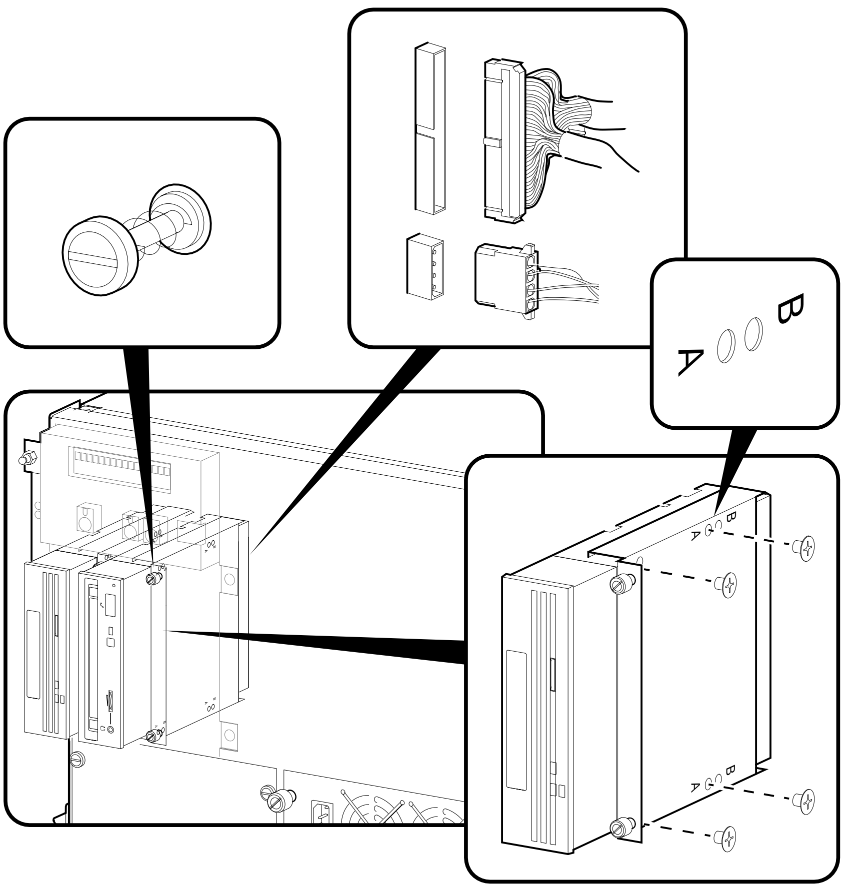
Be sure that you set the device's node ID so that there are no duplicate node IDs, as each device must have a unique node ID. Nodes 0–6 are available for drives, and node 7 is reserved for the host adapter. For information on device switch settings, refer to the documentation supplied with the device.

Note

RRDnn and TLZ0n drives use the set of bracket holes marked "A" in Figure 5–22.

The TZK11 drive uses the set of bracket holes marked "B" in Figure 5–22.

Figure 5–22 Installing Removable Media, Rackmount (BA741)



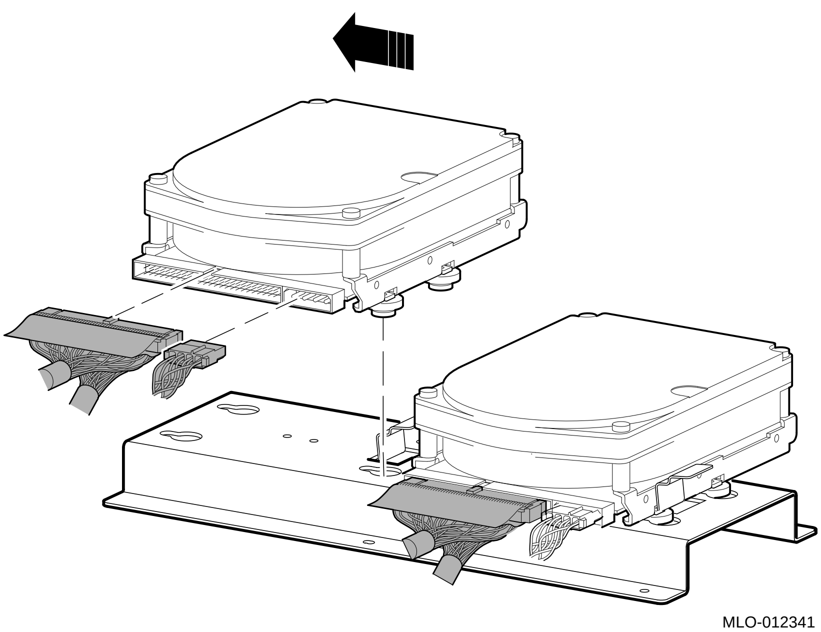
5.8.9 Installing Fixed-Disks, Rackmount (BA741) Systems

To install a hard-disk drive:

1. Mount four rubber grommets provided in the accessories kit to the drive.
2. Install drive as shown in Figure 5–23.

Be sure that you set the device's node ID so that there are no duplicate node IDs, as each device must have a unique node ID. Nodes 0–6 are available for drives, and node 7 is reserved for the host adapter. For information on device switch settings, refer to the documentation supplied with the device.

Figure 5–23 Installing a Hard-Disk Drive, Rackmount (BA741)



5.9 Power Supply Configurations

AlphaServer systems offer added reliability with redundant power options, as well as UPS options.

5.9.1 Power Supplies: Pedestal (BA720) Systems

The power supplies for AlphaServer 2000 systems support three different modes of operation. In addition, UPS options are available. Refer to Figure 5–24.

Note

AlphaServer 2000 systems (BA720 enclosure), unlike the AlphaServer 2100 systems (BA740/BA741 enclosures), use power supply cables as shown in Figure 5–25.

Power supply modes of operation:

1. Single power supply—Supports systems with:
   - One CPU
   - Two memory modules
   - One diskette drive
   - Two removable drives
   - Eight 3.5-inch StorageWorks hard disks
   - Ten I/O slots
2. Dual power supply (redundant mode)—Provides redundant power (n + 1) for the system described above.

   In redundant mode, the failure of one power supply does not cause the system to shut down. Normal operation continues with no impact on the system.

   The power supply mode jumper (J3) on the I/O backplane module must be installed to activate redundant mode power.

3. Dual power supply (full power mode)—Provides full power for systems with two CPUs. Systems with two CPUs need a second power supply.

The single and redundant mode power supply configurations are available to those systems drawing the following power levels:

Note

Total combined power of all outputs per supply cannot exceed 400 watts.

- 36 A or less of 3.3 V power
- 52 A or less of 5.0 V power
- 11 A or less of +12.0 V power
- 0.2 A or less of -12.0 V power
- 0.2 A or less of -5.0 V power
- The combination of 3.3 V power and 5.0 V power cannot exceed 335 watts.

If you add a second CPU to an AlphaServer 2000-series system, you will need to do one of the following:

- Install a second power supply (H7845-AA).
- If a dual power supply is configured in redundant mode, reconfigure it into full power mode.

Figure 5–24 Pedestal (BA720) Power Supply Configurations

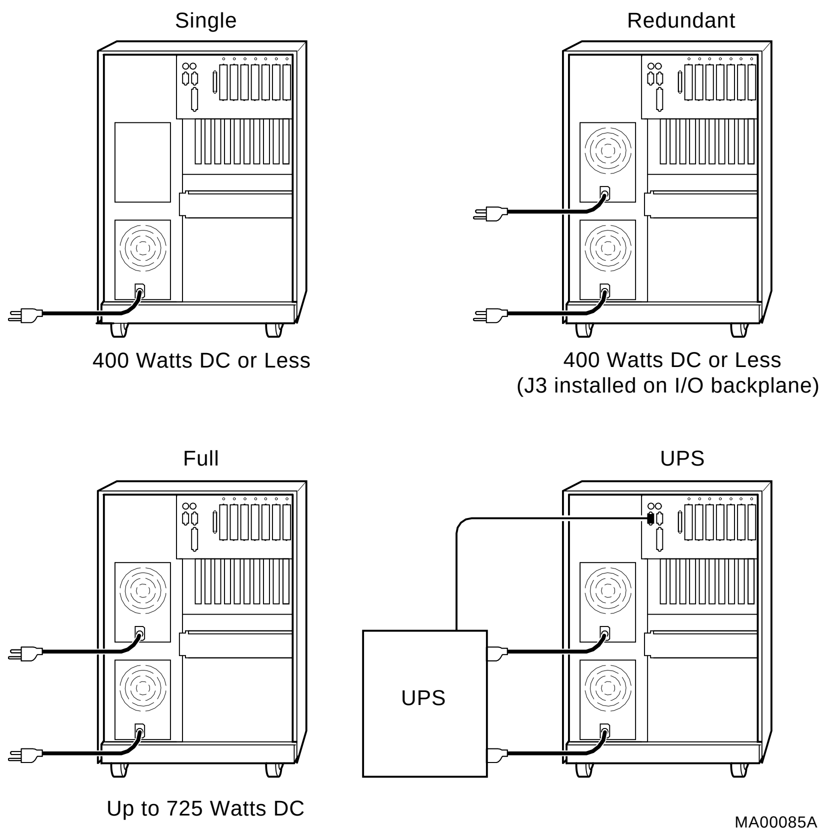
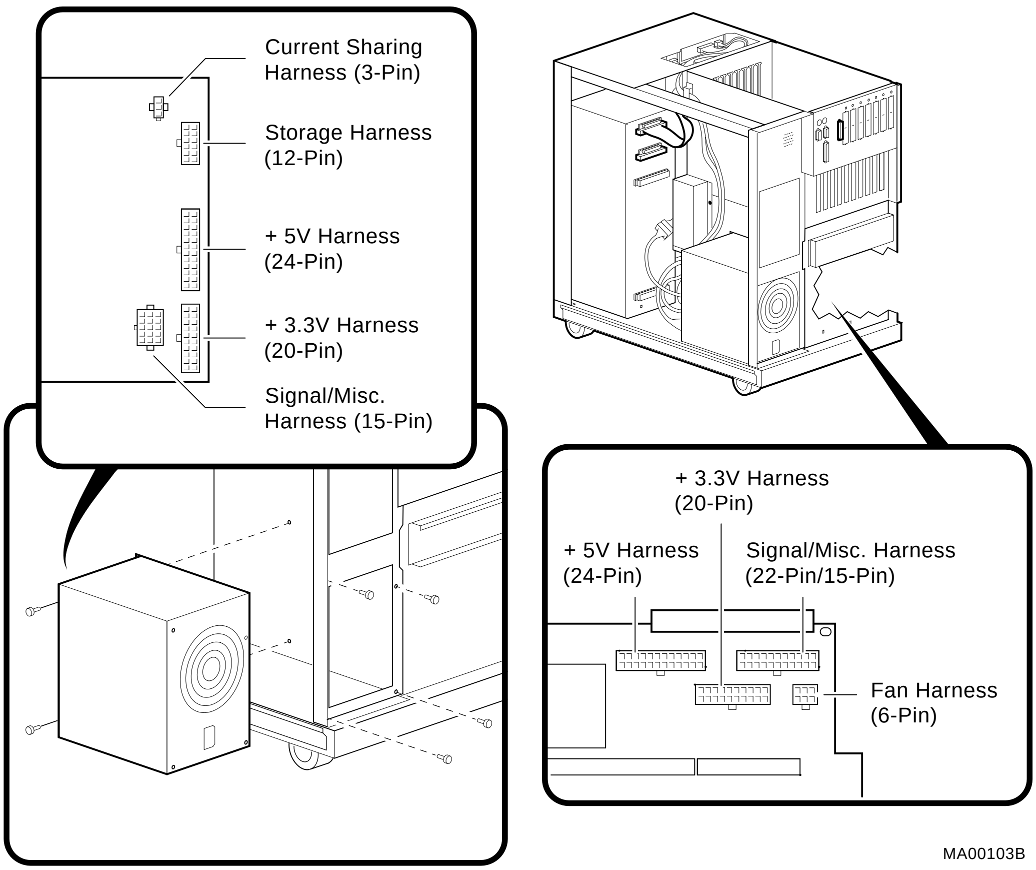


Figure 5–25 Pedestal (BA720) Power Supply Cable Connections



5.9.2 Power Supplies: Pedestal (BA740) Systems

The power supplies for model pedestal systems support three different modes of operation. In addition, UPS options are available. Refer to Figure 5–26.

Power supply modes of operation:

1. Single power supply—Supports entry-level systems, such as a system with two CPUs, one memory module, one floppy drive, one CD–ROM drive, one internal StorageWorks shelf with eight 3.5-in drives, and up to eight EISA /PCI options.
2. Dual Power Supply (redundant mode)—Provides redundant power (n + 1) for entry-level systems, such as a system with two CPUs, one memory module, one floppy drive, one CD–ROM drive, one internal StorageWorks shelf with eight 3.5-in drives, and up to eight EISA/PCI options.

   In redundant mode, the failure of one power supply does not cause the system to shut down. Normal operation continues with no impact on the system.

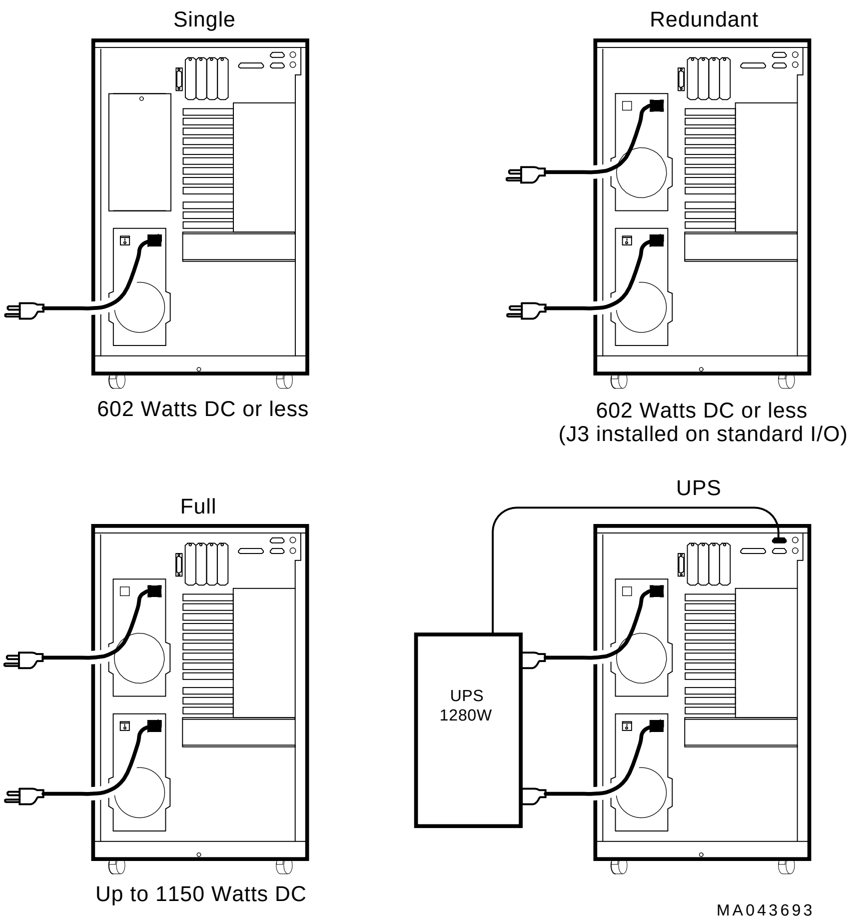
   The power supply mode jumper (J3) on the standard I/O module must be installed to activate redundant mode power.
3. Dual Power Supply (full power mode) — Provides full power for system configurations beyond entry level, such as system with more than two CPUs or more than one internal StorageWorks shelf. These systems require the power of two power supplies.

When you are considering ordering additional options for your server, you should consider the above guidelines for power consumption to determine if you need to upgrade the power supply configuration.

The single and redundant mode power supply configurations are available to those systems drawing:

- 602 watts DC output power or less
- 39 A or less of 3.3 V power
- 62 A or less of 5.1 V power
- 12.5 A or less of +12 V power
- 1.0 A of -12 V power

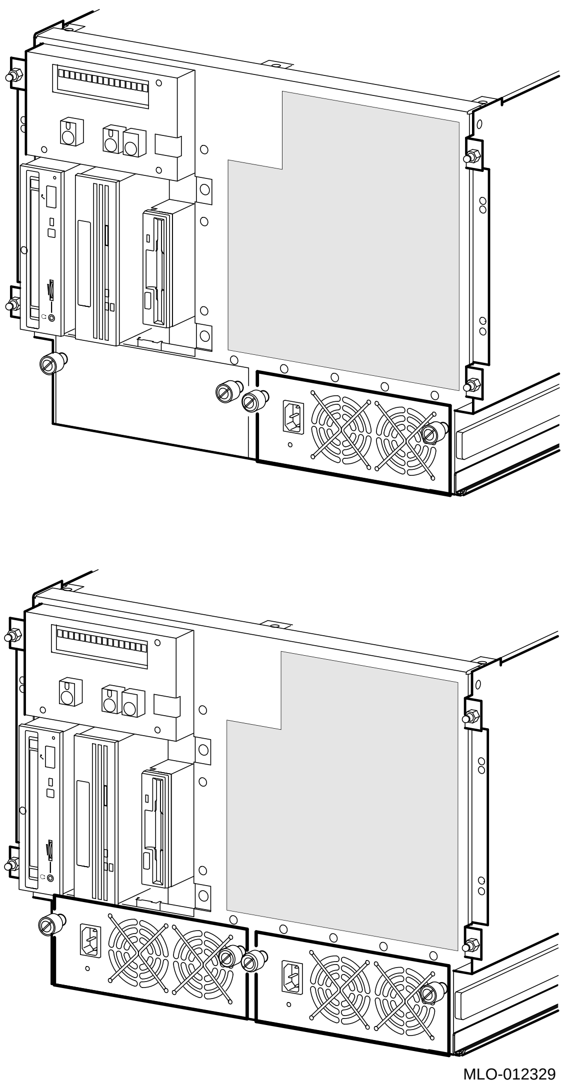
Figure 5–26 Pedestal (BA740) Power Supply Configurations



5.9.3 Power Supplies: Rackmount (BA741) Systems

A second power supply can be added to rackmount systems to provide a redundant power supply. With a redundant power supply, in most cases the failure of one power supply does not cause the system to shut down. Normal operation continues with no impact on the system. Refer to Figure 5–27.

Figure 5–27 Rackmount (BA741) Power Supply Configurations



5.10 Console Port Configurations

Power-up information is typically displayed on the system's console terminal. The console terminal may be either a graphics terminal or a serial terminal (connected through the COM1 serial port). The setting of the console environment variable determines where the system will display power-up output. Set this environment variable according to the console terminal that you are using.

Synopsis:

set console output_device

Arguments:

graphics	Displays the power-up output to a graphics terminal or device connected to the VGA module at rear of the system.
serial	Displays the power-up output to a device connected to the COM1 port at the rear of the system.

Example:

```
>>> set console serial
>>>
```

6

AlphaServer 2000 (BA720 Enclosure) FRU Removal and Replacement

This chapter describes the field-replaceable unit (FRU) removal and replacement procedures for AlphaServer 2000 systems, which use the BA720 enclosure.

- Section 6.1 lists the FRUs for AlphaServer 2000-series systems (BA720enclosure)
- Section 6.2 provides the removal and replacement procedures for the FRUs.

6.1 AlphaServer 2000 (BA720 Enclosure) FRUs

Table 6–1 lists the FRUs by part number and description and provides the reference to the figure or section that shows the removal/replacement procedure.

Figures 6–1 and 6–2 show the locations of FRUs within the system.

Figures 6–3 through 6–5 show how to remove the front door, system cover, and system bus cover.

Table 6–1 BA720 Enclosure FRUs

Part #	Description	Section
Cables		
17-04083-01	Fan harness (6-pin)	Figure 6–6
17-04085-01	Floppy drive cable (34-pin)	Figure 6–7
17-03971-01	OCP module cable (10-pin)	Figure 6–8
17-00083-09	Power cord	Figure 6–9
17-03964-01	Power supply current sharing cable (3-pin)	Figure 6–10
17-03965-01	Power supply signal/misc harness (15-pin)	Figure 6–11
17-04084-01	Power supply storage harness (12-pin)	Figure 6–12
17-04087-01	Power supply +5V harness (24-pin)	Figure 6–13
17-04110-01	Power supply +3.3V harness (20-pin)	Figure 6–14
17-02784-03	Remote I/O cable (60-pin)	Figure 6–15
17-04086-01	SCSI (embedded 8-bit) multinode cable (50-pin)	Figure 6–16
17-03960-02	SCSI RAID internal cable (50-pin)	Figure 6–17
CPU Modules		
B2020-AA	KN450-AA CPU module	Section 6.2.2
B2024-AA	KN460-AA CPU module	Section 6.2.2
Fans		
12-23609-09	4.5-inch fan	Section 6.2.3
12-36202-03	6.75-inch fan	Section 6.2.3
I/O Modules		
B2111-AA	I/O backplane	Section 6.2.4
54-23151-01	Remote I/O module	Section 6.2.5

(continued on next page)

Table 6–1 (Cont.) BA720 Enclosure FRUs

Part #	Description	Section
Internal StorageWorks		
RZnn -VA	StorageWorks disk drive	Section 6.2.6
54-23343-01	Internal StorageWorks backplane	Section 6.2.7
BA35X-ME (54-23376-01)	Internal StorageWorks terminator	Section 6.2.8
BA35X-MF (54-23378-01)	Internal StorageWorks jumper	Section 6.2.8
Memory Modules		
ME524-DE (54-21225-BA)	1 x 4MB SIMM	Section 6.2.9
ME644-DE (54-23170-AA)	1 x 16MB SIMM	Section 6.2.9
B2023-BA	32-SIMM carrier module	Section 6.2.9
Other Modules and Components		
54-23294-01	System bus motherboard	Section 6.2.10
54-23765-01	OCP module	Section 6.2.11
30-43049-01	OCP LCD display module	Section 6.2.11
30-41976-01	Power supply	Section 6.2.13
12-39309-01	Speaker	Section 6.2.14
12-37004-04	External SCSI terminator	
12-41296-01	Internal SCSI terminator	
12-36437-03	Key for door	
Removable Media		
RRDnn -CA	CD–ROM drives	Section 6.2.15
TLZnn -LG	Tape drives	Section 6.2.15
TZKnn -LG	Tape drives	Section 6.2.15
RXnn -AA	Floppy drive	Section 6.2.15

Figure 6–1 FRUs, Front Left

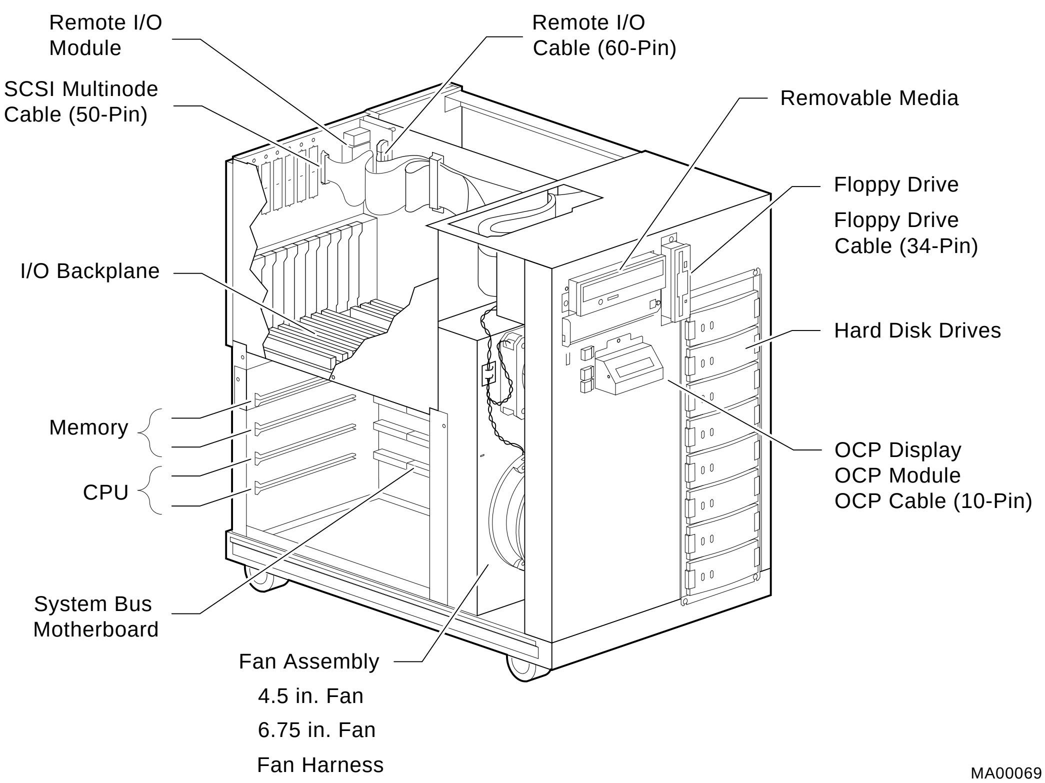
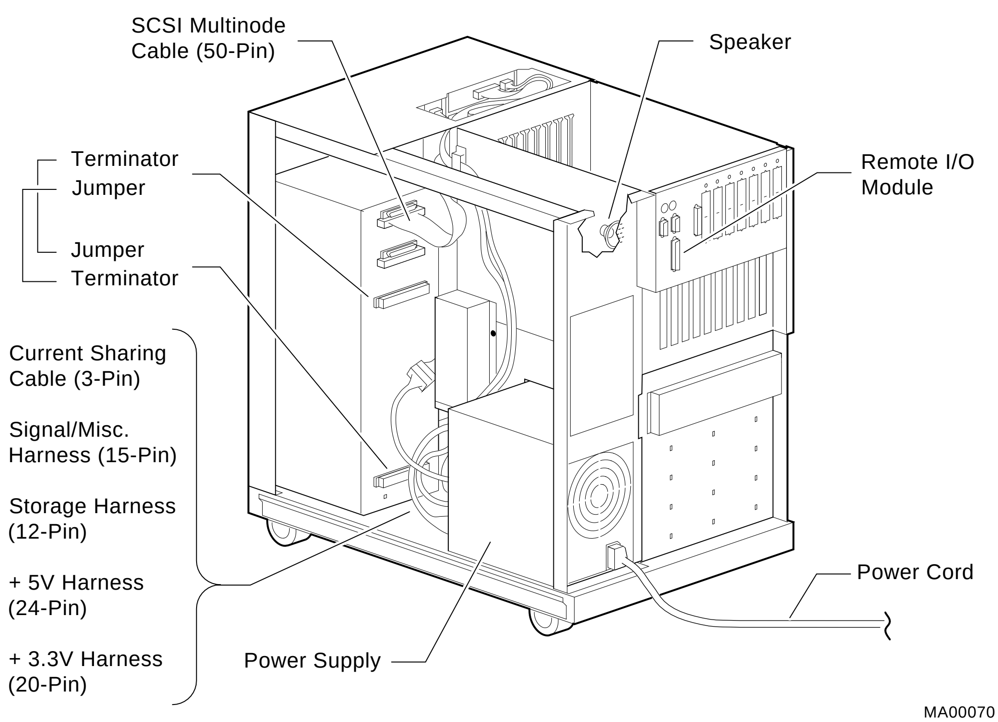


Figure 6–2 FRUs, Rear Right



6.2 Removal and Replacement

This section describes the procedures for removing and replacing FRUs for AlphaServer 2000-series systems, which use the BA720 enclosure.

Caution: Before removing the system cover:

1. Perform orderly shutdown of the operating system.
2. Set the DC on/off button on the operator control panel to off
3. Unplug AC power cords.

Caution

Static electricity can damage integrated circuits. Always use a grounded wrist strap (29-26246) and grounded work surface when working with internal parts of a computer system.

Unless otherwise specified, you can install an FRU by reversing the steps shown in the removal procedure.

Figure 6–3 Removing Front Door

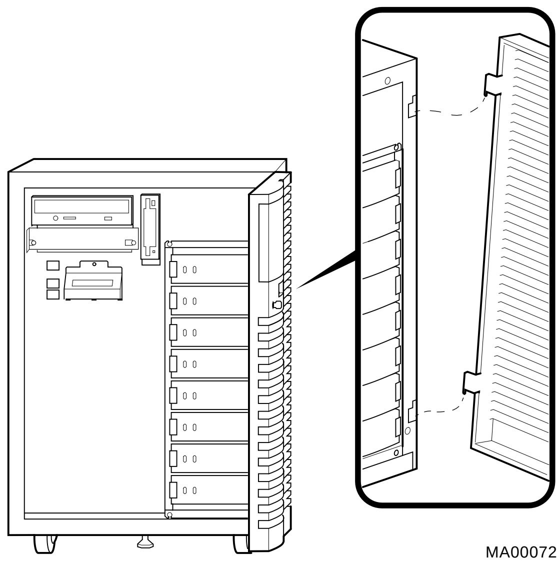


Figure 6–4 Removing System Cover

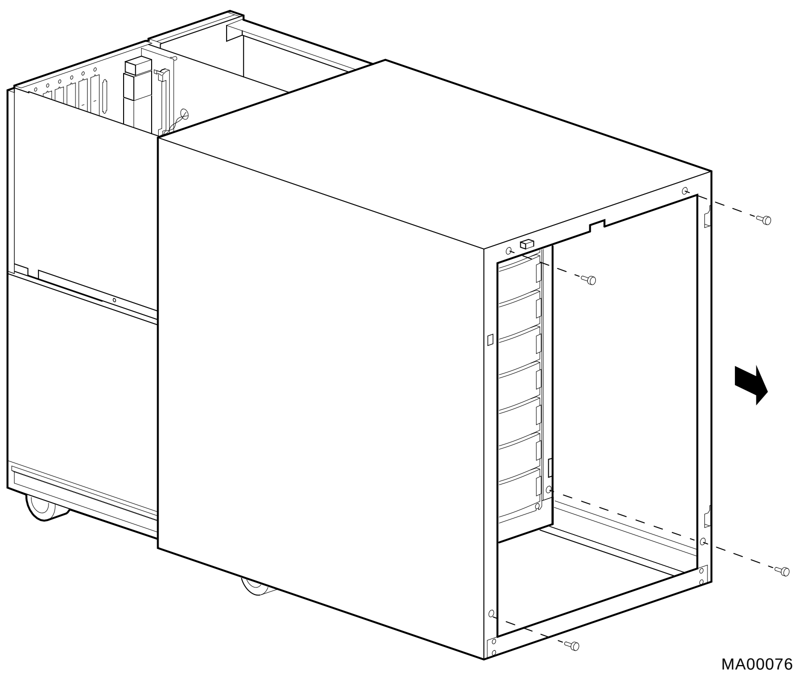
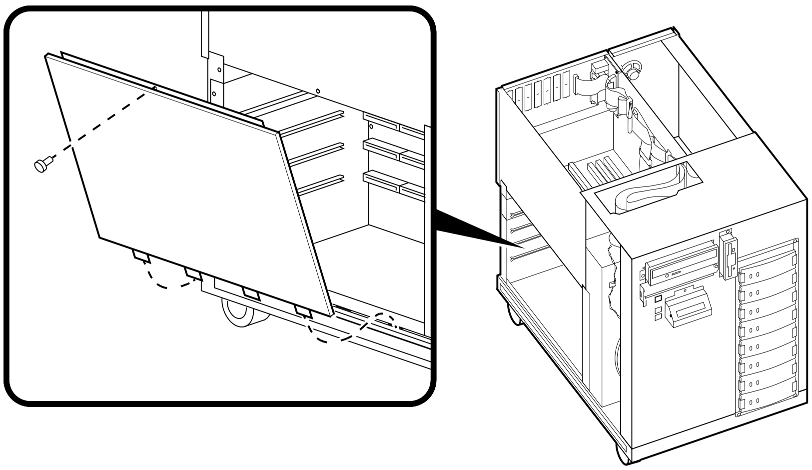


Figure 6–5 Removing System Bus Compartment Cover



6.2.1 Cables

This section shows the routing for each cable in the system.

Figure 6–6 Fan Harness (6-Pin)

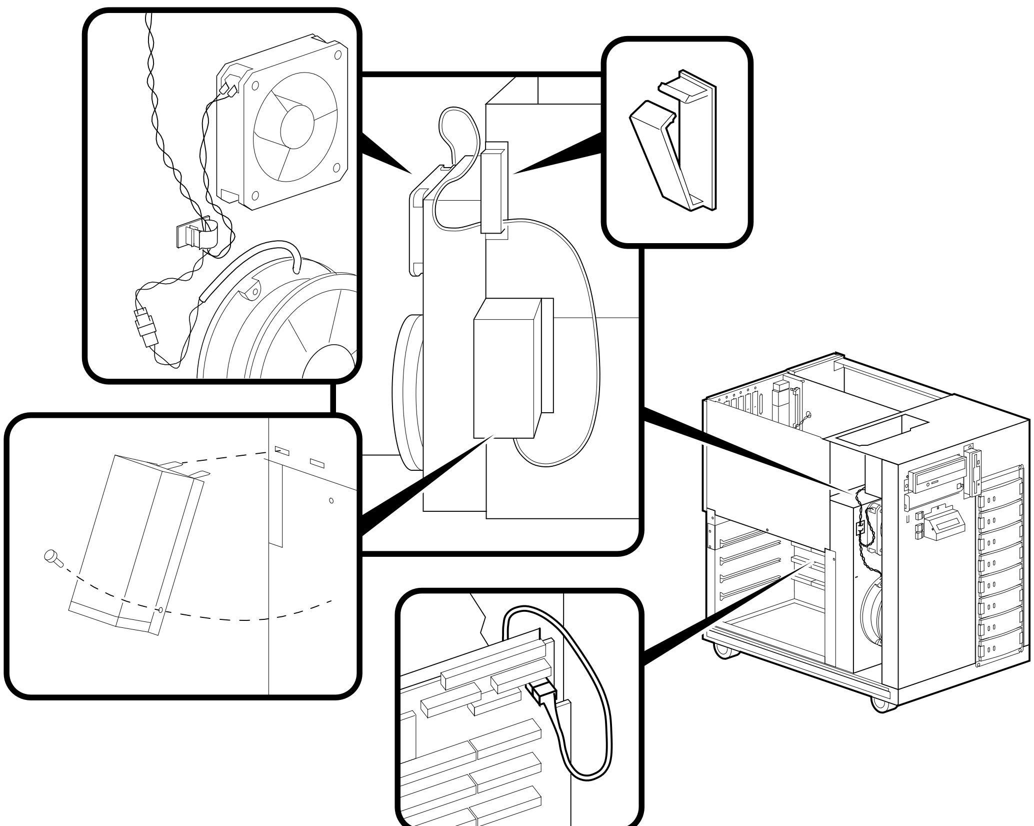


Figure 6–7 Floppy Drive Cable (34-Pin)

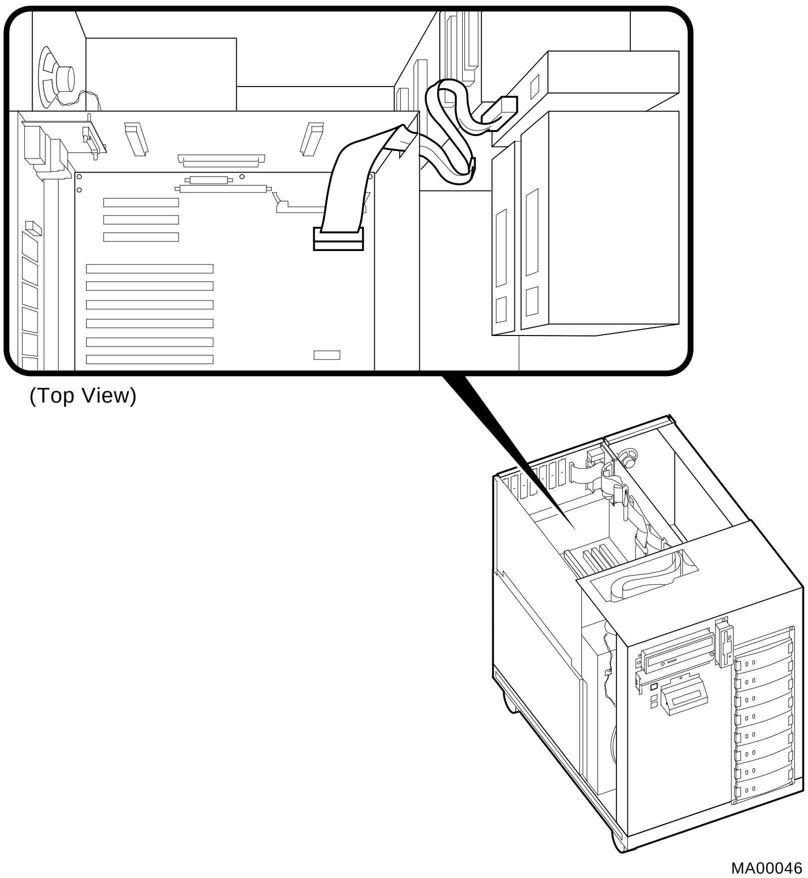


Figure 6–8 OCP Module Cable (10-Pin)

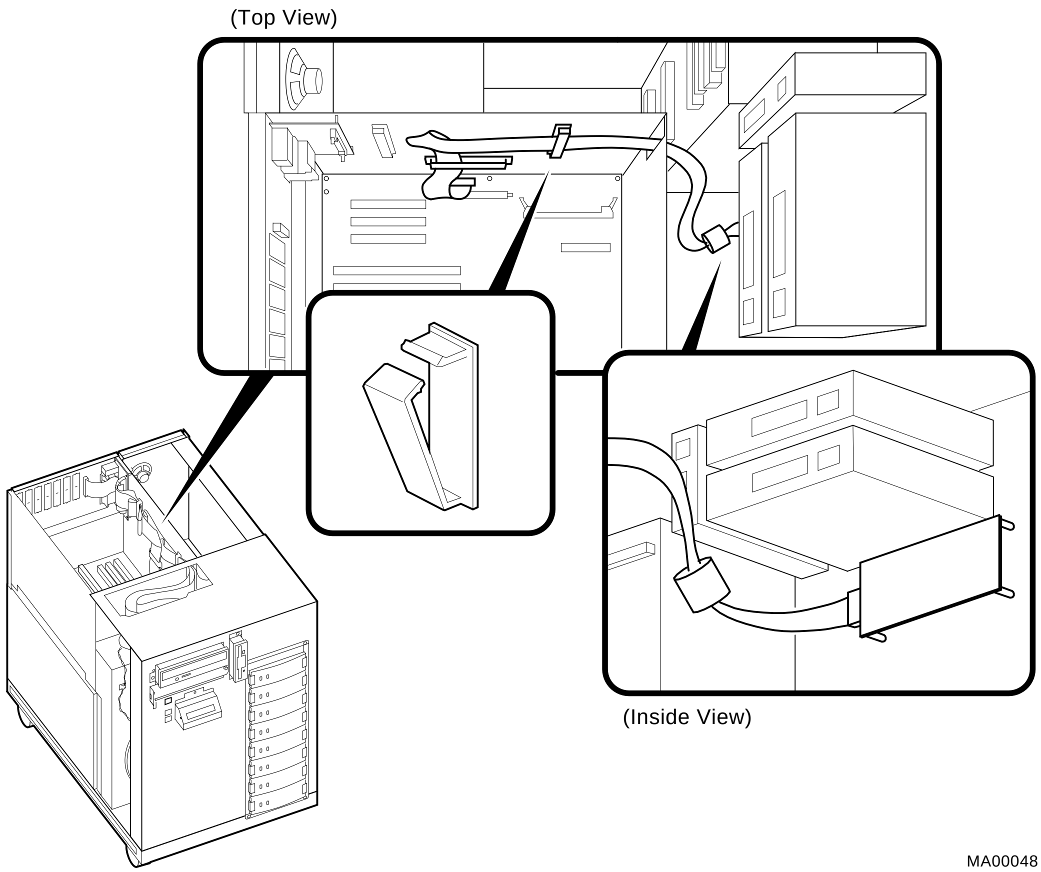


Figure 6–9 Power Cord

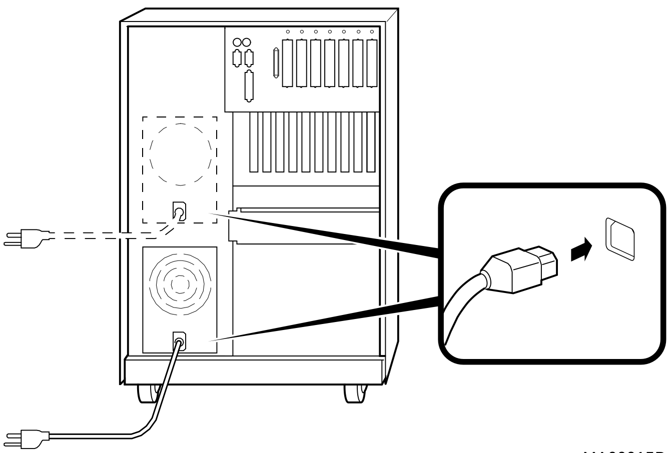


Table 6–2 lists the country-specific power cables.

Table 6–2 Power Cord Order Numbers

Country	Power Cord BN Number	Digital Number
U.S., Japan, Canada	BN09A-1K	17-00083-09
Australia, New Zealand	BN019H-2E	17-00198-14
Central Europe (Aus, Bel, Fra, Ger, Fin, Hol, Nor, Swe, Pro, Spa)	BN19C-2E	17-00199-21
U.K., Ireland	BN19A-2E	17-00209-15
Switzerland	BN19E-2E	17-00210-13
Denmark	BN19K-2E	17-00310-08
Italy	BN19M-2E	17-00364-18
India, South Africa	BN19S-2E	17-00456-16
Israel	BN18L-2E	17-00457-16

Figure 6–10 Power Supply Current Sharing Cable (3-Pin)

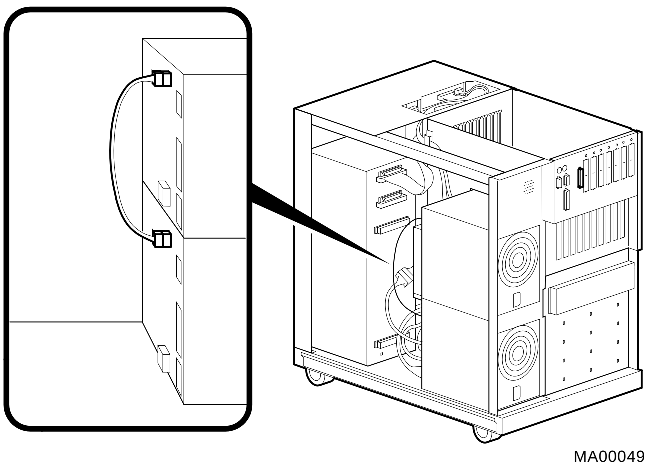


Figure 6–11 Power Supply Signal/Misc Harness (15-Pin)

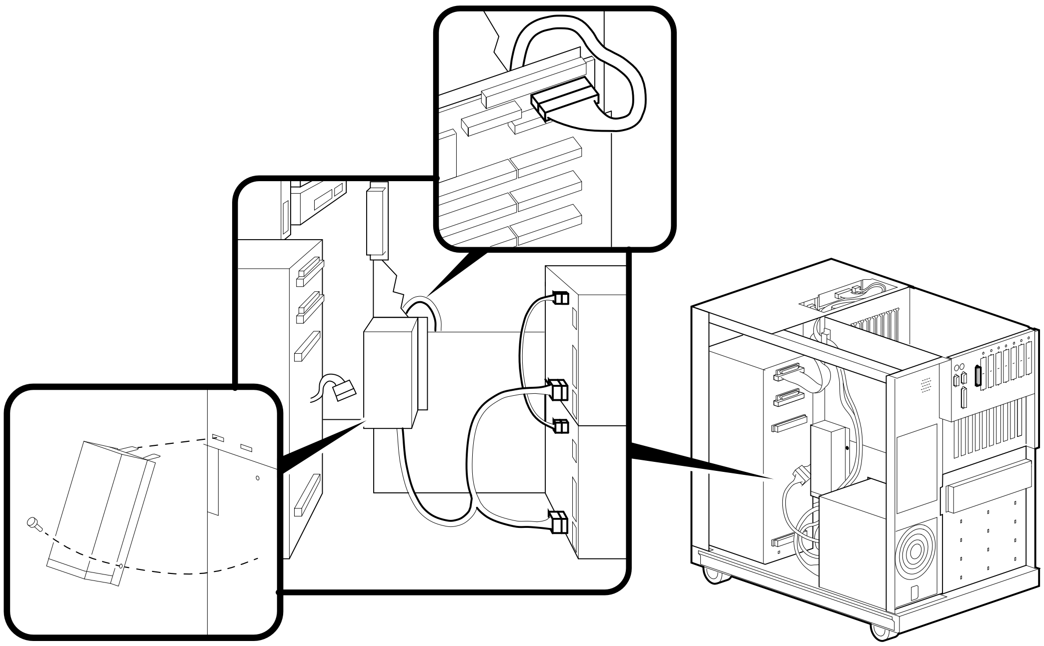


Figure 6–12 Power Supply Storage Harness (12-Pin)

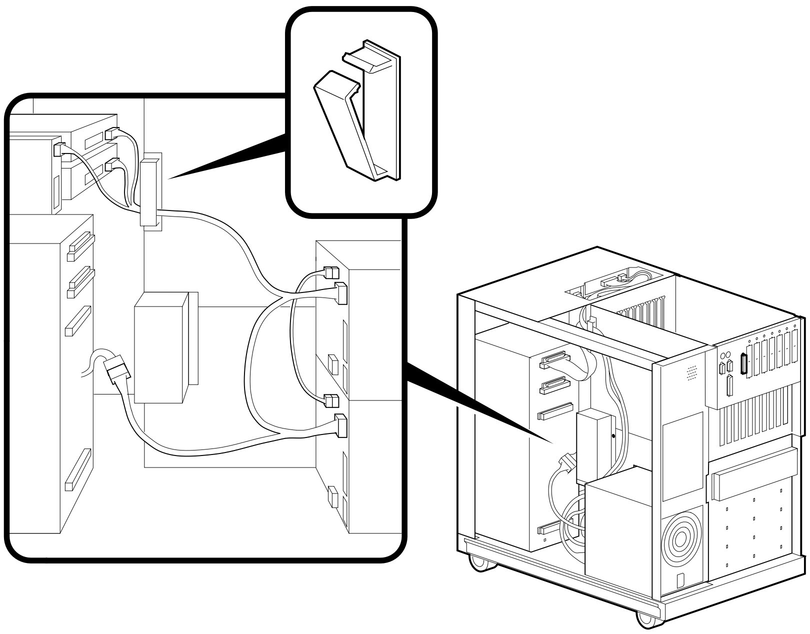


Figure 6–13 Power Supply +5V Harness (24-Pin)

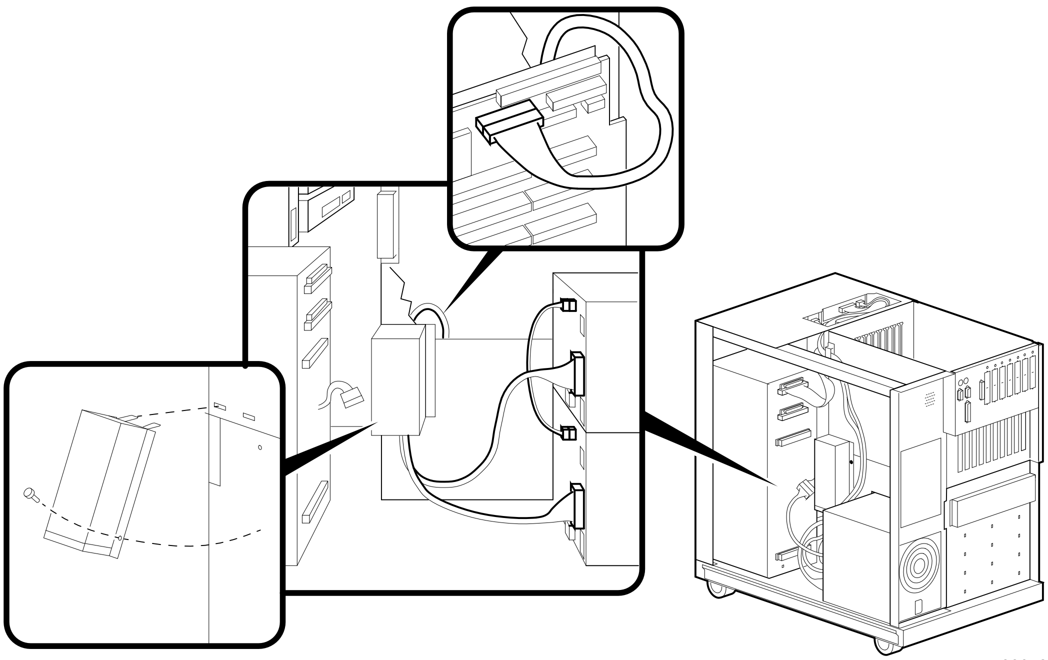


Figure 6–14 Power Supply +3.3V Harness (20-Pin)

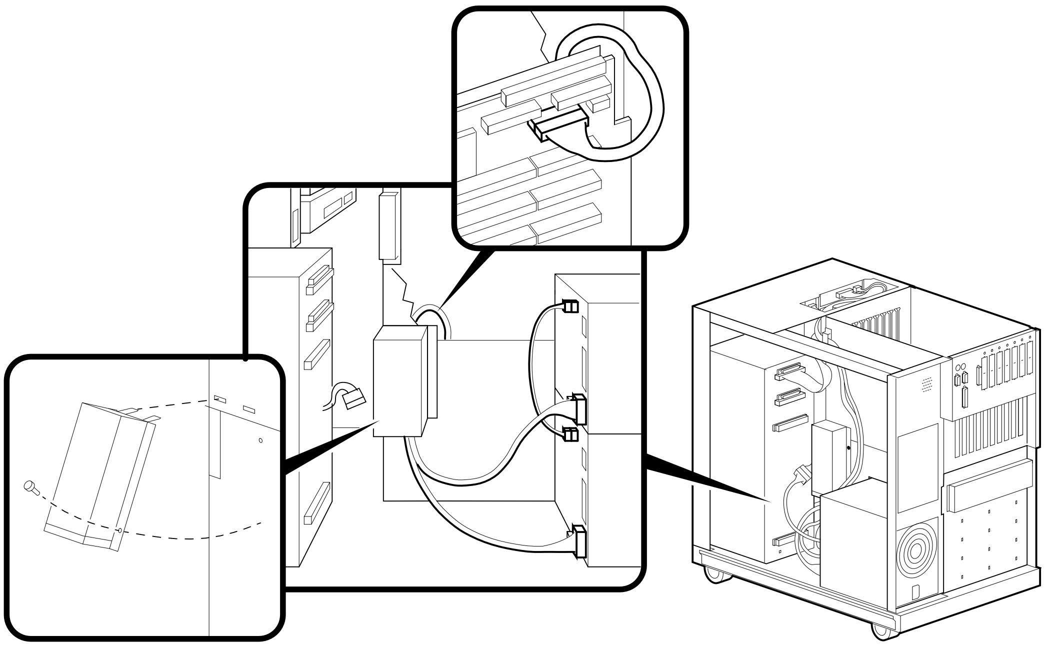


Figure 6–15 Remote I/O Cable (60-Pin)

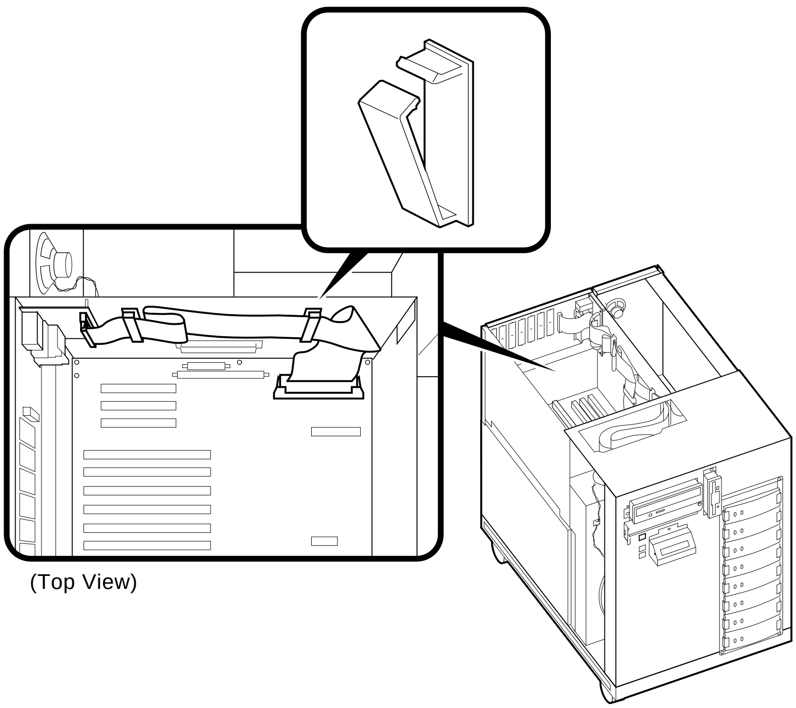


Figure 6–16 SCSI (embedded 8-bit) Multinode Cable (50-Pin)

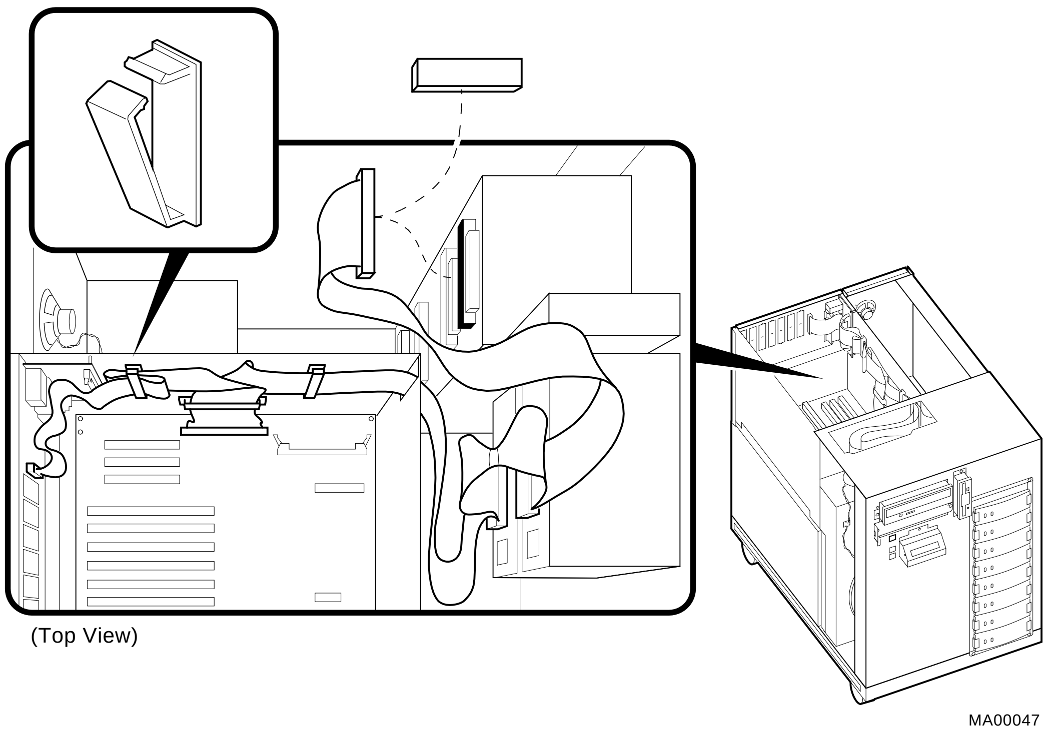
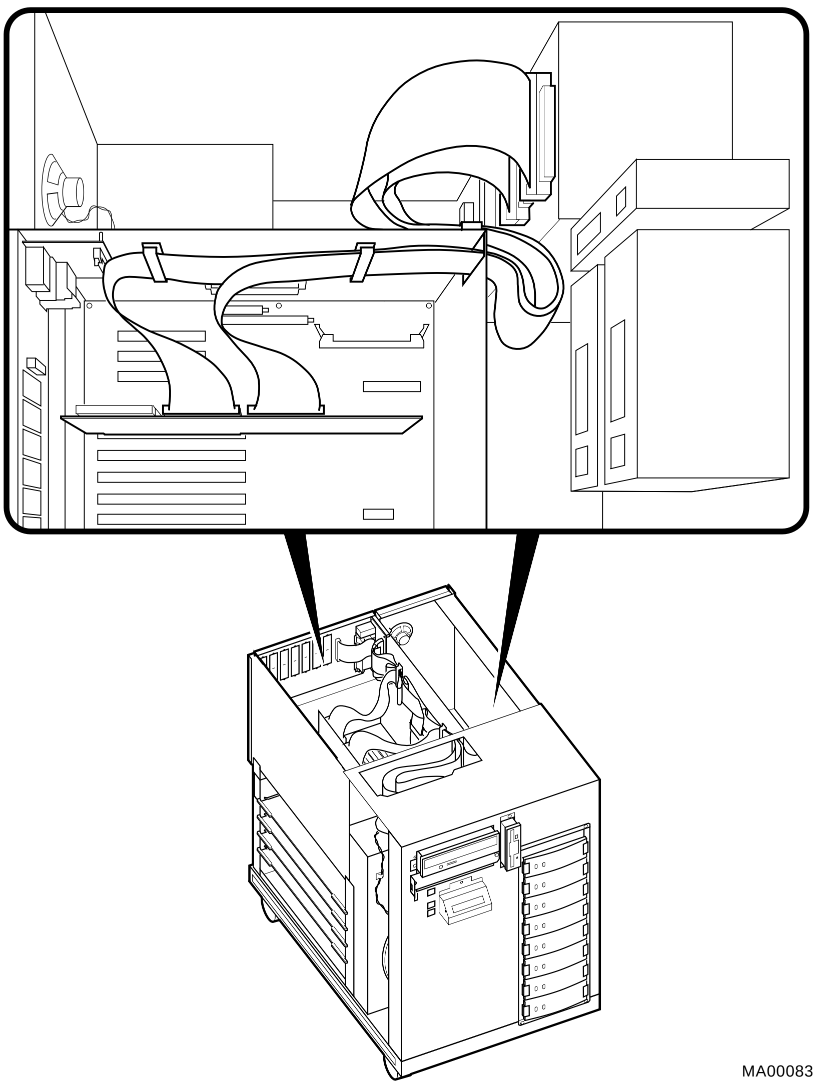


Figure 6–17 SCSI RAID Internal Cable (50-Pin)



6.2.2 CPU Modules

Note

Different CPU types cannot be used within the same system. Example: A KN450 CPU module and a KN460 CPU module cannot be used in the same system.

Before replacing a CPU module, perform the following steps to verify which CPU is failing. After installing a new CPU, repeat this procedure to ensure that the new CPU configuration is working properly.

STEP 1: CHECK FOR ERRORS LOGGED TO THE CPU.

Verify that errors have been logged through the serial control bus before replacing a CPU module. Using the `show fru` and `show error` console commands, you can determine if errors are logged for a bad CPU.

If an event is logged for any other test than test number 00, the CPU should be replaced.

1. **Enter the `show fru` command to check for test-directed diagnostic (TDD) errors logged to the CPU.**

   In the following example, a test-directed diagnostic (TDD) error is logged for CPU0.

```
P00>>> show fru

                                 Rev                      Events logged
 Slot   Option  Part#           Hw Sw   Serial#          SDD     TDD
   0    IO      B2111-AA        H2 0    KA347DWV06       00      00
   2    CPU0    B2020-AA        B2 9    ML33900048       00      01
   1    CPU1    B2020-AA        B2 9    KA34509090       00      00
   3    MEM0    B2023-AA        A1 0    ML41400005       00      00
   4    MEM1    B2023-AA        A1 0    ML34100008       00      00
 .
 .
 .
P00>>>
```

2. **Enter the `show error cpu0` command to verify that an error, other than test number 00, is currently logged for that CPU.**

```
P00>>> show error cpu0

CPU0 Module EEROM Event Log

Test Directed Errors
```

```
Entry: 0  Test Number: 02       Subtest Number: 02
Parameter 1: 00000000,00000010
Parameter 2: ffffffff,ffffffff
Parameter 3: fffffeff,ffffffff

CPU Event Counters
C3_CA_NOACK     0
   .
   .
   .
C3_DT_PAR_E     0
C3_DT_PAR_O     0

B-Cache Correctable Errors

Entry   Syndrome        Offset L        Offset H        Count

No Entries Found
P00>>>
```

STEP 2: IF THE CPU HAS AN ERROR LOGGED, OTHER THAN FOR TEST NUMBER 00, PERFORM POWER SHUTDOWN AND REPLACE THE CPU MODULE.

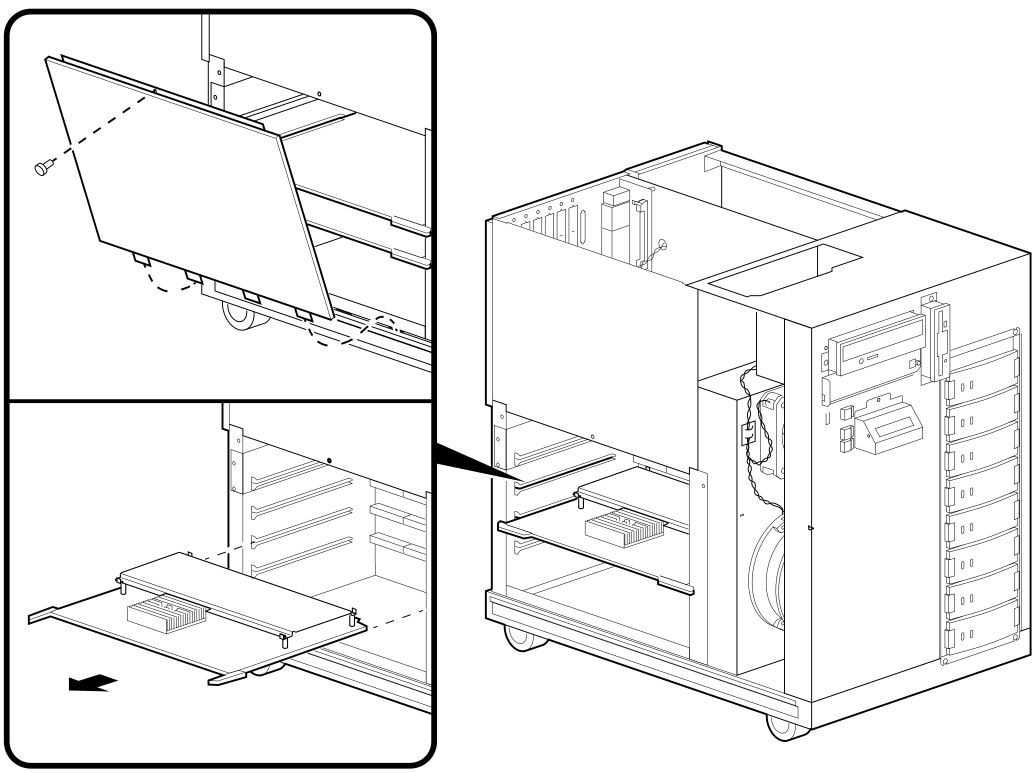
An event logged for test number 00 does not indicate a bad CPU. Test number 00 indicates that a CPU failover occurred sometime in the past.

Note

All systems must have a CPU module installed in system bus slot 2 (CPU0).

All system bus slots must be populated with a printed circuit board (PCB) module or a clear plastic module to assure proper airflow over each PCB module.

Figure 6–18 Removing CPU Modules



MA00102

Warning: CPU and memory modules have parts that operate at high temperatures. Wait 2 minutes after power is removed before handling these modules.

STEP 3: VERIFY THAT ERRORS ARE NO LONGER LOGGED FOR THE CPU.

Use the `show fru` command to verify that the errors are cleared.

```
P00>>> show fru
```

```
                              Rev                      Events logged
 Slot   Option  Part#         Hw Sw   Serial#          SDD     TDD
   0    IO      B2111-AA      H2 0    KA347DWV06       00      00
   2    CPU0    B2020-AA      B2 9    ML33900048       00      00
   1    CPU1    B2020-AA      B2 9    KA34509090       00      00
   3    MEM0    B2023-AA      A1 0    ML41400005       00      00
   4    MEM1    B2023-AA      A1 0    ML34100008       00      00
 .
 .
 .
P00>>>
```

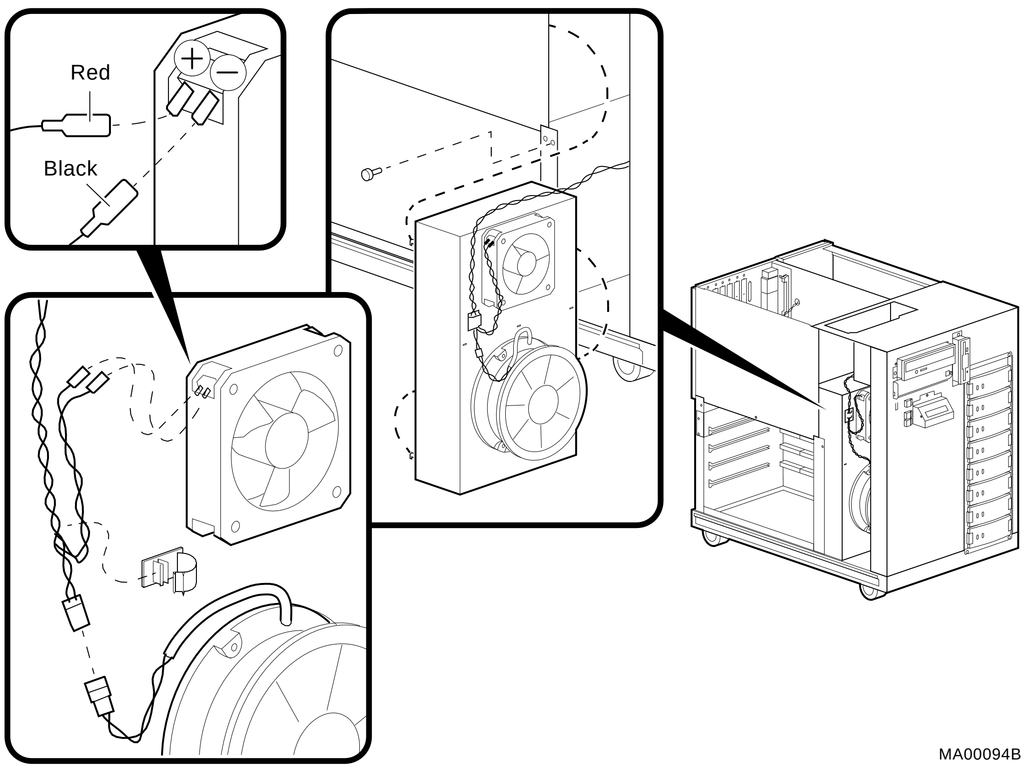
Note

To clear an event logged for test number 00 (CPU failover), use the `clear_error cpu#` command.

6.2.3 Fans

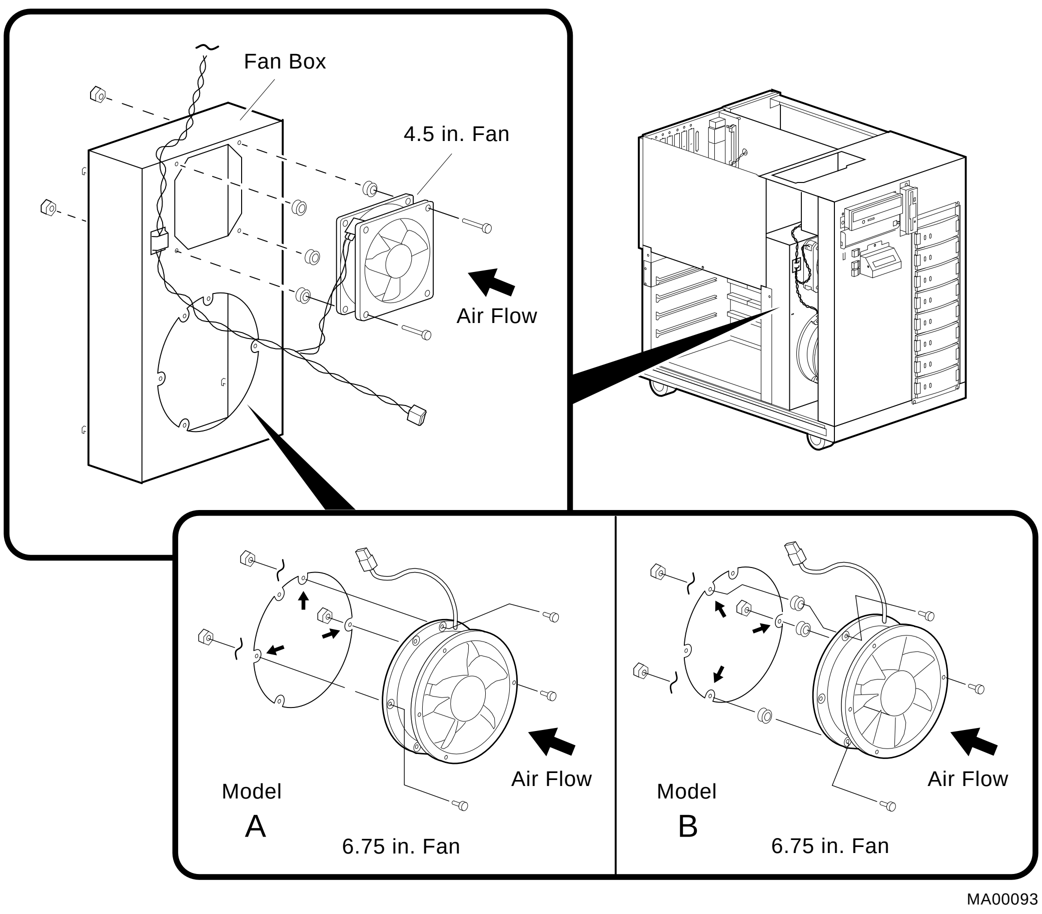
STEP 1: DISCONNECT FAN HARNESS AT FANS AND REMOVE FAN ASSEMBLY.

Figure 6–19 Removing Fan Assembly



STEP 2: REMOVE FAN.

Figure 6–20 Removing Fan



Caution

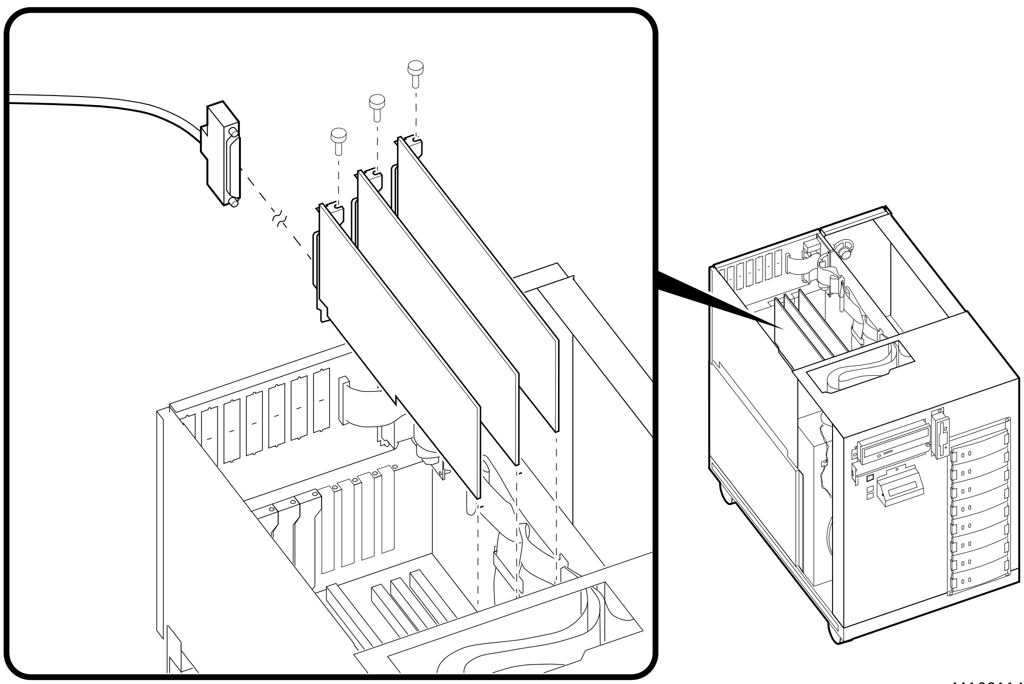
Two types of 6.75 inch fans are used with the BA720 enclosure. One type, shown as Model A in the illustration, manufactured by Sanyo Denki, needs to be oriented with the ground boss to the top. If this fan is not in the proper orientation, system bus components may overheat.

6.2.4 I/O Backplane

STEP 1: RECORD THE POSITION OF EISA AND PCI OPTIONS.

STEP 2: REMOVE EISA AND PCI OPTIONS.

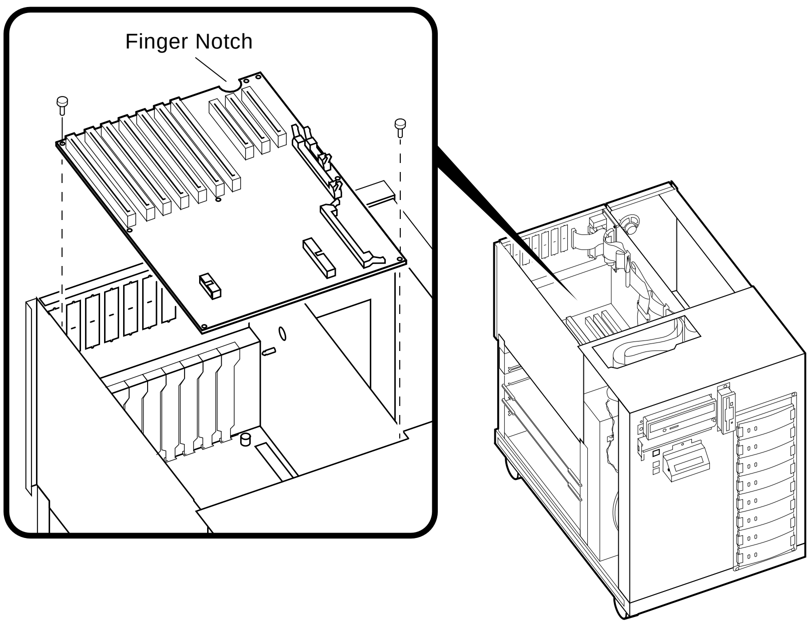
Figure 6–21 Removing EISA and PCI Options



MA00114

STEP 3: DISCONNECT ALL I/O BACKPLANE CABLES AND REMOVE THE I/O BACKPLANE.

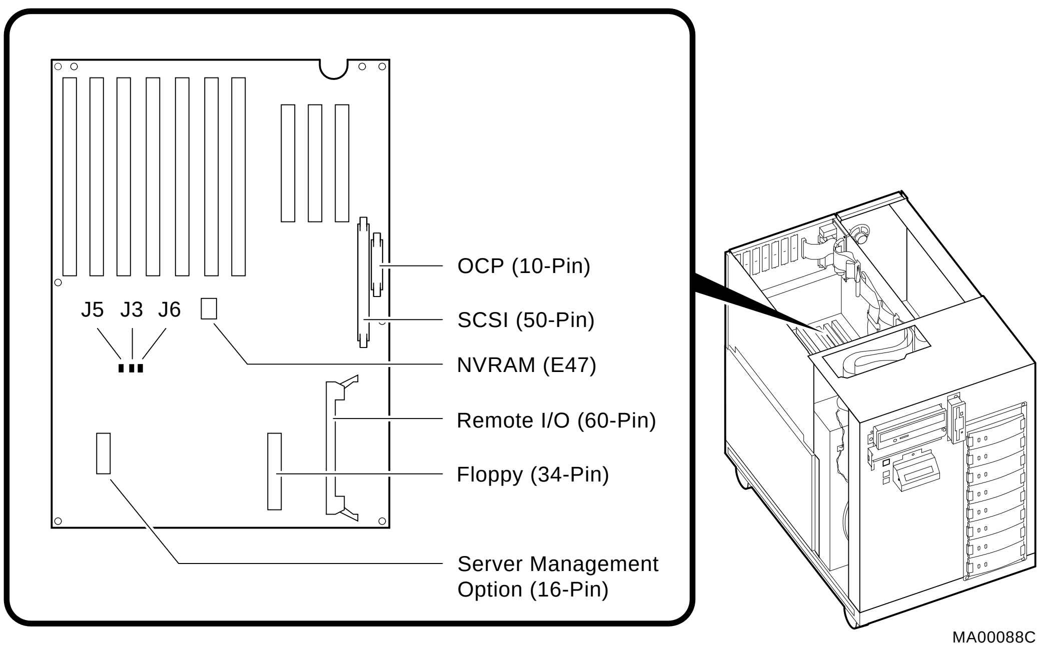
Figure 6–22 Removing I/O Backplane



STEP 4: MOVE THE NVRAM CHIP TO NEW BACKPLANE.

Move the socketed NVRAM chip (position E47) to the replacement I/O backplane and set jumpers to match previous settings.

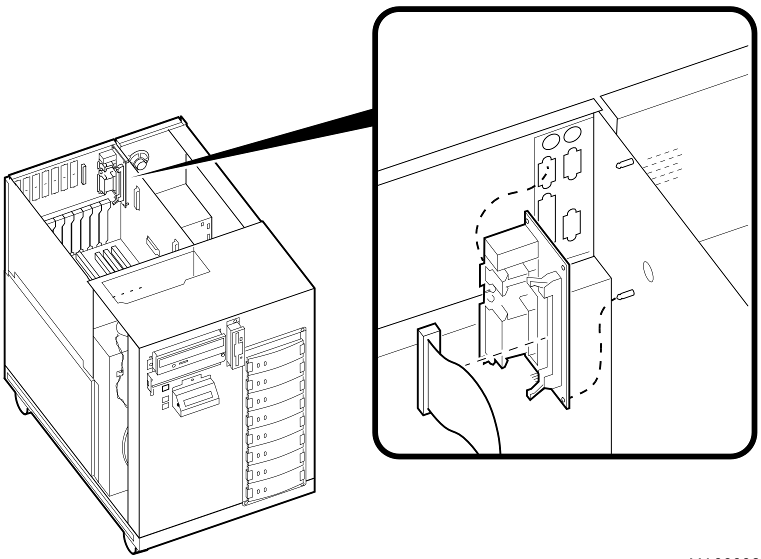
Figure 6–23 I/O Backplane: Jumpers, Connectors, and NVRAM Chip



J3–Power supply mode: When installed, dual power supplies operate in redundant mode.
J5–Program voltage: Internal use only.
J6–Fail-Safe: When installed, selects the fail-safe loader firmware.

6.2.5 Remote I/O Module

Figure 6–24 Removing the Remote I/O module



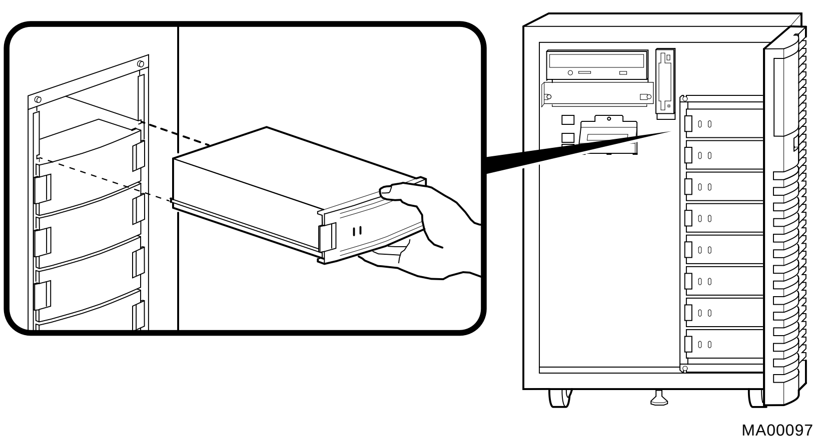
6.2.6 StorageWorks Drive

Note

If the StorageWorks drives are plugged into an SWXCR-xx controller, you can "hot swap" drives; that is, you can add or replace drives without first shutting down the operating system or powering down the server hardware. For more information, see *StorageWorks RAID Array 200 Subsystem Family Installation and Configuration Guide, EK-SWRA2-IG.*

If the StorageWorks drives are not plugged into an SWXCR-xx controller, you will need to shut down the operating system before swapping a drive. However, you will not need to power down the server before installing the drives.

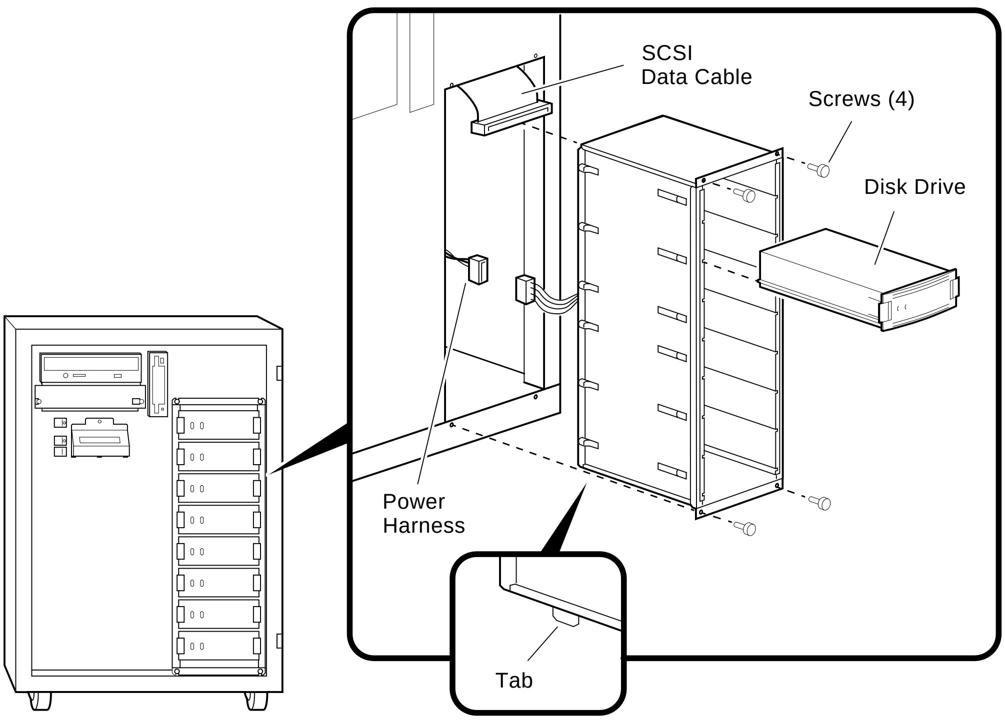
Figure 6–25 Removing StorageWorks Drive



6.2.7 Internal StorageWorks Backplane

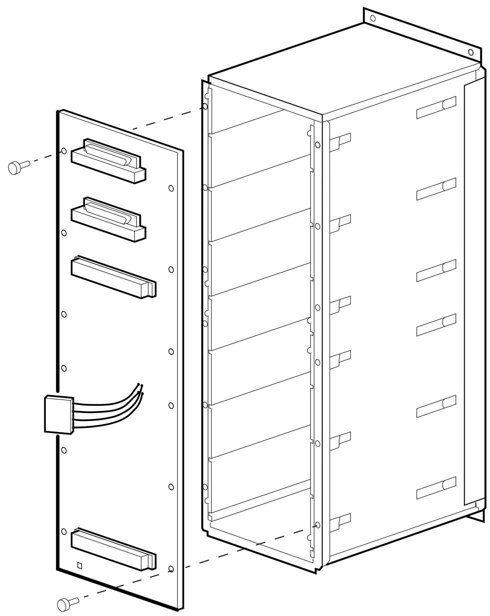
STEP 1: REMOVE INTERNAL STORAGEWORKS SHELF.

Figure 6–26 Removing Internal StorageWorks Shelf



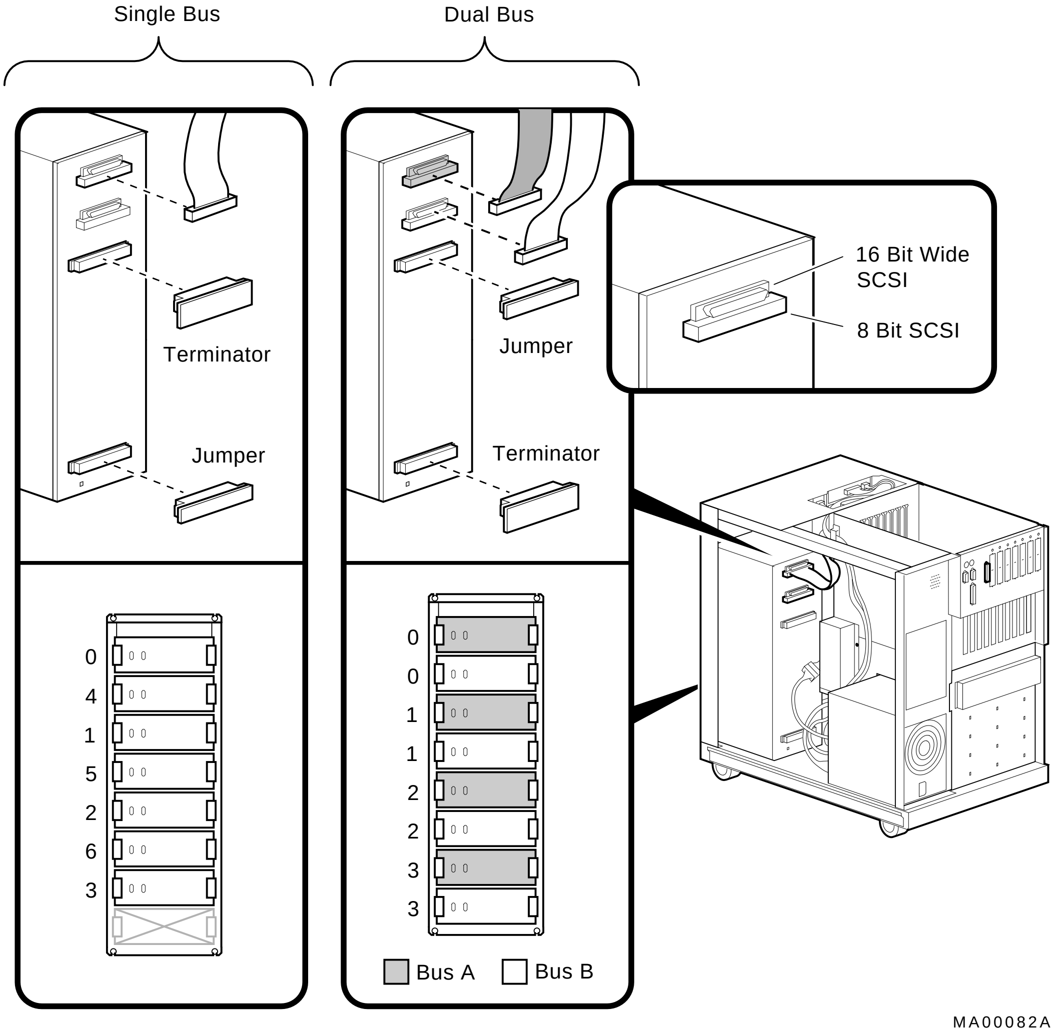
STEP 2: REMOVE INTERNAL STORAGEWORKS BACKPLANE.

Figure 6–27 Removing Internal StorageWorks Backplane



6.2.8 Internal StorageWorks Terminator and Jumper

Figure 6–28 Removing Internal StorageWorks Terminator and Jumper



6.2.9 Memory Modules

The position of the failing single-inline memory modules (SIMMs) are reported by:

- The power-up screen console and console event log (using the `cat el` command)
- The power-up/diagnostic display on the operator control panel (OCP) when 1 bank of good memory is not detected
- The `show error` console command
- ROM-based diagnostics

Note

- Certain memory errors that are reported by the OCP may not be reported by the ROM-based diagnostics. Always check the power-up /diagnostic display before running diagnostic commands.
- You cannot mix 4-megabyte SIMMs and 16-megabyte SIMMs on an individual module.
- Fill your first memory module to capacity before adding memory to the second module.
- The second memory module can be filled with 1, 2, or 4 banks of SIMMs. The second memory module cannot be filled with 3 banks of memory.
- Maximum memory is 640 megabytes using: One fully-populated module with 4-megabyte SIMMs and one fully populated module with 16-megabyte SIMMs.
- The maximum height for SIMMs in the AlphaServer 2000 system is 1.1 inches.

If 1 bank of good memory is not detected at power-up, the firmware console cannot be loaded and the power-up terminates. In this case, the first two data bits of bad memory are displayed in hexadecimal on the power-up/diagnostics display on the operator control panel (OCP). Refer to Section 2.1.1 for instructions of isolating the failing SIMM or SIMMs from the OCP display.

STEP 1: CHECK FOR ERRORS LOGGED AGAINST SIMMS.

Verify that memory errors have been logged through the serial control bus before replacing SIMMs on the carrier module. Use the `show fru` command to determine if memory errors have been logged. Use the `show error` command to determine the type of error (correctable or uncorrectable) and to which SIMMs they are logged against.

1. **Enter the `show fru` command to check for events logged for memory.**

   In the following example, a symptom-directed diagnostic (SDD) error is logged for MEM1.

```
P00>>> show fru

                                Rev                       Events logged
 Slot   Option  Part#          Hw Sw    Serial#          SDD     TDD
   0    IO      B2111-AA       H2 0     ML41100003       00      00
   2    CPU0    B2020-AA       B2 9     ML43400028       00      00
   1    CPU1    B2020-AA       B2 9     KA34509090       00      00
   3    MEM0    B2023-BA       A1 0     ML41400005       00      00
   4    MEM1    B2023-BA       A1 0     AY34915430       01      00
   .
   .
   .
P00>>>
```

2. **Enter the `show error mem1` to determine the type of error and position of the failing SIMM.**

   In the following example, an uncorrectible error is logged for the SIMMs at position J31 and J34.

Note

Correctible errors are indicated by event type 00. If five or more correctible errors are logged for the same memory carrier, the specified SIMMs should be replaced.

For all unncorrectible errors, indicated by event types 01 and 10, you should replace the failing SIMM(s).

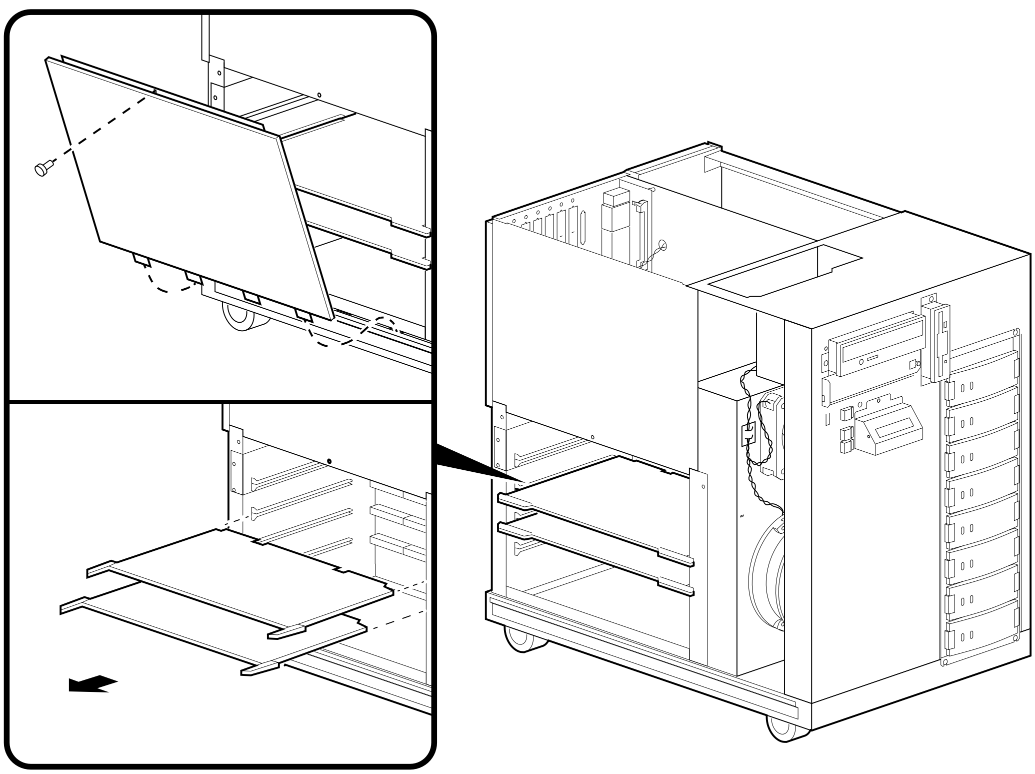
Only two bad memory data bits at a time are captured by the system diagnostics. If more than two SIMMs are bad, you may need to repeat the SIMM isolation and replacement procedures until all bad SIMMs are replaced.

```
P00>>> show error mem1

MEM1 Module EEROM Event Log

Test Directed Errors

No Entries Found

Symptom Directed Errors

Entry   Fail Address   Bits/Syndrome   Bank #   ASIC #   Source   Event Type
  00     00000040     70(J31), 76(J34)   0        0        1          01
P00>>>
```

STEP 2: RECORD THE POSITION OF THE FAILING SIMMS.

STEP 3: REMOVE THE MEMORY MODULE THAT CONTAINS THE FAILING SIMMS.

Figure 6–29 Removing Memory Modules



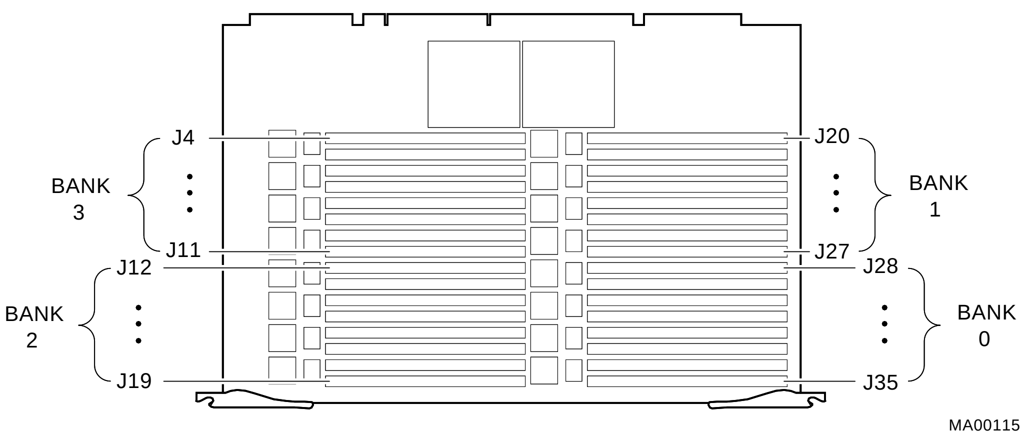
Warning: Memory and CPU modules have parts that operate at high temperatures. Wait 2 minutes after power is removed before handling these modules.

Note

All system bus slots must be populated with a printed circuit board (PCB) module or a clear plastic module to assure proper airflow over each PCB module.

STEP 4: LOCATE THE J# ON THE MEMORY MODULE FOR THE FAILING SIMM.

Figure 6–30 Memory Module (Carrier) Layout



STEP 5: REPLACE THE FAILING SIMMS.

Caution

Do not use any metallic tools or implements including pencils to release SIMM latches. Static discharge can damage the SIMMs.

Note

SIMMs can only be removed and installed in successive order. For example; to remove a SIMM at position J35, SIMMs at J20 through J34 must first be removed.

Figure 6–31 Removing SIMMs from Memory Module (Carrier)

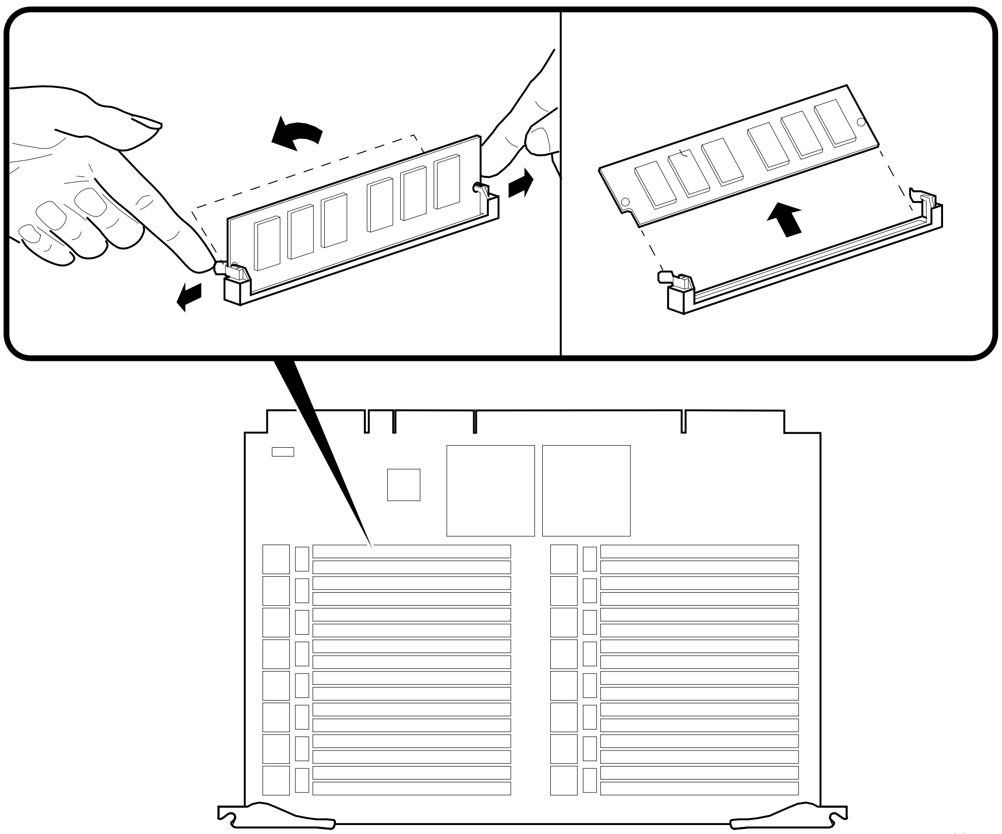
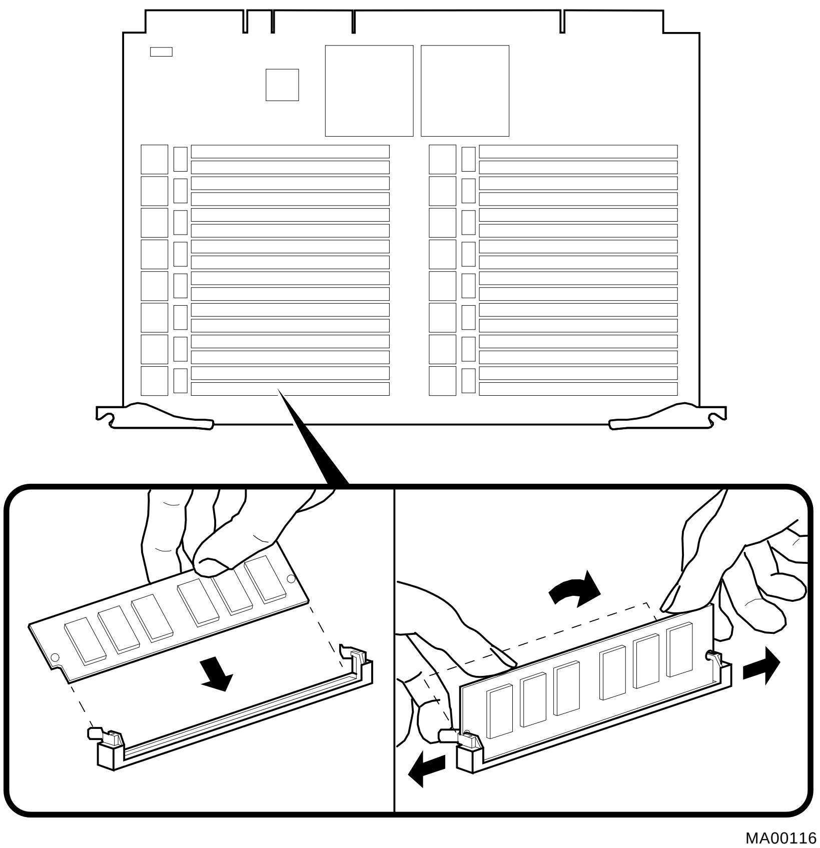


Figure 6–32 Installing SIMMs on Memory Module (Carrier)



Note

When installing SIMMs, make sure that the SIMMs are fully seated. The two latches on each SIMM connector should lock around the edges of the SIMMs.

STEP 6: CLEAR ERRORS THAT WERE LOGGED AGAINST THE SIMMS.

Use the `clear_error` command to clear errors logged for the SIMMs that have been replaced. If you do not clear the memory errors, the new replacement SIMMs will be reported as failing.

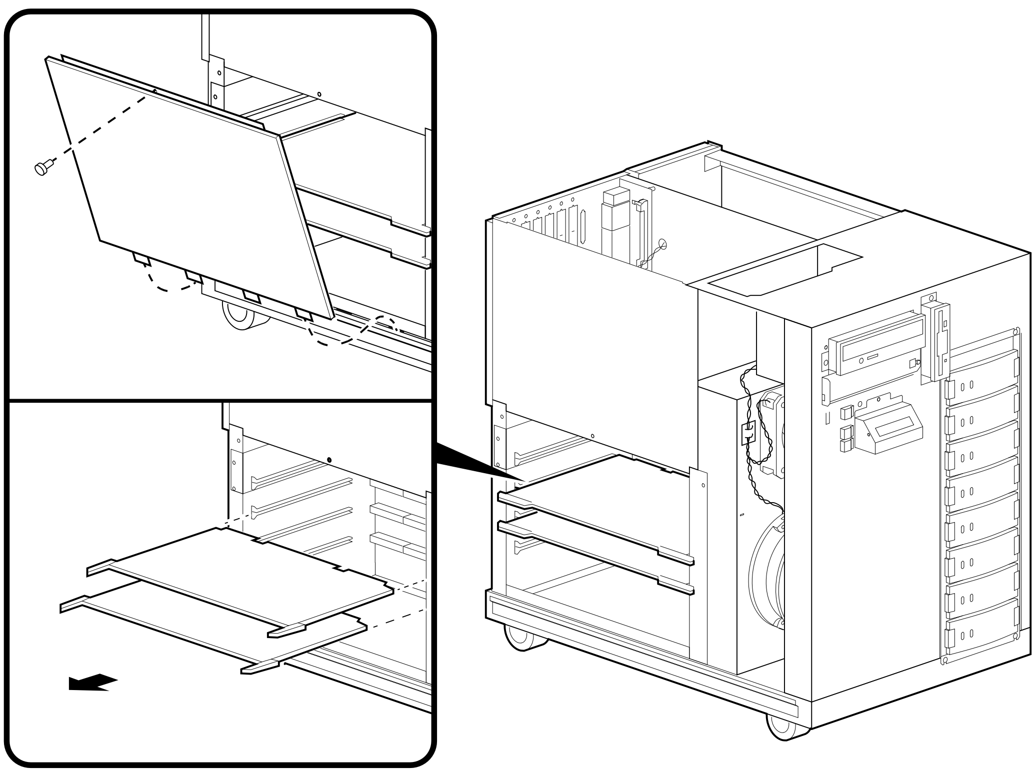
In the following example, errors logged against SIMMs on carrier or memory module 1 are cleared.

```
P00>>> clear_error mem1
P00>>>
```

6.2.10 System Bus Motherboard

STEP 1: REMOVE SYSTEM BUS COVER AND MODULES.

Figure 6–33 Removing System Bus Cover and Modules



MA00100A

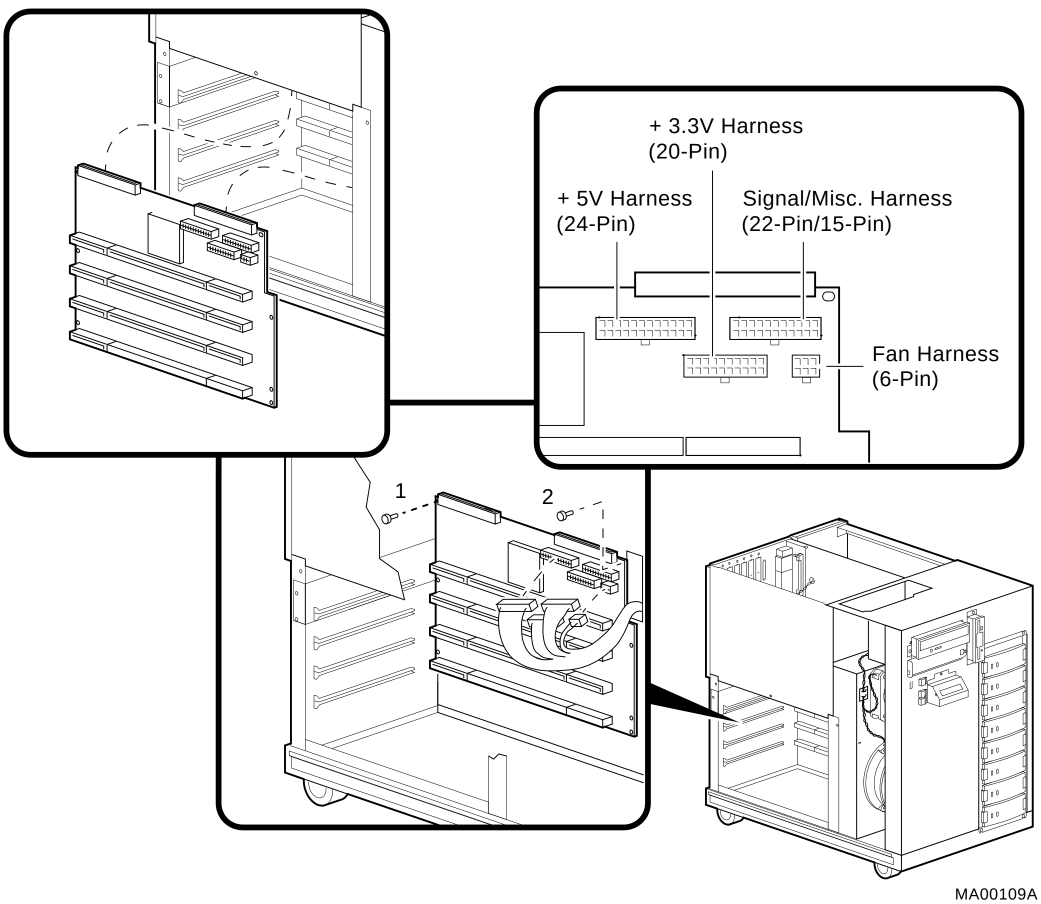
Warning: Memory and CPU modules have parts that operate at high temperatures. Wait 2 minutes after power is removed before handling these modules.

STEP 2: DETACH SYSTEM BUS MOTHERBOARD CABLES, REMOVE SCREWS AND DISCONNECT MOTHERBOARD FROM I/O BACKPLANE.

Caution

When replacing the system bus motherboard, carefully guide motherboard connectors into the I/O backplane. Install the screws in the order indicated.

Figure 6–34 Removing Motherboard



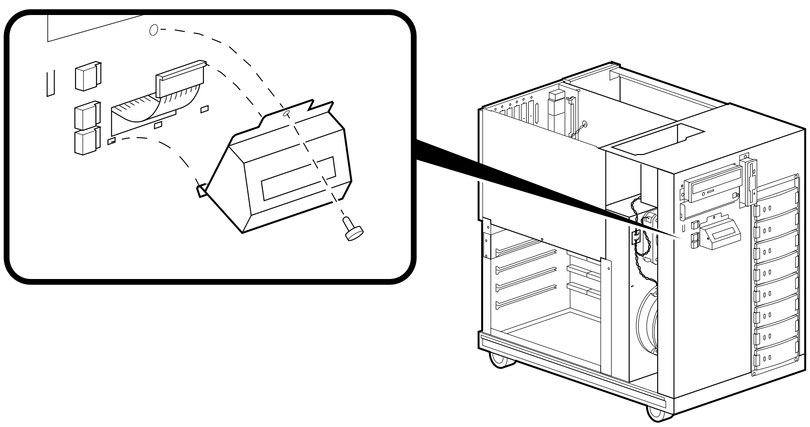
6.2.11 OCP Module

Note

AlphaServer 2000 systems (BA720 enclosures) have a contrast control for the power-up/diagnostic display on the OCP. If power-up messages do not display on the OCP, try adjusting the contrast control for your viewing angle.

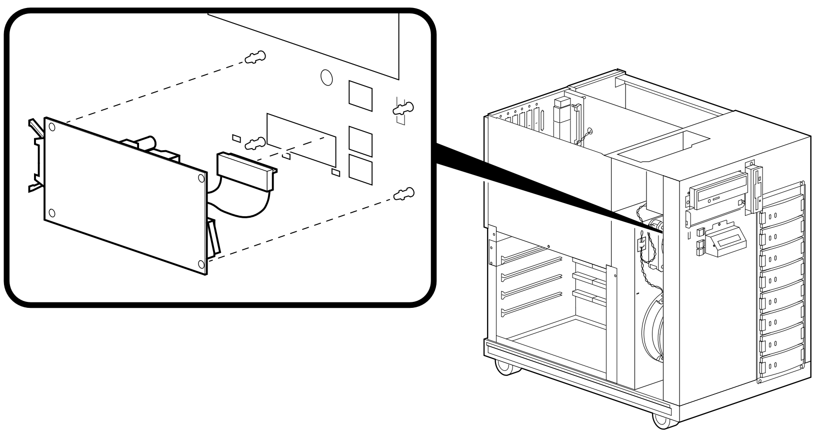
STEP 1: REMOVE SCREW, TIP OCP DISPLAY FORWARD AND DETACH LCD CABLE.

Figure 6–35 Detaching LCD Cable



STEP 2: REMOVE OCP MODULE.

Figure 6–36 Removing OCP Module



Note

If replacing the OCP module does not solve the problem, replace the LCD display module.

6.2.12 Operator Control Panel LCD Display Module

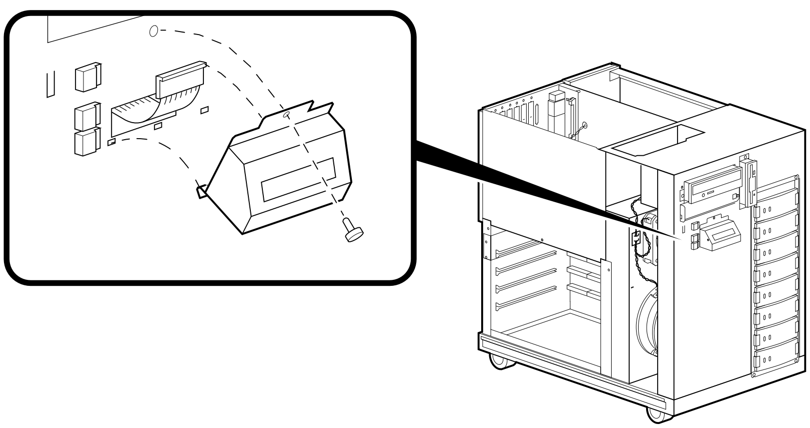
Note

AlphaServer 2000 systems (BA720 enclosures) have a contrast control for the power-up/diagnostic display on the OCP. If power-up messages do not display on the OCP, try adjusting the contrast control for your viewing angle.

Replace this module if replacing the OCP module did not solve the problem.

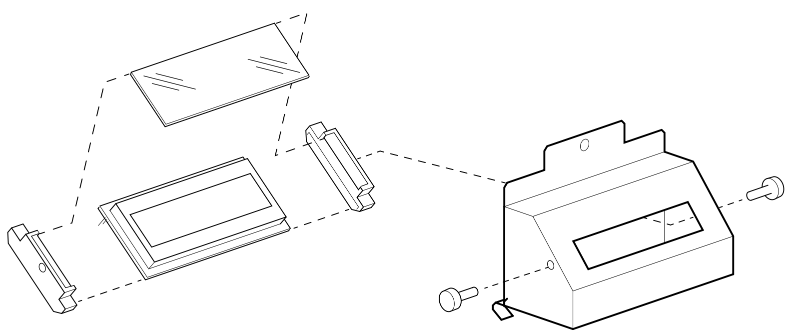
STEP 1: TIP OCP DISPLAY FORWARD AND DETACH LCD CABLE FROM LCD MODULE.

Figure 6–37 Detaching LCD Cable



STEP 2: DETACH ANTISTATIC LENS AND REMOVE THE LCD DISPLAY.

Figure 6–38 Removing LCD Display

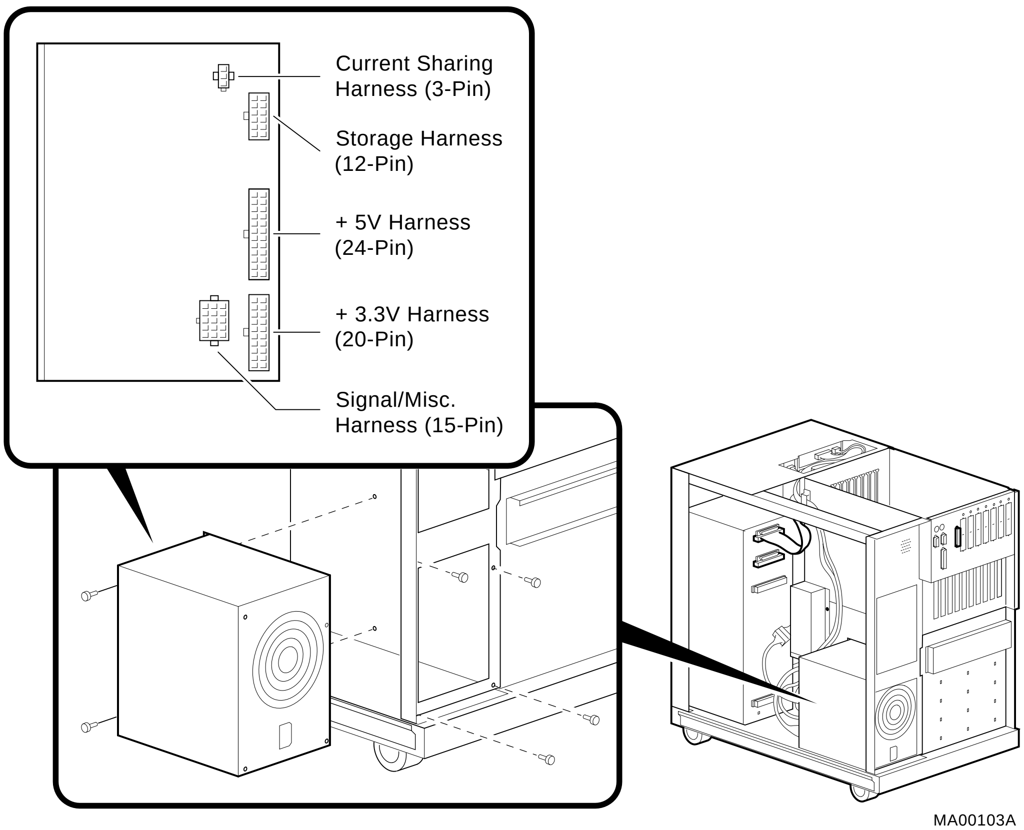


6.2.13 Power Supply

STEP 1: DISCONNECT POWER SUPPLY CABLES.

STEP 2: REMOVE POWER SUPPLY.

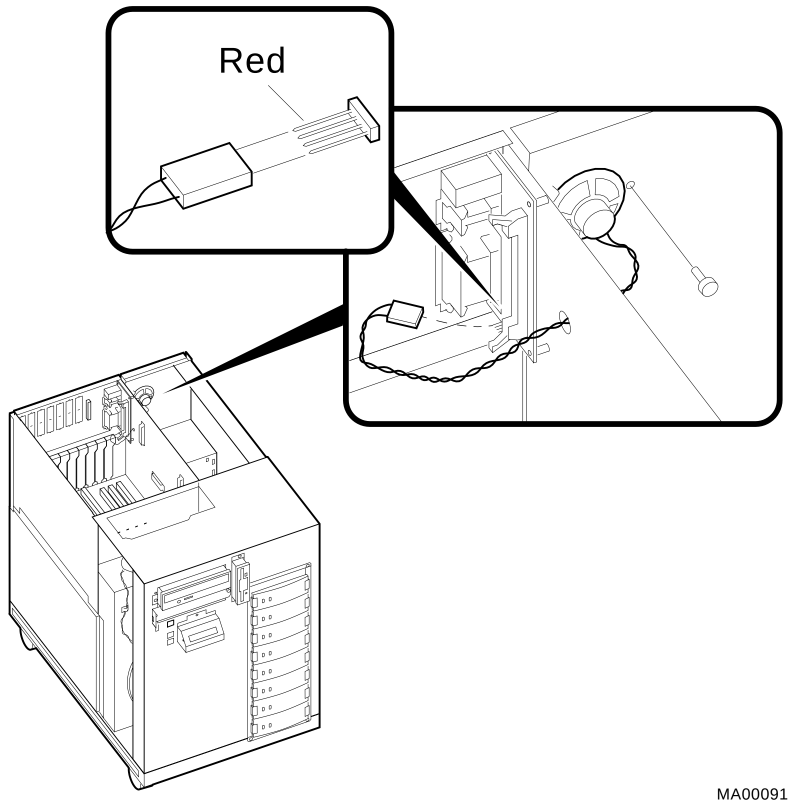
Figure 6–39 Removing Power Supply



Warning: Hazardous voltages contained within. Do not service. Return to factory for service.

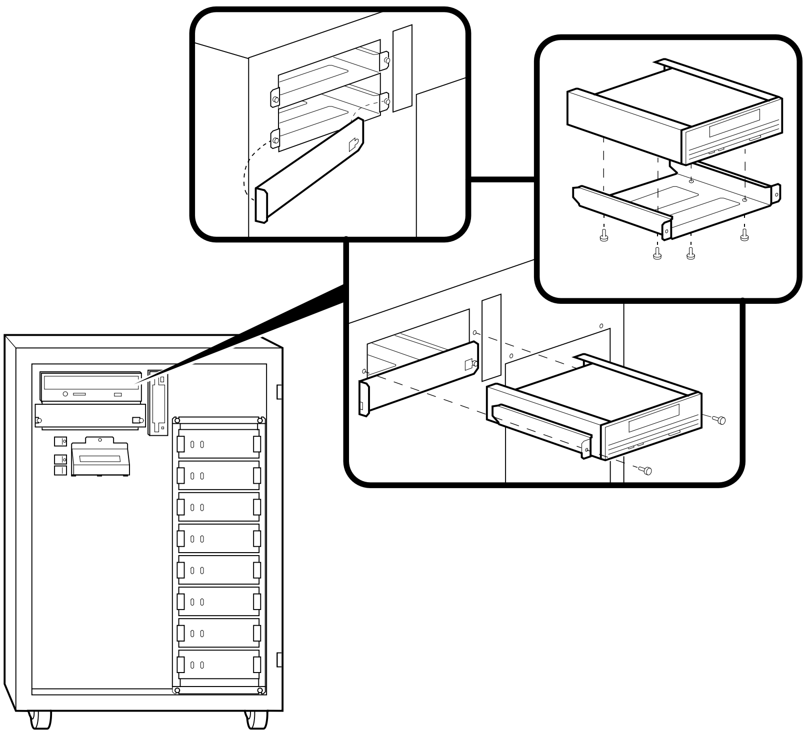
6.2.14 Speaker

Figure 6–40 Removing Speaker



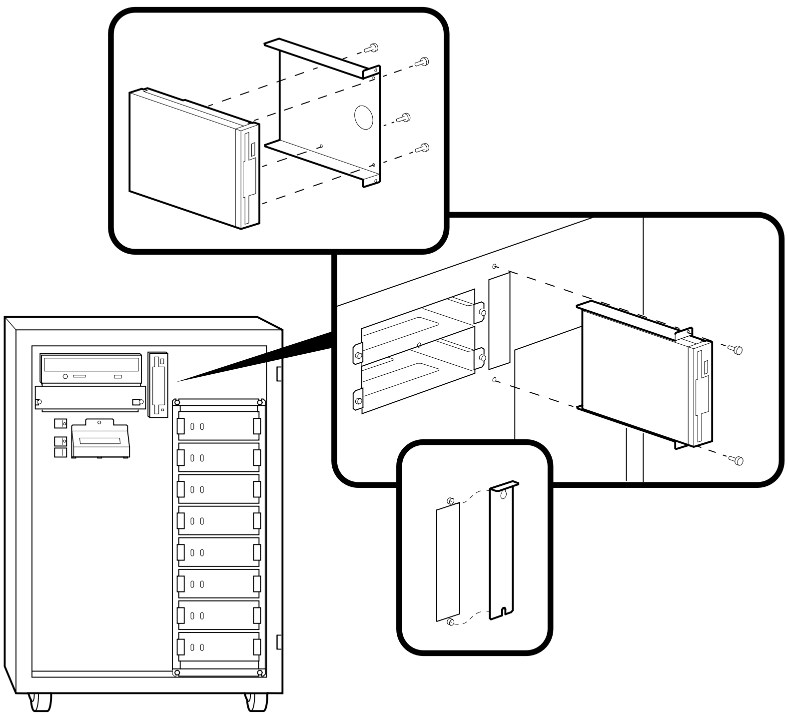
6.2.15 Removable Media

Figure 6–41 Removing a Removable-Media Drive



MA00107

Figure 6–42 Removing Floppy Drive



7

AlphaServer 2100 (BA740 Enclosure) FRU Removal and Replacement

This chapter describes the field-replaceable unit (FRU) removal and replacement procedures for AlphaServer 2100 systems, which use the BA740 enclosure.

- Section 7.1 lists the FRUs for AlphaServer 2100-series systems (BA740 enclosure)
- Section 7.2 provides the removal and replacement procedures for the FRUs.

7.1 AlphaServer 2100 (BA740 Enclosure) FRUs

Table 7–1 lists the FRUs by part number and description and provides the reference to the figure or section that shows the removal/replacement procedure.

Figures 7–1 and 7–2 show the locations of FRUs within the system. Figure 7–3 shows how to remove the door and panels.

Table 7–1 BA740 Enclosure FRUs

Part #	Description	Section
Cables		
17-03870-01	Fan/removable media cable (12-pin)	Figure 7–4
17-03871-01	Floppy drive cable (34-pin)	Figure 7–5
17-03868-01	Internal StorageWorks power cable (5-pin)	Figure 7–6
17-03869-01	OCP module cable (10-pin)	Figure 7–7
17-00083-15	Power cord	Figure 7–8
17-02784-03	Remote I/O cable (60-pin)	Figure 7–9
17-03872-01	SCSI cable (50-pin)	Figure 7–10
17-03873-01	SCSI multinode cable (50-pin)	Figure 7–11
17-03948-01	SCSI RAID internal cable (50-pin)	Figure 7–12
CPU Modules		
B2020-AA	KN450-AA CPU module	Section 7.2.2
B2024-AA	KN460-AA CPU module	Section 7.2.2
Fans		
12-23609-09	4.5-inch fan	Section 7.2.3
12-36202-02	6.75-inch fan	Section 7.2.3
54-23260-01	Fan speed control board	Section 7.2.3
I/O Modules		
B2110-AA (54-23146-01)	KFE40 standard I/O	Section 7.2.4
54-23151-01	Remote I/O module	Section 7.2.5

(continued on next page)

Table 7–1 (Cont.) BA740 Enclosure FRUs

Part #	Description	Section
Internal StorageWorks		
RZnn -VA	StorageWorks disk drive	Section 7.2.6
54-22903-01	Internal StorageWorks backplane	Section 7.2.7
BA35X-MB (54-22000-01)	Internal StorageWorks terminator	Section 7.2.8
BA35X-MC (54-21998-01)	Internal StorageWorks jumper	Section 7.2.8
Memory Modules		
B2021-BA	MS450-BA 64MB, 80-ns memory module	Section 7.2.9
B2021-CA	MS450-CA 128MB, 80-ns memory module	Section 7.2.9
B2022-CA	MS451-CA 512MB, 80-ns memory module	Section 7.2.9
Other Modules and Components		
54-23149-01	Motherboard	Section 7.2.10
54-23180-01	OCP module	Section 7.2.11
30-41274-01	Power supply	Section 7.2.12
12-39309-01	Speaker	Section 7.2.13
12-36437-03	Key for door	
12-37004-04	External SCSI terminator	
12-41296-01	Internal SCSI terminator	
Removable Media		
RRDnn -CA	CD–ROM drives	Section 7.2.14
TLZnn -LG	Tape drives	Section 7.2.14
TZKnn -LG	Tape drives	Section 7.2.14
RXnn -AA	Floppy drive	Section 7.2.14

Figure 7–1 FRUs, Front Left

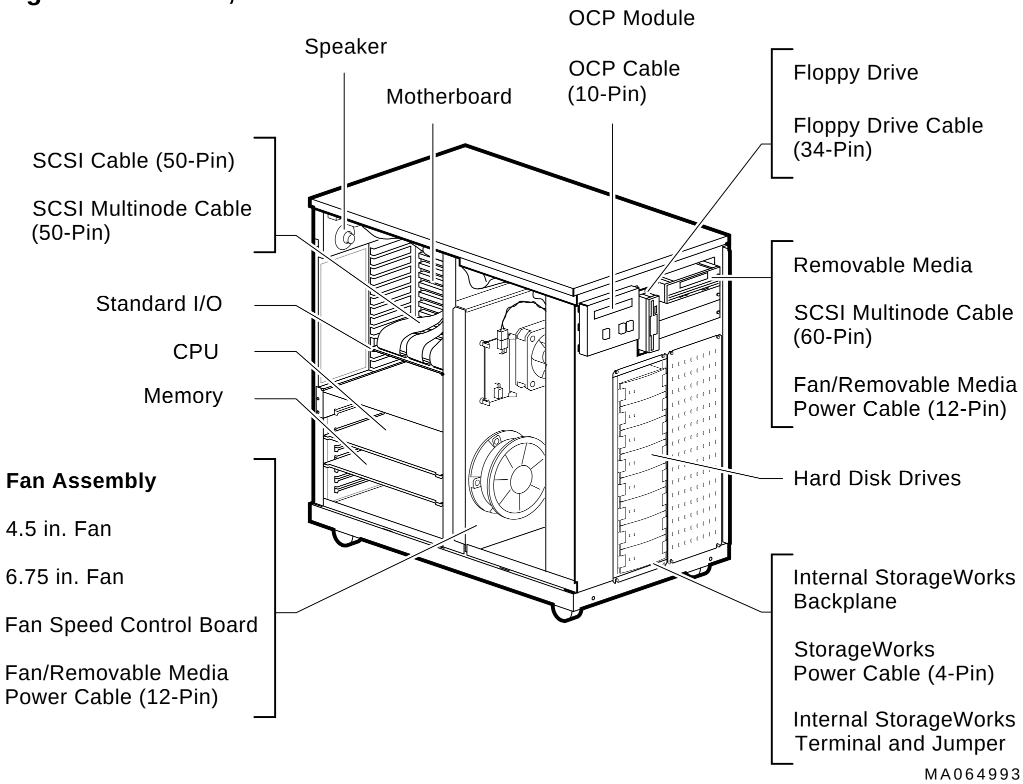
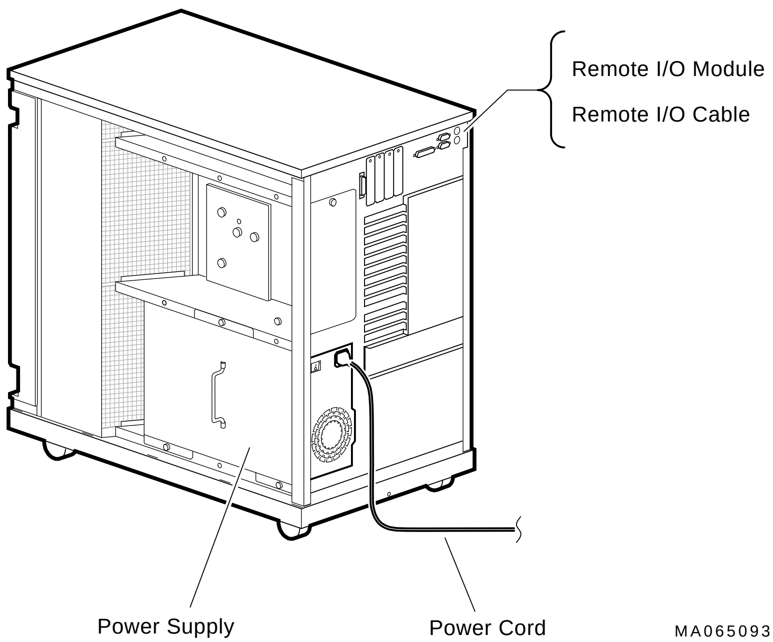


Figure 7–2 FRUs, Rear Right



7.2 Removal and Replacement

This section describes the procedures for removing and replacing FRUs for AlphaServer 2100-series systems, which use the BA740 enclosure.

Caution: Before opening or removing panels:

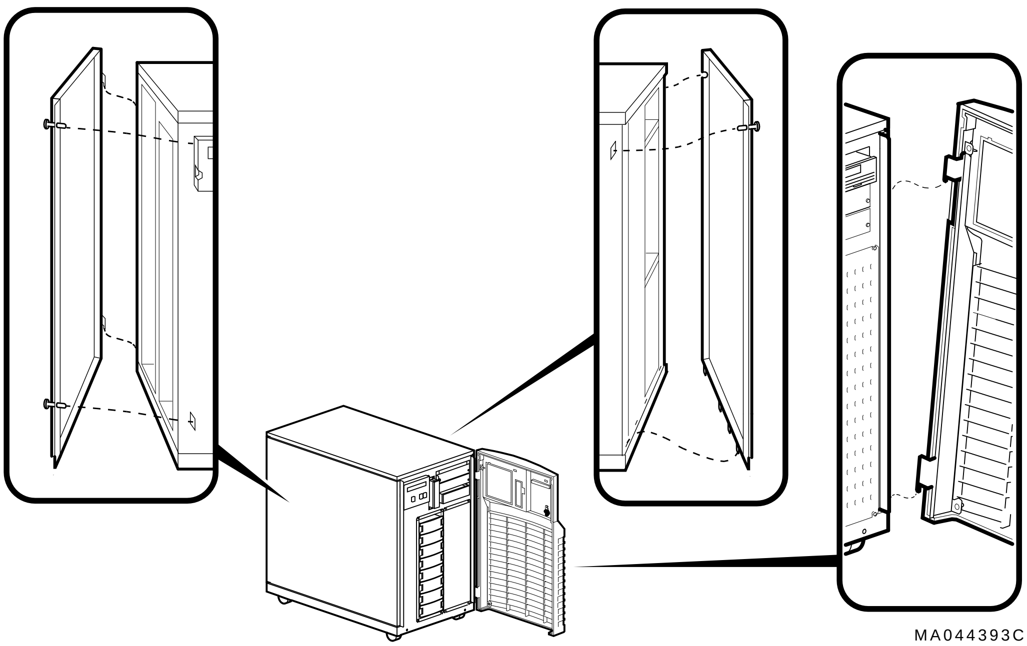
1. Perform orderly shutdown of the operating system.
2. Set the DC power switch on the operator control panel to off
3. For power supplies with AC On/Off switches, set switches to off.
4. Unplug AC power cords.

Caution

Static electricity can damage integrated circuits. Always use a grounded wrist strap (29-26246) and grounded work surface when working with internal parts of a computer system.

Unless otherwise specified, you can install an FRU by reversing the steps shown in the removal procedure.

Figure 7–3 Removing Door and Panels



7.2.1 Cables

This section shows the routing for each cable in the system.

Figure 7–4 Fan/Removable Media Cable (12-Pin)

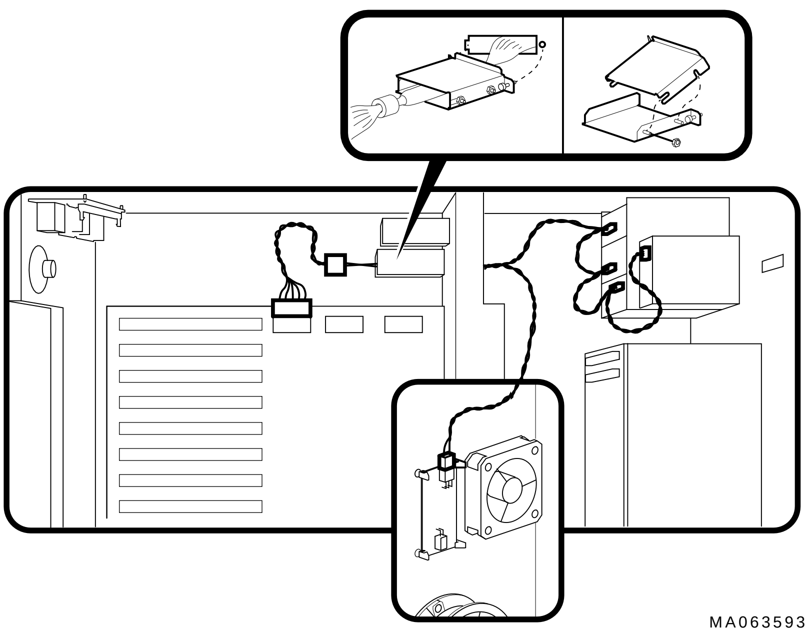


Figure 7–5 Floppy Drive Cable (34-Pin)

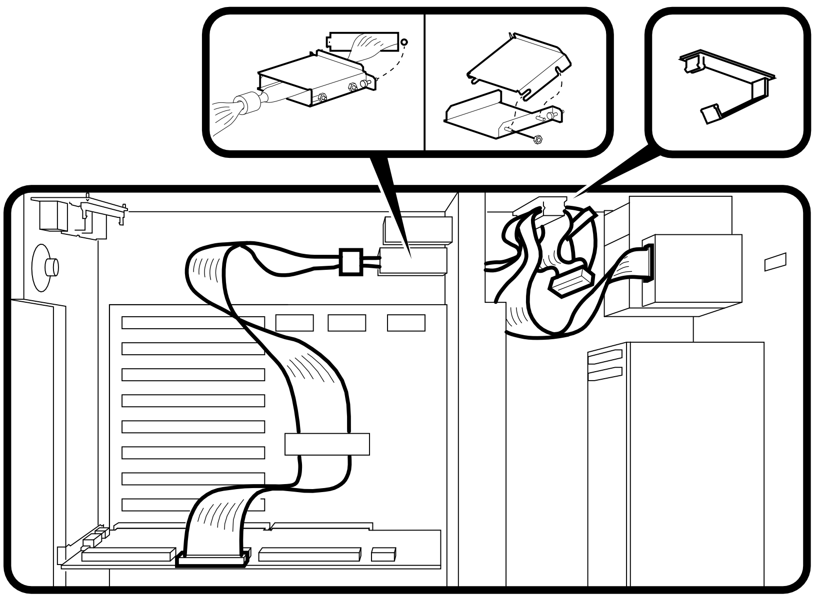


Figure 7–6 Internal StorageWorks Power Cable (5-Pin)

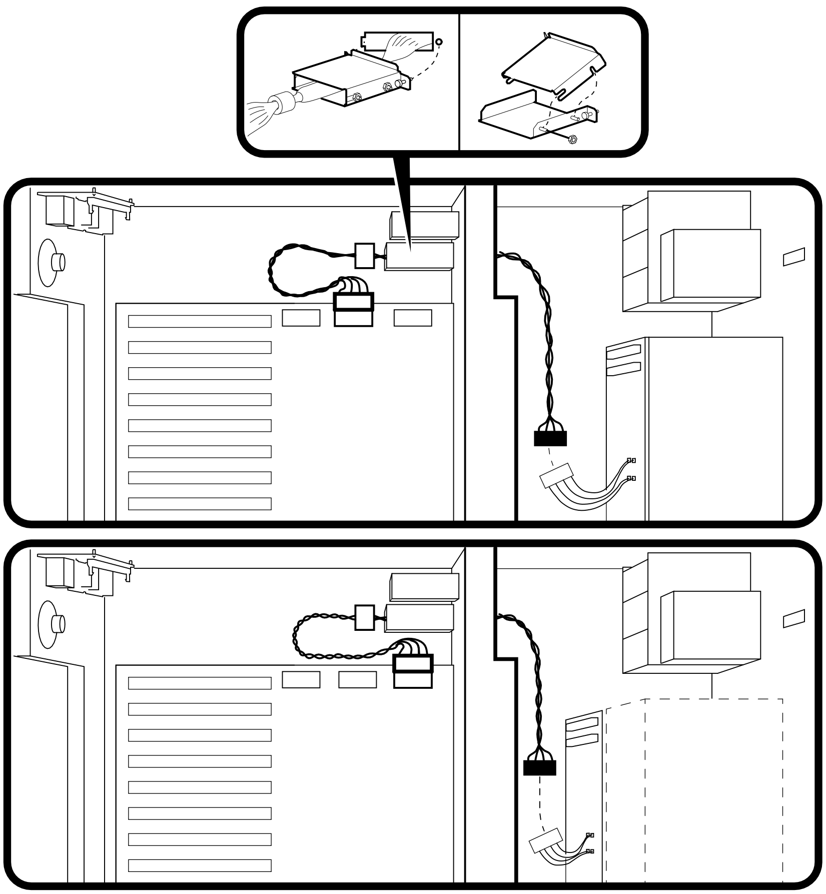


Figure 7–7 OCP Module Cable (10-Pin)

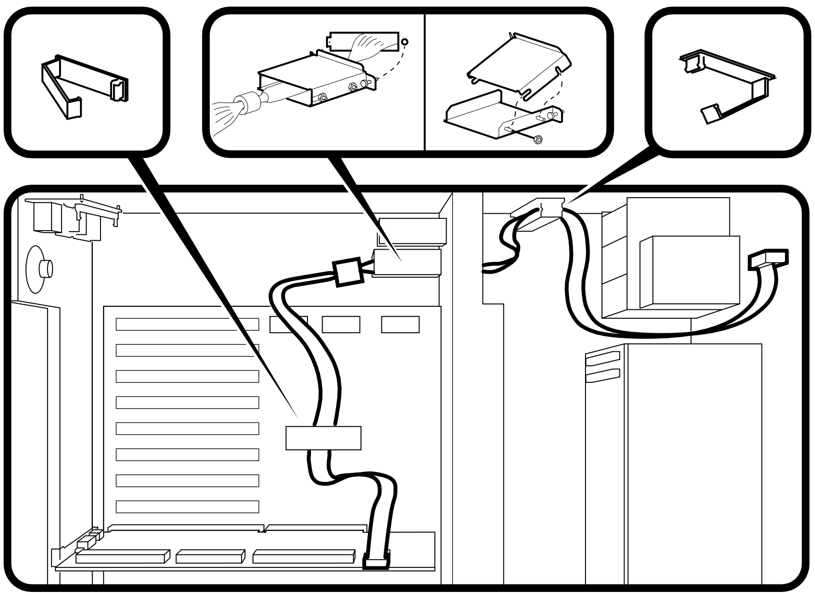


Figure 7–8 Power Cord

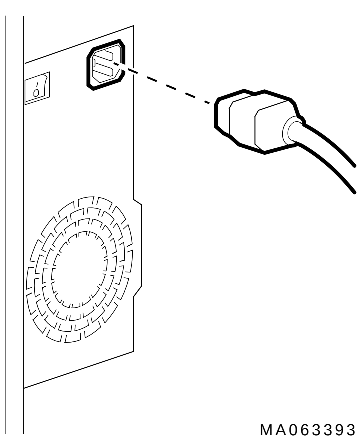


Table 7–2 lists the country-specific power cables.

Table 7–2 Power Cord Order Numbers

Country	Power Cord BN Number	Digital Number
U.S., Japan, Canada	BN27Y-1J	17-00083-15
Australia, New Zealand	BN19H-2E	17-00198-14
Central European (Aus, Bel, Fra, Ger, Fin, Hol, Nor, Swe, Por, Spa)	BN19C-2E	17-00199-21
U.K., Ireland	BN19A-2E	17000209-15
Switzerland	BN19E-2E	17-00210-13
Denmark	BN19K-2E	17-00310-08
Italy	BN19M-2E	17-00364-18
India, South Africa	BN19S-2E	17-00456-16
Israel	BN18L-2E	17-00457-16

Figure 7–9 Remote I/O Cable (60-Pin)

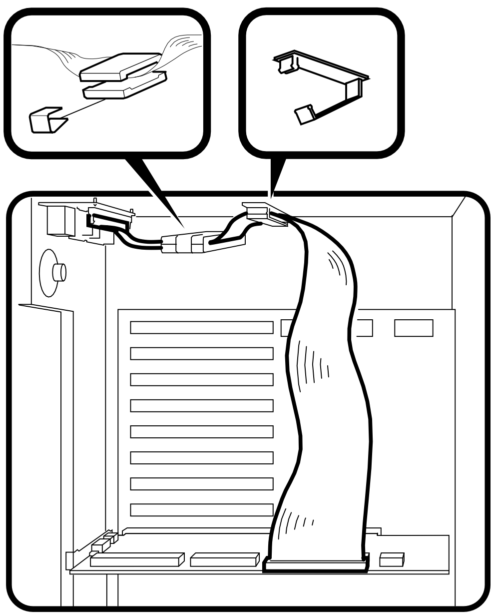


Figure 7–10 SCSI Cable (50-Pin)

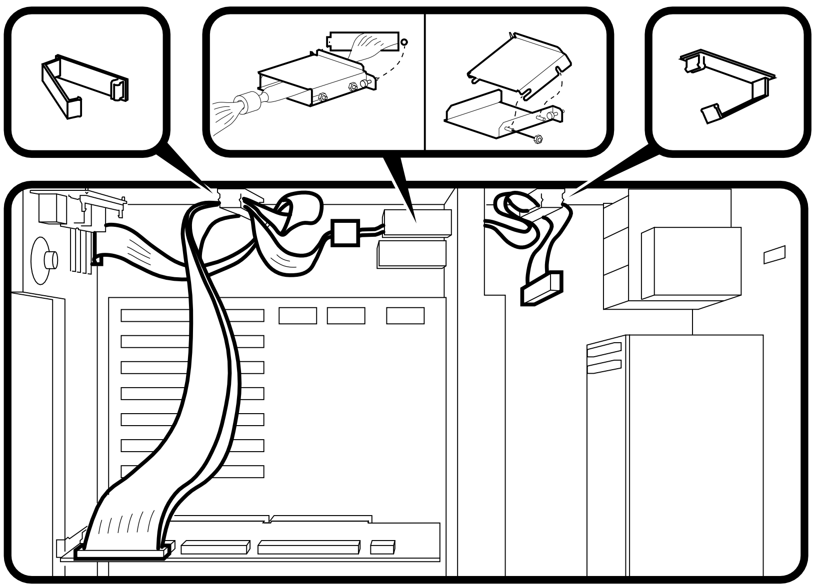


Figure 7–11 SCSI Multinode Cable (50-Pin)

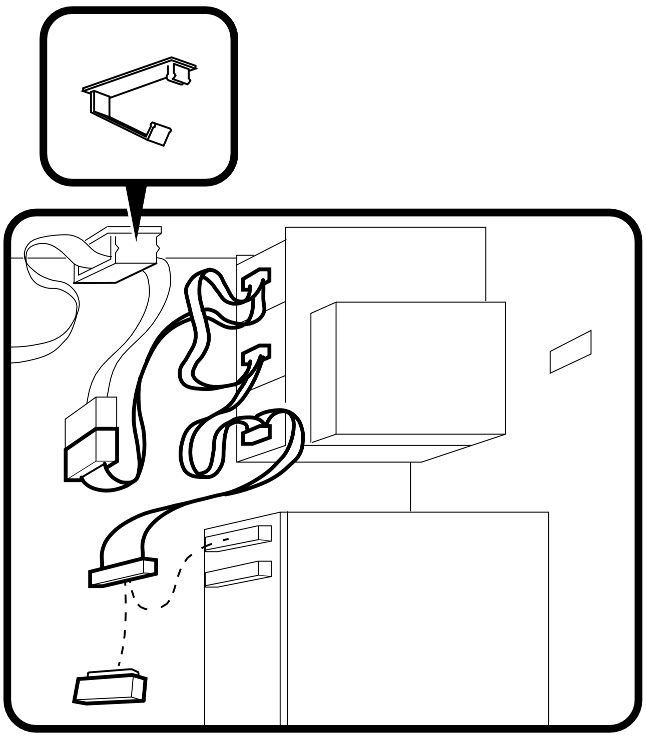
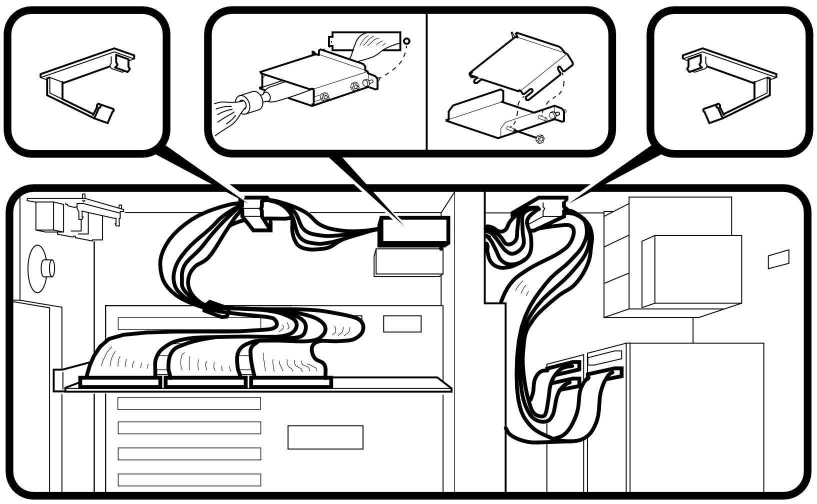


Figure 7–12 SCSI RAID Internal Cable (50-Pin)



7.2.2 CPU Modules

Note

Different CPU types cannot be used within the same system. Example: A KN450 CPU module and a KN460 CPU module cannot be used in the same system.

Before replacing a CPU module, perform the following steps to verify which CPU is failing. After installing a new CPU, repeat this procedure to ensure that the new CPU configuration is working properly.

STEP 1: CHECK FOR ERRORS LOGGED TO THE CPU.

Verify that errors have been logged through the serial control bus before replacing a CPU module. Using the `show fru` and `show error` console commands, you can determine if errors are logged for a bad CPU.

If an event is logged for any other test than test number 00, the CPU should be replaced.

1. **Enter the** `show fru` **command to check for test-directed diagnostic (TDD) errors logged to the CPU.**

In the following example, a test-directed diagnostic (TDD) error is logged for CPU0.

```
P00>>> show fru

                                Rev                        Events logged
 Slot   Option  Part#          Hw Sw   Serial#         SDD     TDD
   0    IO      B2110-AA       C4 0    KA347DWV06      00      00
   2    CPU0    B2020-AA       B2 9    ML33900048      00      01
   3    CPU1    B2020-AA       B2 9    KA34509090      00      00
   6    MEM2    B2022-CA       A1 0    ML34100009      00      00
   7    MEM3    B2022-CA       A1 0    ML34100008      00      00
 .
 .
 .
P00>>>
```

2. **Enter the `show error cpu0` command to verify that an error, other than test number 00, is currently logged for that CPU.**

```
P00>>> show error cpu0

CPU0 Module EEROM Event Log

Test Directed Errors

Entry: 0  Test Number: 02      Subtest Number: 02
Parameter 1: 00000000,00000010
Parameter 2: ffffffff,ffffffff
Parameter 3: fffffeff,ffffffff

CPU Event Counters
C3_CA_NOACK     0
   .
   .
   .
C3_DT_PAR_E     0
C3_DT_PAR_O     0

B-Cache Correctable Errors

Entry   Syndrome        Offset L        Offset H        Count

No Entries Found
P00>>>
```

STEP 2: IF THE CPU HAS AN ERROR LOGGED, OTHER THAN FOR TEST NUMBER 00, PERFORM POWER SHUTDOWN AND REPLACE THE CPU MODULE.

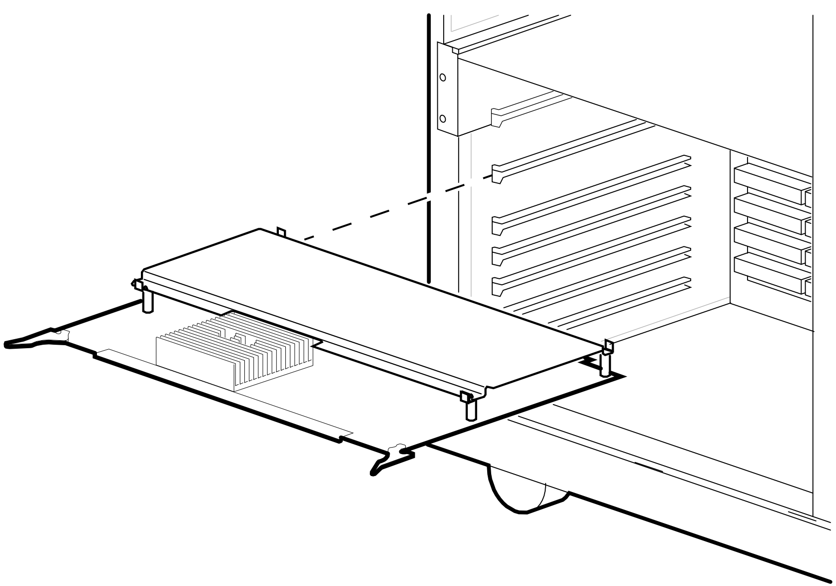
An event logged for test number 00 does not indicate a bad CPU. Test number 00 indicates that a CPU failover occurred sometime in the past.

Note

All systems must have a CPU module installed in system bus slot 2 (CPU0).

All system bus slots must be populated with a printed circuit board (PCB) module or a clear plastic module to assure proper airflow over each PCB module.

Figure 7–13 Removing CPU Modules



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Warning: CPU and memory modules have parts that operate at high temperatures. Wait 2 minutes after power is removed before handling these modules.

STEP 3: VERIFY THAT ERRORS ARE NO LONGER LOGGED FOR THE CPU.

Use the `show fru` **command to verify that the errors are cleared.**

```
P00>>> show fru

                                 Rev                        Events  logged
 Slot   Option  Part#           Hw Sw   Serial#         SDD     TDD
   0    IO      B2110-AA        C4 0    KA347DWV06      00      00
   2    CPU0    B2020-AA        B2 9    ML33900048      00      00
   3    CPU1    B2001-AA        B2 9    KA34509090      00      00
   6    MEM2    B2022-CA        A1 0    ML34100009      00      00
   7    MEM3    B2022-CA        A1 0    ML34100008      00      00
 .
 .
 .
P00>>>
```

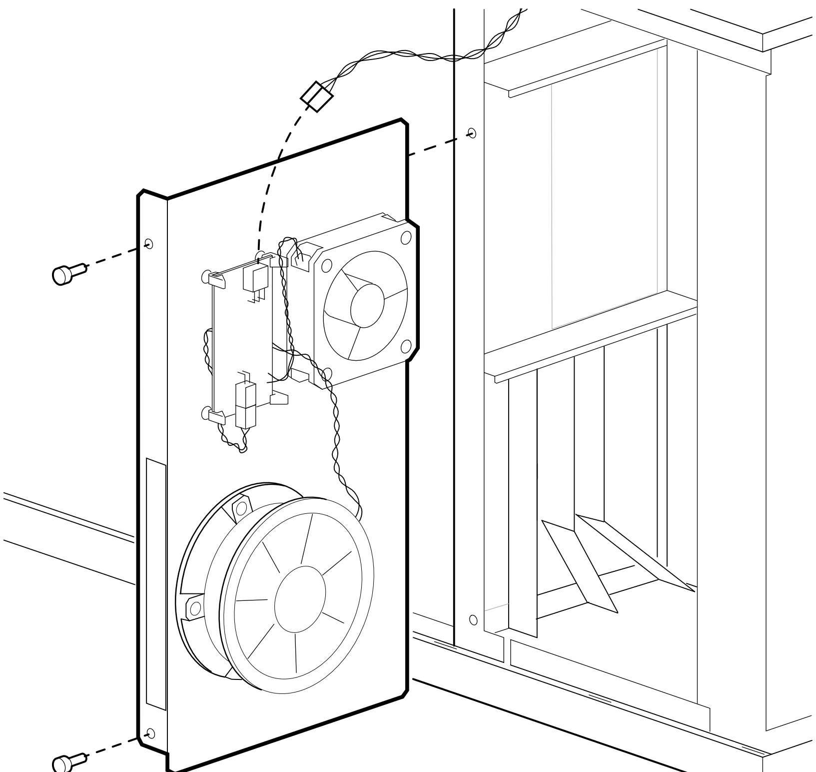
Note

To clear an event logged for test number 00 (CPU failover), use the `clear_error cpu#` command.

7.2.3 Fans and Fan Speed Control Board

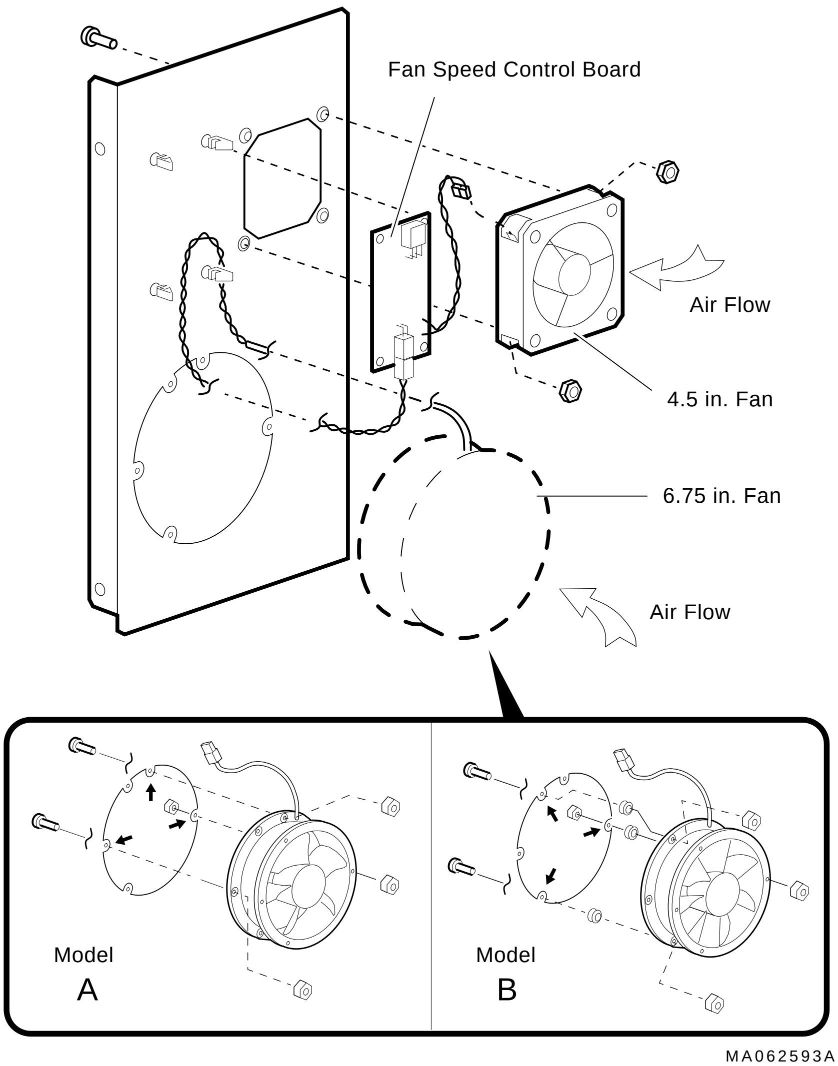
STEP 1: REMOVE FAN ASSEMBLY.

Figure 7–14 Removing Fan Assembly



STEP 2: REMOVE FAN COMPONENT.

Figure 7–15 Removing Fan Component



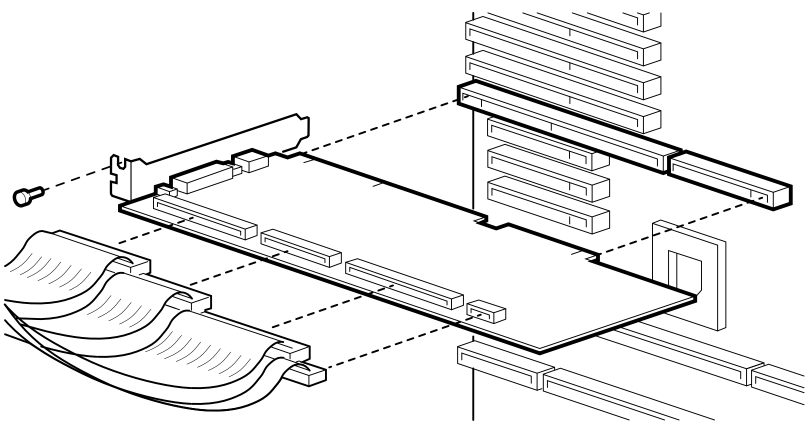
Caution

Two types of 6.75 inch fans are used with the BA720 enclosure. One type, shown as Model A in the illustration, manufactured by Sanyo Denki, needs to be oriented with the ground boss to the top. If this fan is not in the proper orientation, system bus components may overheat.

7.2.4 Standard I/O Module

STEP 1: DISCONNECT THE CABLES AND REMOVE THE MODULE.

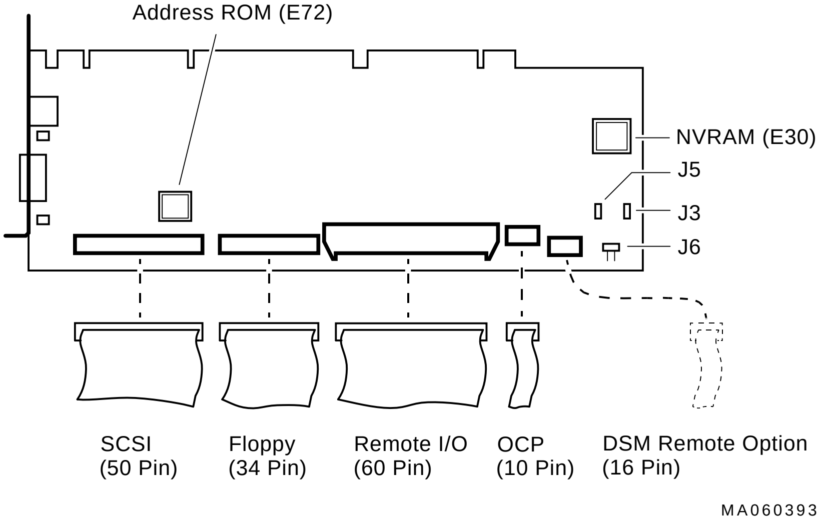
Figure 7–16 Removing Standard I/O Module



STEP 2: MOVE CHIPS TO NEW MODULE.

Move the socketed Ethernet station address ROM (position E72) and NVRAM chip (position E30) to the replacement standard I/O module and set jumpers to match previous settings.

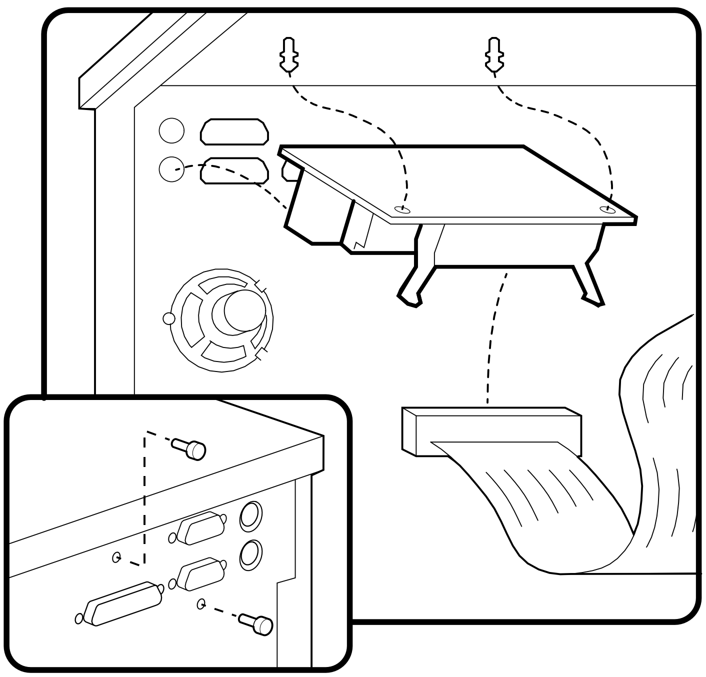
Figure 7–17 Standard I/O Module: Jumpers, Connectors, and Swapable Chips



J3–Power supply mode: When installed, dual power supplies operate in redundant mode.
J5–Program voltage: Internal use only.
J6–Fail-Safe: When installed, selects the fail-safe loader firmware.

7.2.5 Remote I/O Module

Figure 7–18 Removing the Remote I/O Panel



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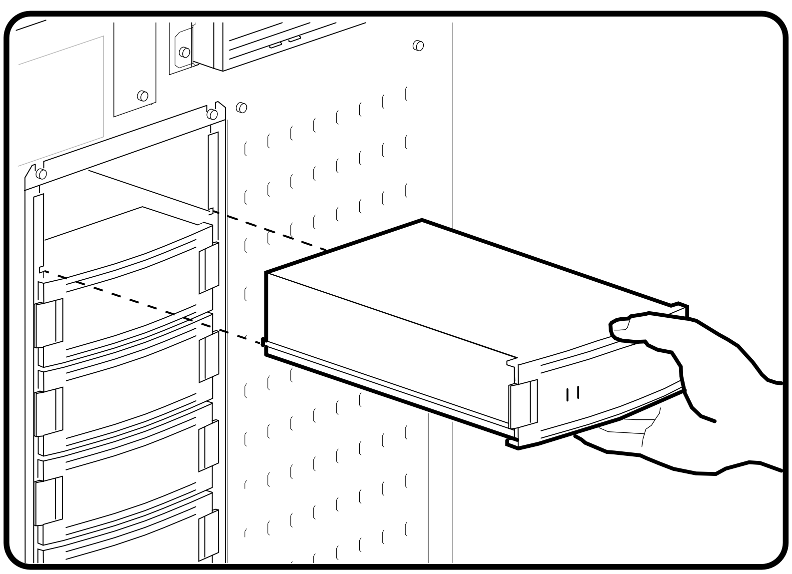
7.2.6 StorageWorks Drive

Note

If the StorageWorks drives are plugged into an SWXCR-xx controller, you can "hot swap" drives; that is, you can add or replace drives without first shutting down the operating system or powering down the server hardware. For more information, see *StorageWorks RAID Array 200 Subsystem Family Installation and Configuration Guide*, EK-SWRA2-IG.

If the StorageWorks drives are not plugged into an SWXCR-xx controller, you will need to shut down the operating system before swapping a drive. However, you will not need to power down the server before installing the drives.

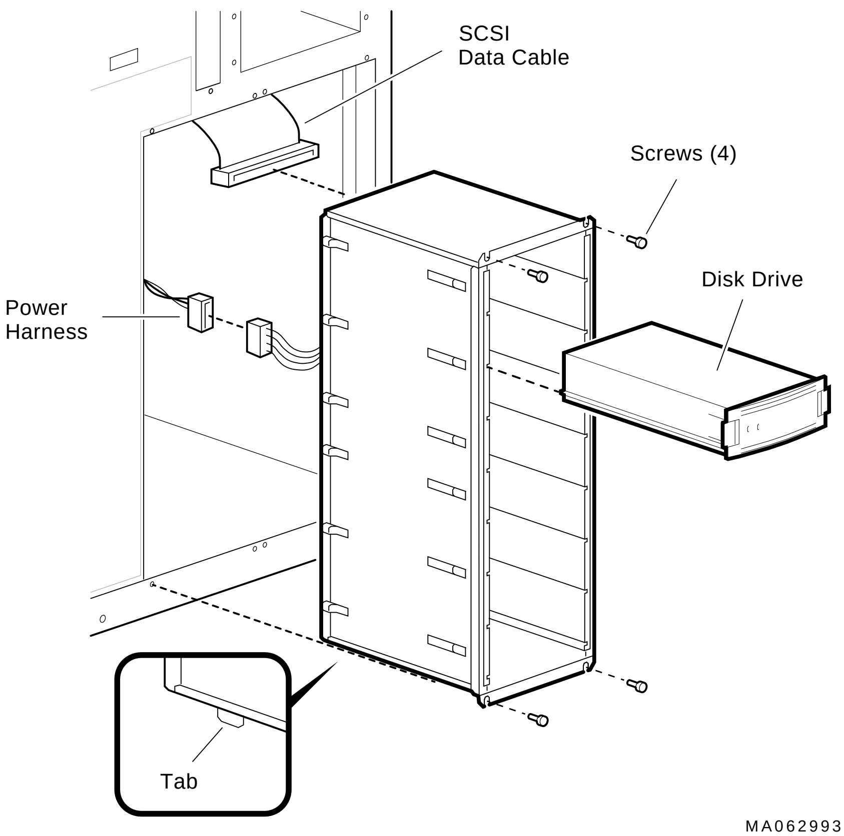
Figure 7–19 Removing StorageWorks Drive



7.2.7 Internal StorageWorks Backplane

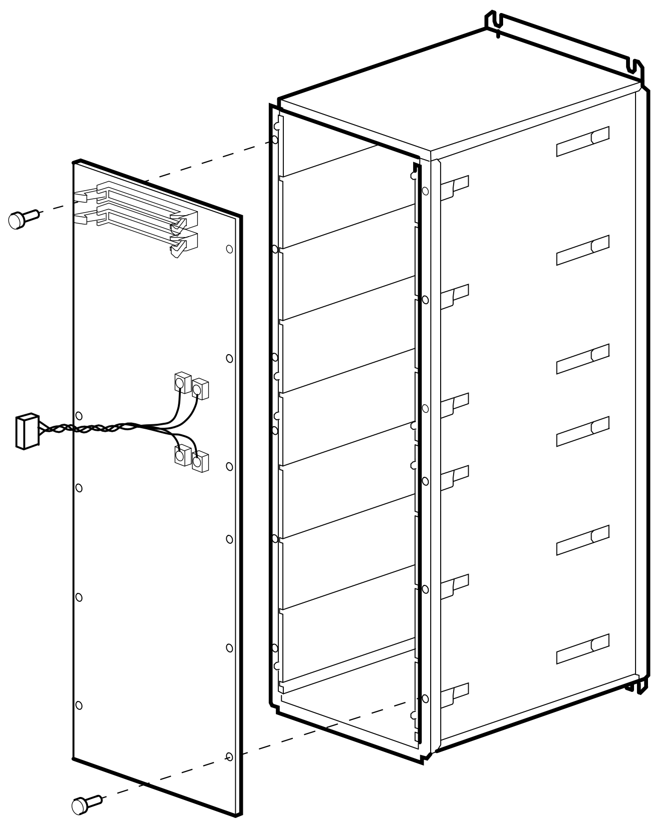
STEP 1: REMOVE INTERNAL STORAGEWORKS SHELF.

Figure 7–20 Removing Internal StorageWorks Shelf



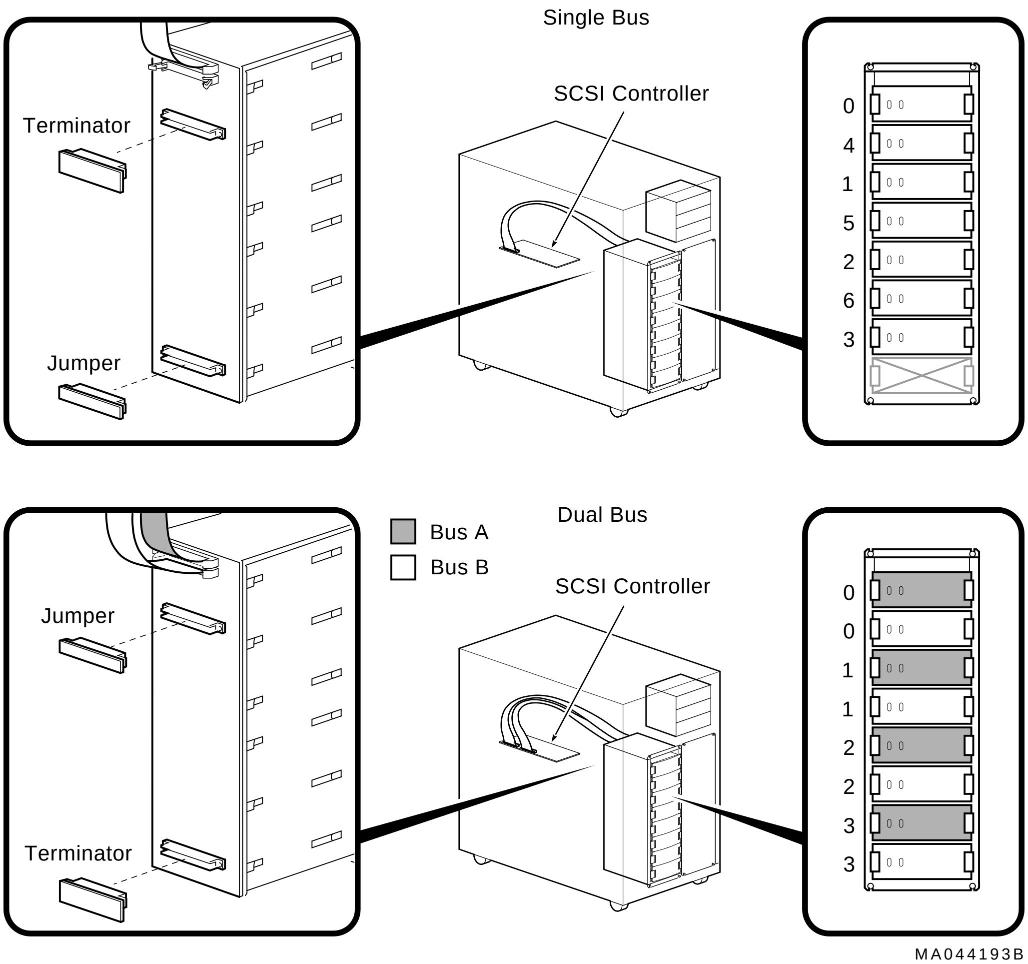
STEP 2: REMOVE INTERNAL STORAGEWORKS BACKPLANE.

Figure 7–21 Removing Internal StorageWorks Backplane



7.2.8 Internal StorageWorks Terminator and Jumper

Figure 7–22 Removing Internal StorageWorks Terminator and Jumper

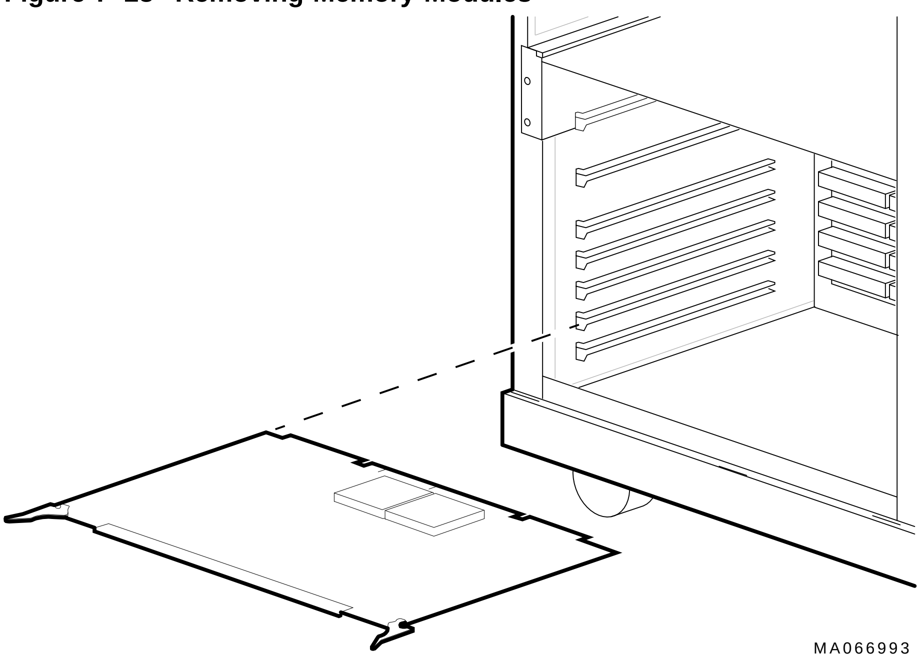


7.2.9 Memory Modules

Note

All system bus slots must be populated with a printed circuit board (PCB) module or a clear plastic module to assure proper airflow over each PCB module.

Figure 7–23 Removing Memory Modules

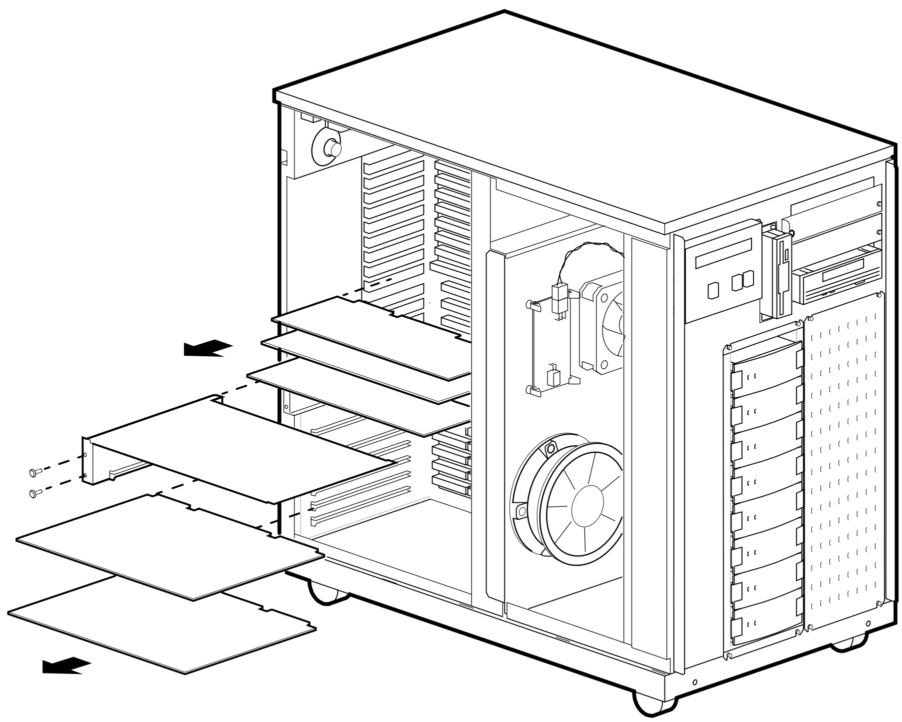


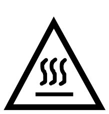
Warning: Memory and CPU modules have parts that operate at high temperatures. Wait 2 minutes after power is removed before handling these modules.

7.2.10 Motherboard

STEP 1: REMOVE MODULES AND DIVIDER.

Figure 7–24 Removing Modules and Divider

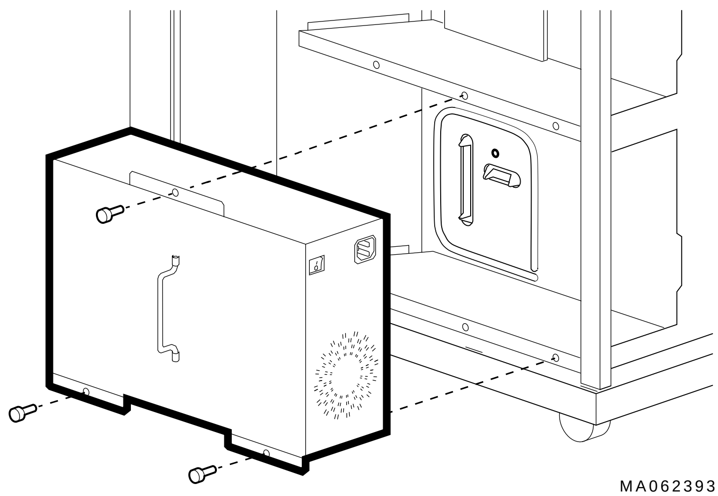




Warning: Memory and CPU modules have parts that operate at high temperatures. Wait 2 minutes after power is removed before handling these modules.

STEP 2: REMOVE POWER SUPPLIES.

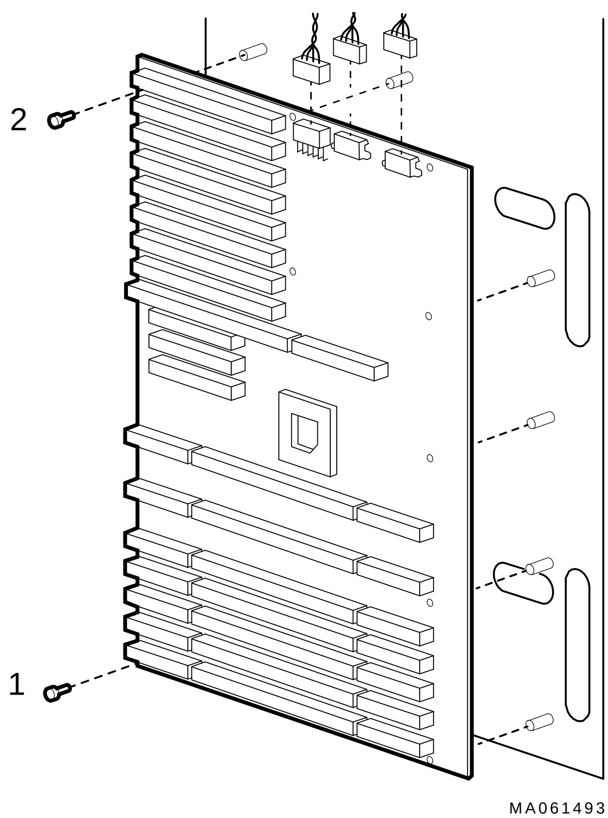
Figure 7–25 Removing Power Supplies



STEP 3: DETACH CABLES AND REMOVE MOTHERBOARD.

When replacing module, install screws in order indicated.

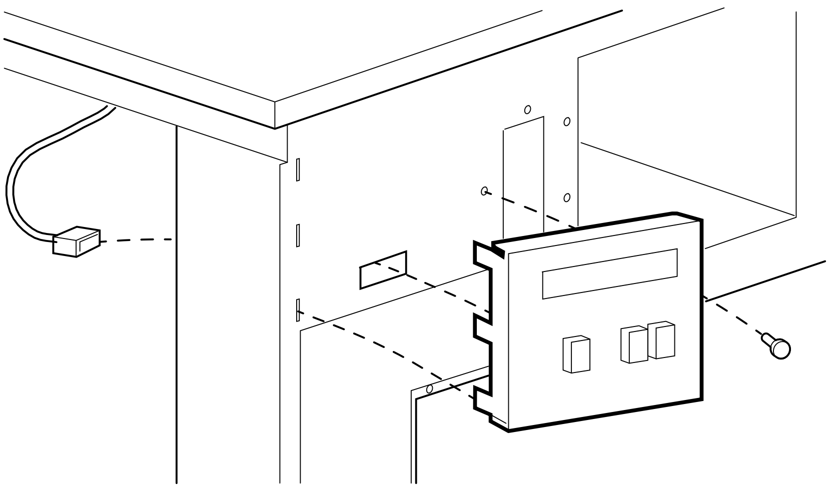
Figure 7–26 Removing Motherboard



7.2.11 OCP Module

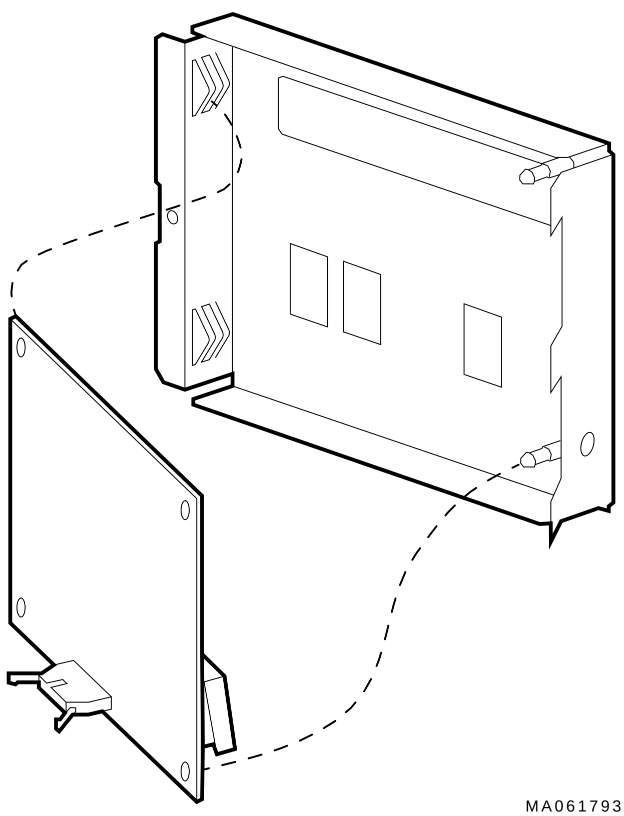
STEP 1: DETACH OCP CABLE AND REMOVE OCP COVER.

Figure 7–27 Removing OCP Cover



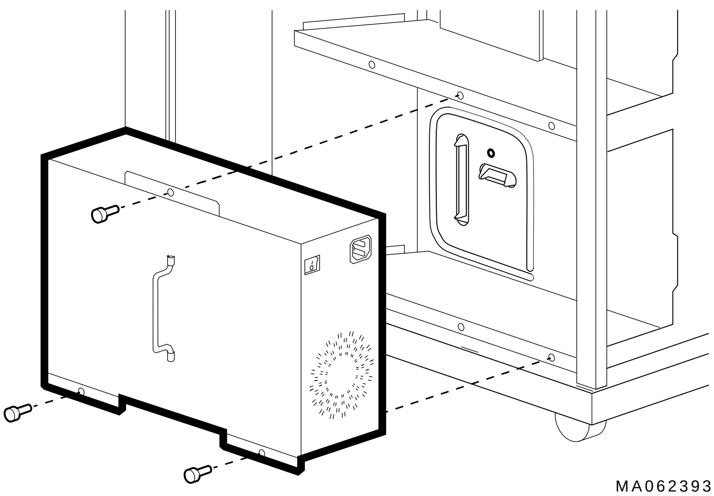
STEP 2: REMOVE OCP MODULE.

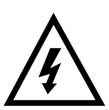
Figure 7–28 Removing OCP Module



7.2.12 Power Supply

Figure 7–29 Removing Power Supply

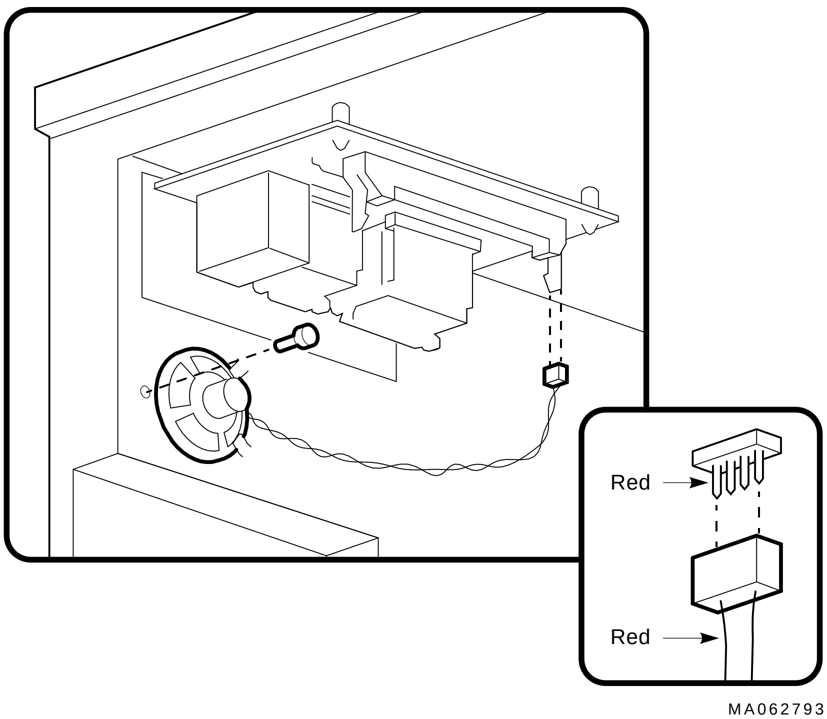




Warning: Hazardous voltages contained within. Do not service. Return to factory for service.

7.2.13 Speaker

Figure 7–30 Removing Speaker



7.2.14 Removable Media

Figure 7–31 Removing a Removable-Media Drive

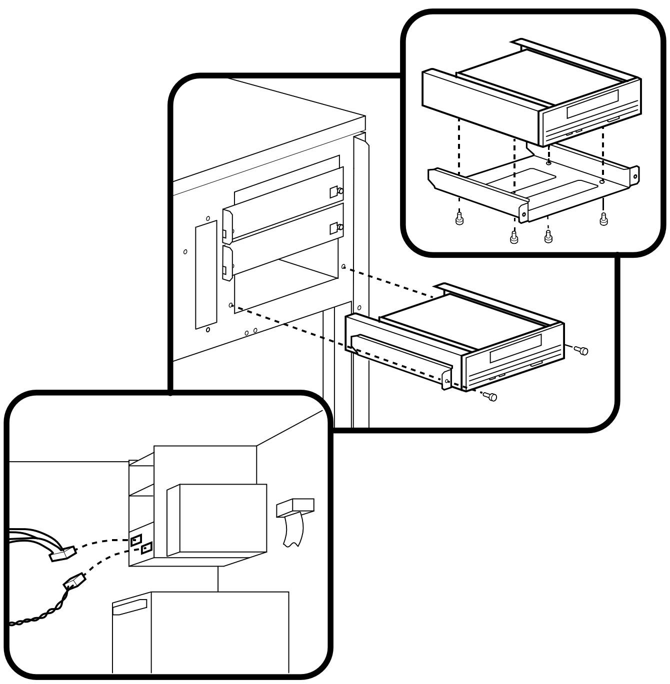
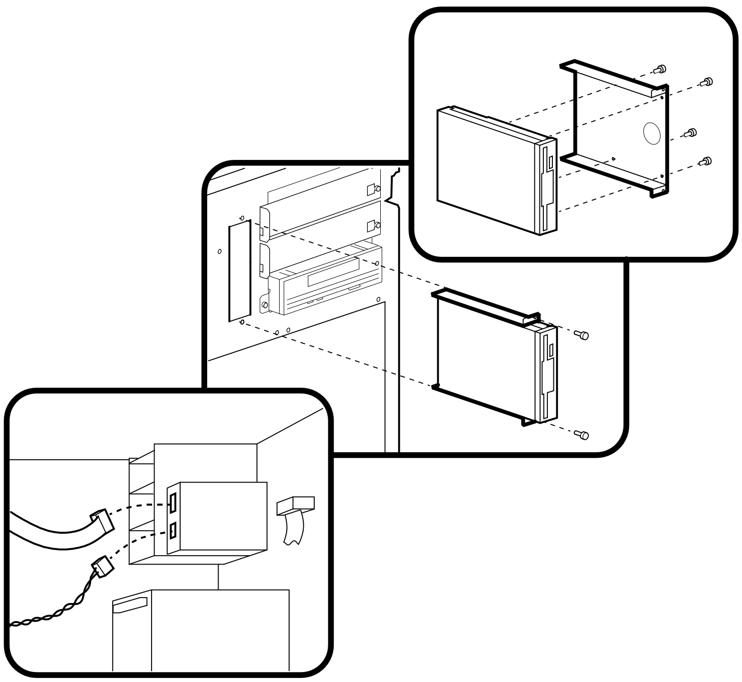


Figure 7–32 Removing Floppy Drive



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8

AlphaServer 2100 RM/CAB (BA741 Enclosure) FRU Removal and Replacement

This chapter describes the field-replaceable unit (FRU) removal and replacement procedures for AlphaServer 2100R and 2200 systems, which use the BA741 enclosure.

- Section 8.1 lists the FRUs for AlphaServer 2100R and 2200 systems (BA741 enclosure)
- Section 8.2 provides the removal and replacement procedures for the FRUs.

8.1 AlphaServer 2100 RM/CAB (BA741 Enclosure) FRUs

Table 8–1 lists the FRUs by part number and description and provides the reference to the figure or section that shows the removal/replacement procedure.

Figures 8–1 and 8–2 show the locations of FRUs within the system. Sections 8.2.1 through 8.2.2 show how to access rackmount FRUs.

Table 8–1 BA741 Enclosure FRUs

Part #	Description	Section
Cables		
17-03871-01	Floppy drive cable (34-pin)	Figure 8–9
17-03940-01	KFESA DSSI internal cable (50-pin)	Figure 8–10
17-04013-01	Multinode fan/storage device cable (4-pin)	Figure 8–11
17-04031-01	OCP module cable (10-pin)	Figure 8–12
17-00083-51	Power cord	Figure 8–13
17-04014-01	Power supply control cable assembly (24-pin to 15-pin)	Figure 8–14
17-04015-01	Power supply 12V cable assembly (16-pin to 8-pin)	Figure 8–15
17-02784-03	Remote I/O cable (60-pin)	Figure 8–16
17-04025-01 or 17-04093-01	SCSI multinode cable (50-pin)	Figure 8–17
17-03664-02	SCSI RAID internal cable (50-pin)	Figure 8–18
CPU Modules		
B2020-AA	KN450-AA CPU module	Section 8.2.4
B2024-AA	KN460-AA CPU module	Section 8.2.4
Fans		
12-23374-02 or 12-36202-02	6.75-inch fans	Section 8.2.5
54-22615-01	Fan speed control board	Section 8.2.6
I/O Modules		
B2110-AA (54-23146-01)	KFE40 standard I/O	Section 8.2.7
54-23151-01	Remote I/O module	Section 8.2.8

(continued on next page)

Table 8–1 (Cont.) BA741 Enclosure FRUs

Part #	Description	Section
Memory Modules		
B2021-BA	MS450-BA 64MB, 80-ns memory module	Section 8.2.9
B2021-CA	MS450-CA 128MB, 80-ns memory module	Section 8.2.9
B2022-CA	MS451-CA 512MB, 80-ns memory module	Section 8.2.9
Other Modules and Components		
54-23180-03	OCP module	Section 8.2.10
30-41765-01	Power supply	Section 8.2.11
12-39309-03	Speaker	Section 8.2.12
54-22601-01	System bus motherboard	Section 8.2.13
54-22603-01	PCI/EISA bus daughter board	Section 8.2.13
90-11194-01	Key, 1/4-turn fastener	
12-37004-04	External SCSI terminator	
Removable Media		
RRDnn -AA	CD–ROM drives	Section 8.2.15
TLZnn -LG	Tape drives	Section 8.2.15
TZKnn -LG	Tape drives	Section 8.2.15
RXnn -AA	Floppy drive	Section 8.2.15
Fixed Disk Drives		
RZnn -AA	Disk drive	Section 8.2.14

Figure 8–1 FRUs, Upper Compartments

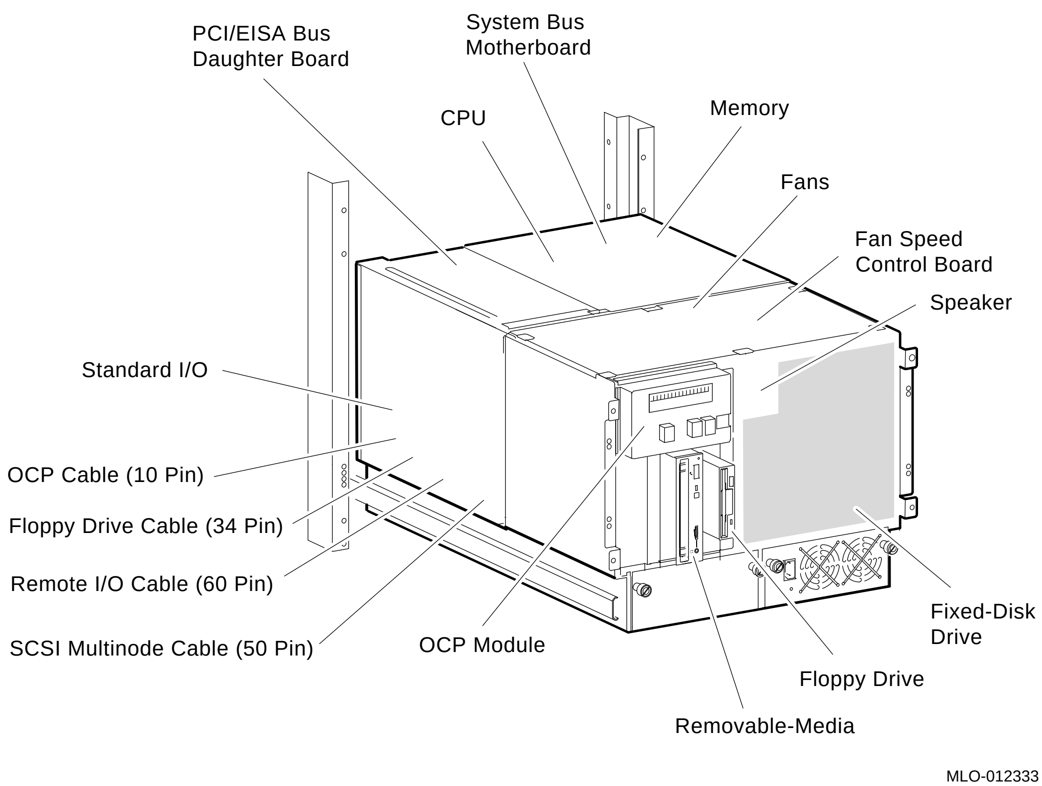
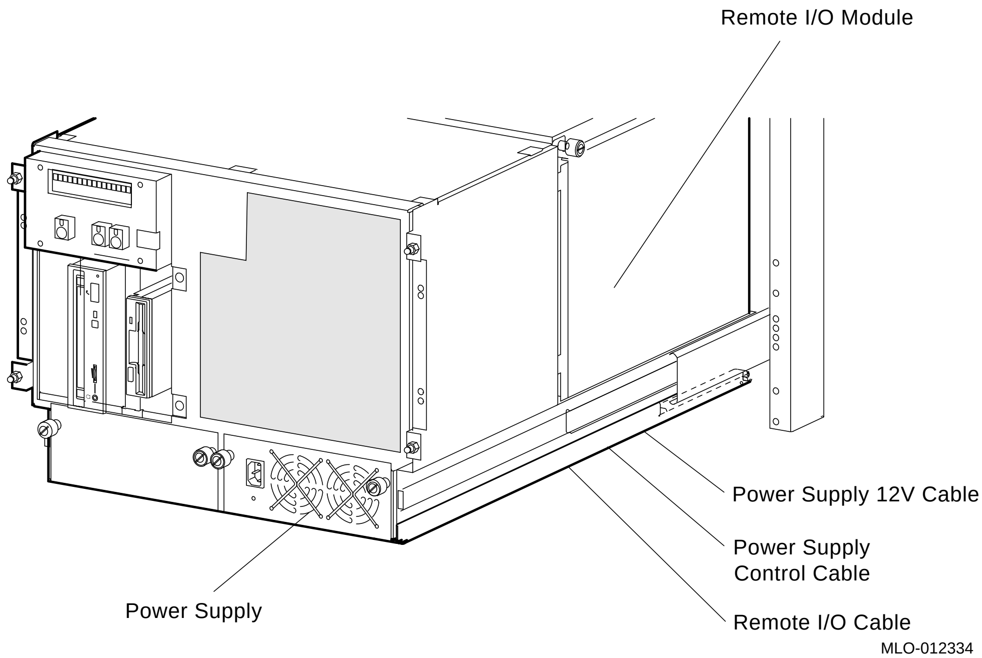


Figure 8–2 FRUs, Lower Compartment



8.2 Removal and Replacement

This section describes the procedures for removing and replacing FRUs for AlphaServer 2100 RM and 2100 CAB systems, which use the BA741 enclosure.

Warning: Before accessing enclosure compartments:

1. Perform orderly shutdown of the operating system.
2. Set the DC power switch on the operator control panel to off
3. Remove power by unplugging the AC power cord from each power supply.

Caution

Static electricity can damage integrated circuits. Always use a grounded wrist strap (29-26246) and grounded work surface when working with internal parts of a computer system.

Unless otherwise specified, you can install an FRU by reversing the steps shown in the removal procedure.

8.2.1 Sliding System Out

Warning

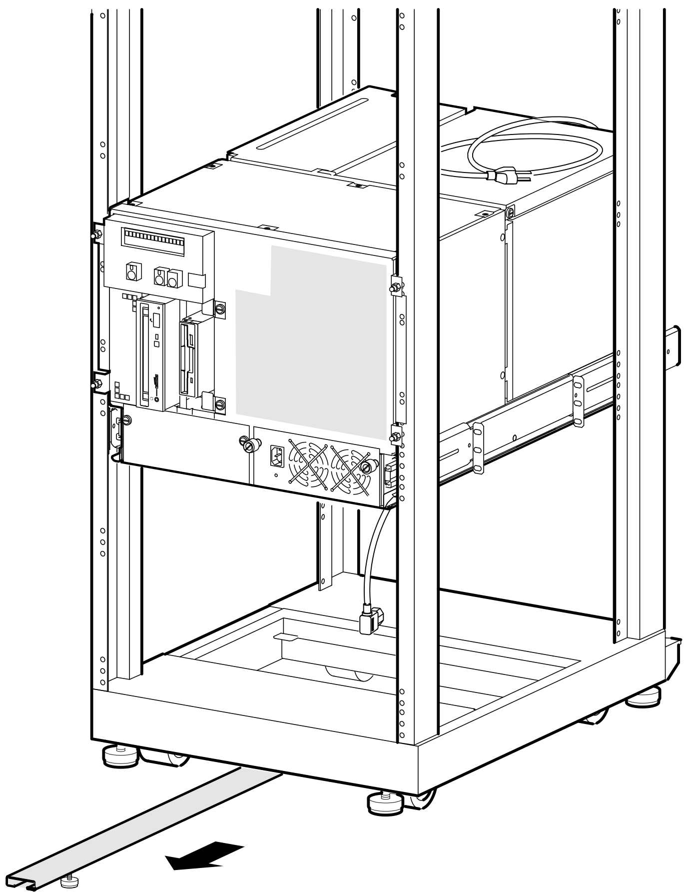
The system weighs 45.4 kg (100 lb). To prevent personal injury and equipment damage, ensure that only one system is extended out of the cabinet at any one time and that the cabinet is stabilized (as in Figure 8–3) before pulling the system out on its slides.

The adjustable leveling feet should be down and the cabinet's stabilizing bar fully extended before any component is extended out of the cabinet on slides.

Do not extend more than one slide assembly at a time, cabinet instability may result.

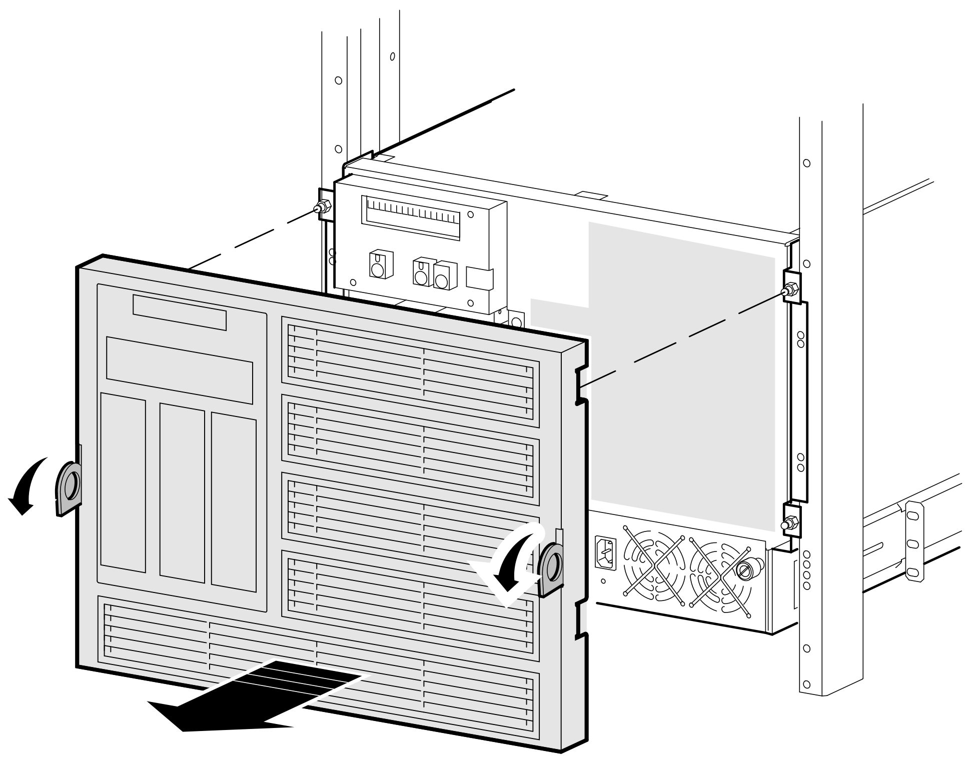
STEP 1: STABILIZE CABINET BEFORE SLIDING SYSTEM OUT.

Figure 8–3 Example of a Cabinet Stabilizer



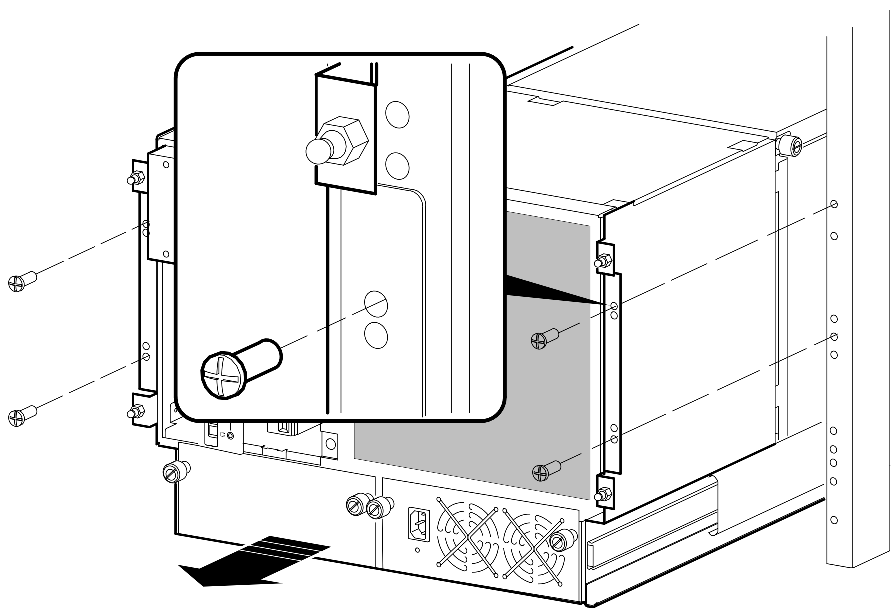
STEP 2: REMOVE FRONT PANEL.

Figure 8–4 Removing Front Panel



STEP 3: REMOVE SCREWS AND SLIDE SYSTEM OUT.

Figure 8–5 Sliding Out Rackmount System

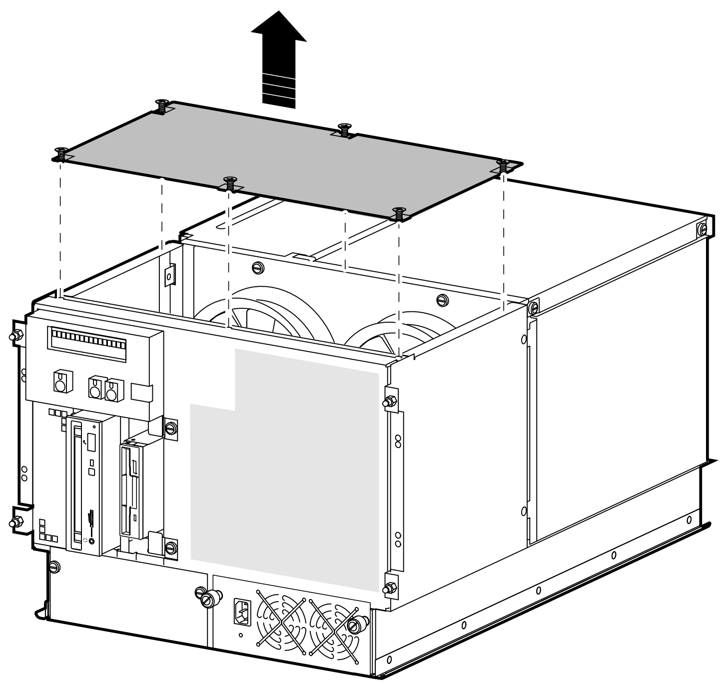


8.2.2 Accessing Enclosure Compartments

The following figures show how to open doors or remove panels to access compartments containing FRUs.

- Figure 8–6 shows how to remove the cover to access the mass storage compartment.
- Figure 8–7 shows how to open the door to access the PCI/EISA bus compartment.
- Figure 8–8 shows how to remove the cover to access the system bus compartment.

Figure 8–6 Accessing the Mass Storage Compartment



Note

The mass storage compartment cover requires a number 1 screwdriver.

Figure 8–7 Accessing the PCI/EISA Compartment

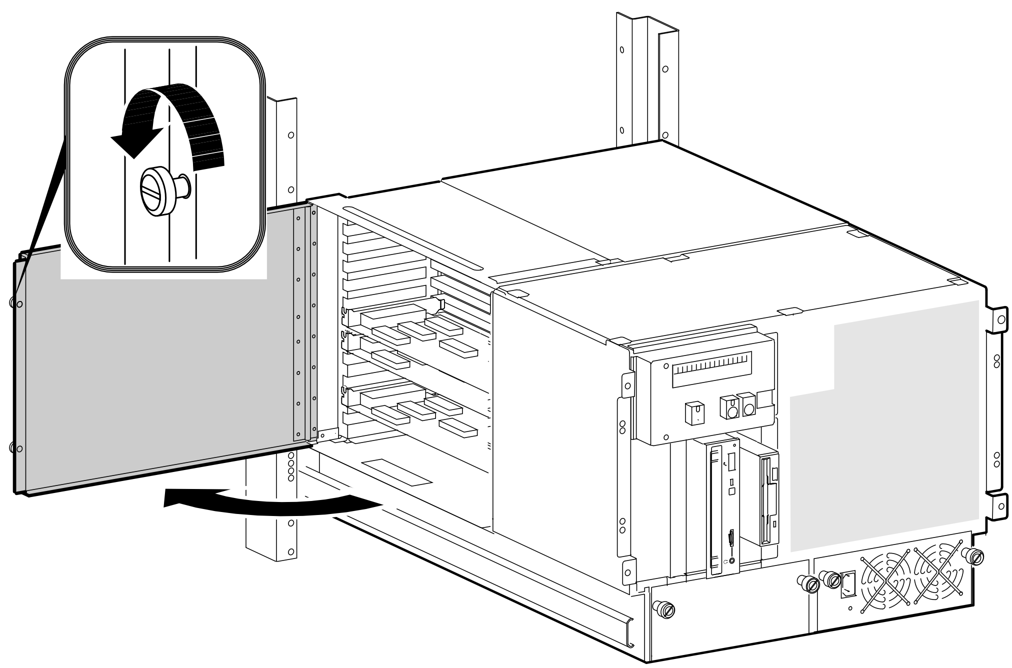
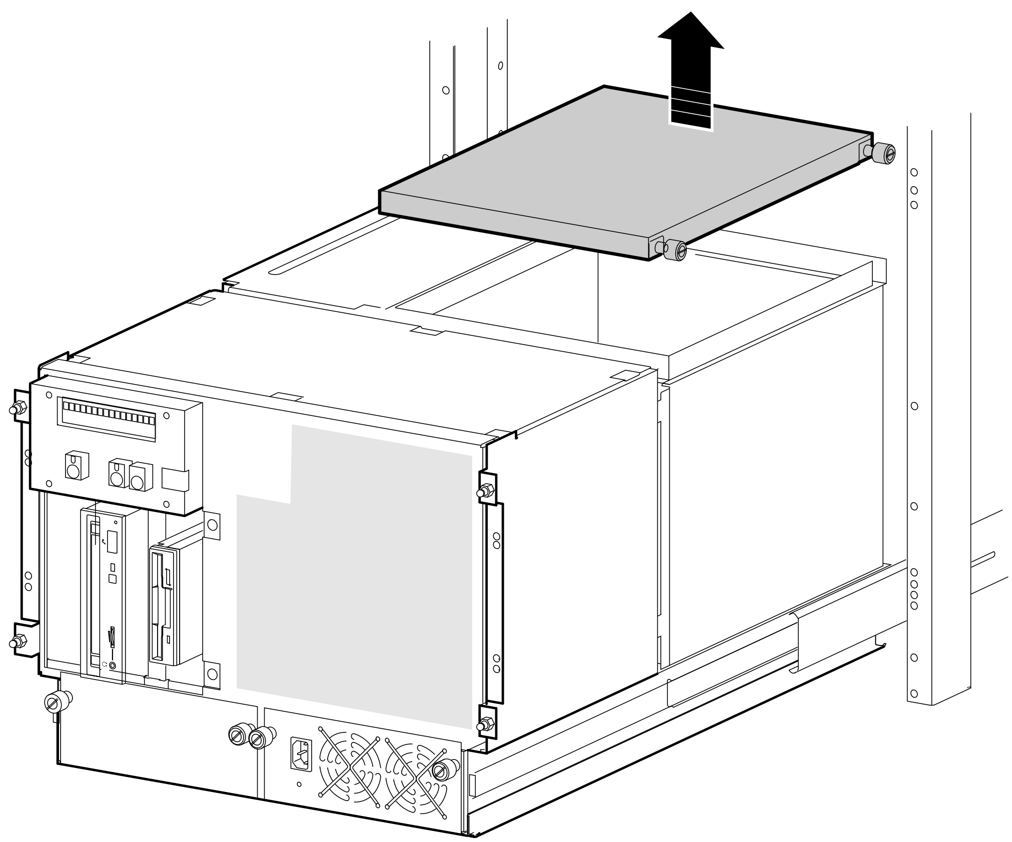


Figure 8–8 Accessing the System Bus Compartment



8.2.3 Cables

This section shows the routing for each cable in the system.

Figure 8–9 Floppy Drive Cable (34-pin)

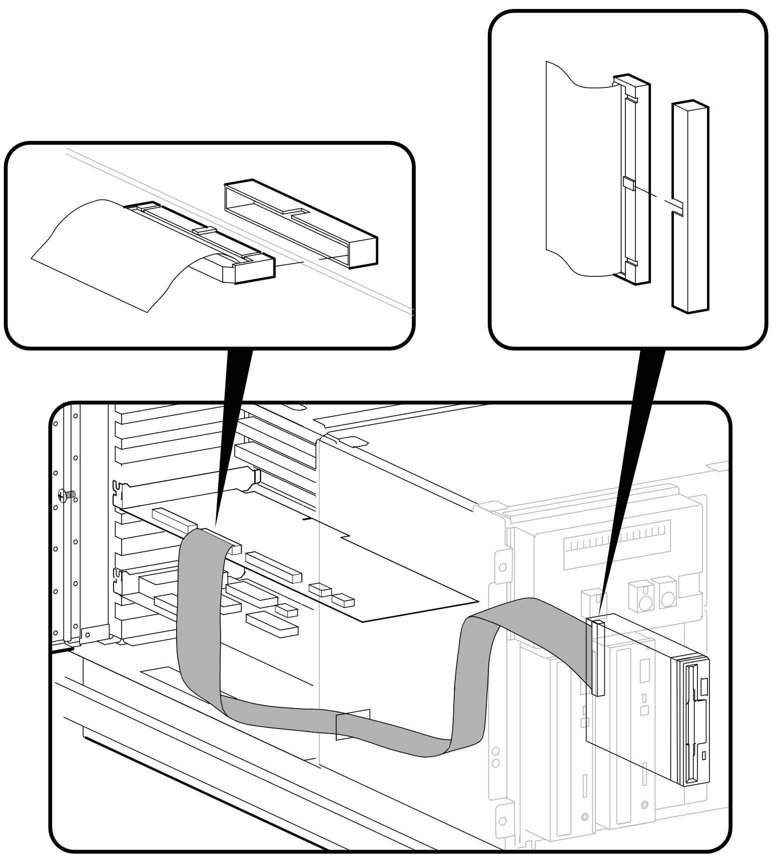


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Figure 8–10 KFESA DSSI Internal Cable (50-pin)

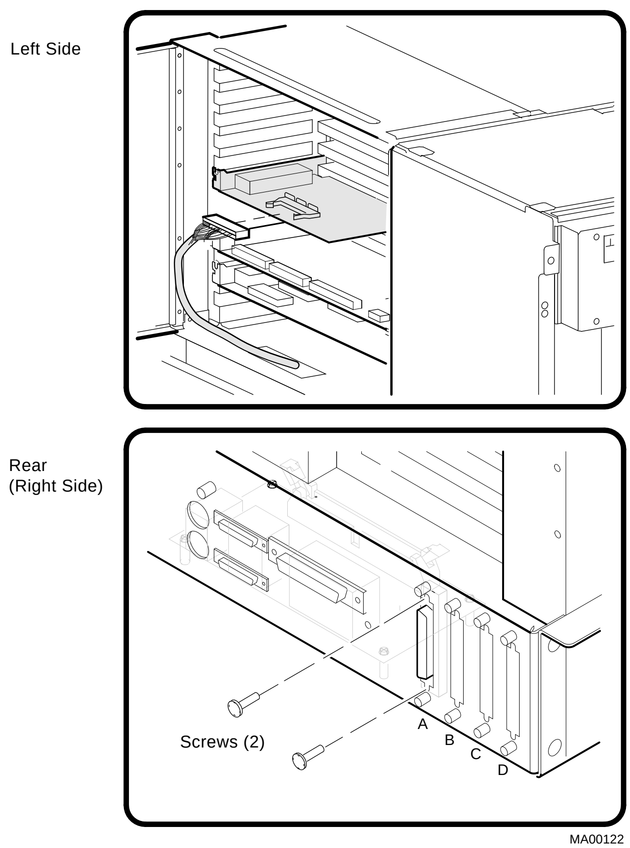


Figure 8–11 Multinode Fan/Storage Device Cable (4-pin)

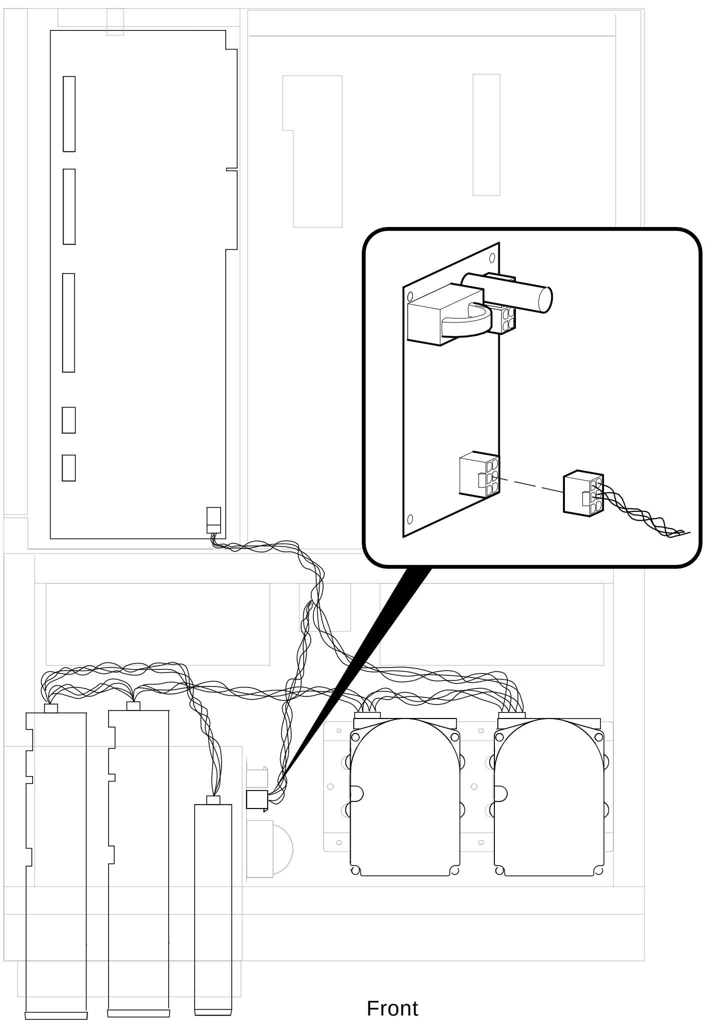


Figure 8–12 OCP Module Cable (10-pin)

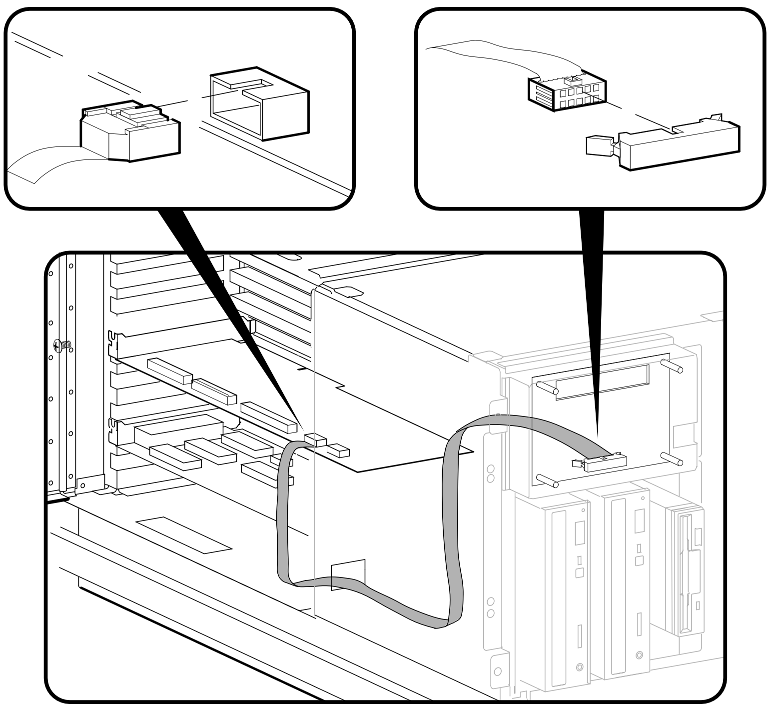


Figure 8–13 Power Cord

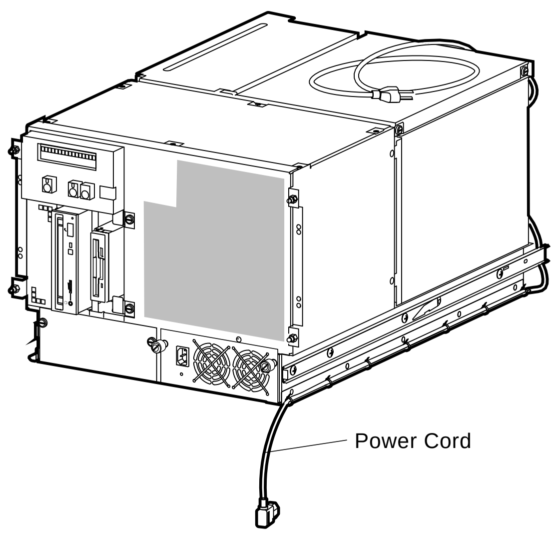


Table 8–2 lists the country-specific power cables.

Table 8–2 Power Cord Order Numbers

Country	Power Cord BN Number	Digital Number
U.S., Japan, Canada	Included	17-00083-51
Australia, New Zealand	BN19J-2E	17-00198-13
Central European (Aus, Bel, Fra, Ger, Fin, Hol, Nor, Swe, Por, Spa)	BN19D-2E	17-00199-22
U.K., Ireland	BN19B-2E	17000209-12
Switzerland	BN04B-2E	17-00210-12
Denmark	BN19L-2E	17-00310-06
Italy	BN19N-2E	17-00364-17
India, South Africa	BN19T-2E	17-00456-15
Israel	BN18Y-2E	17-00457-15

Figure 8–14 Power Supply Control Cable Assembly (15-pin to 24-pin)

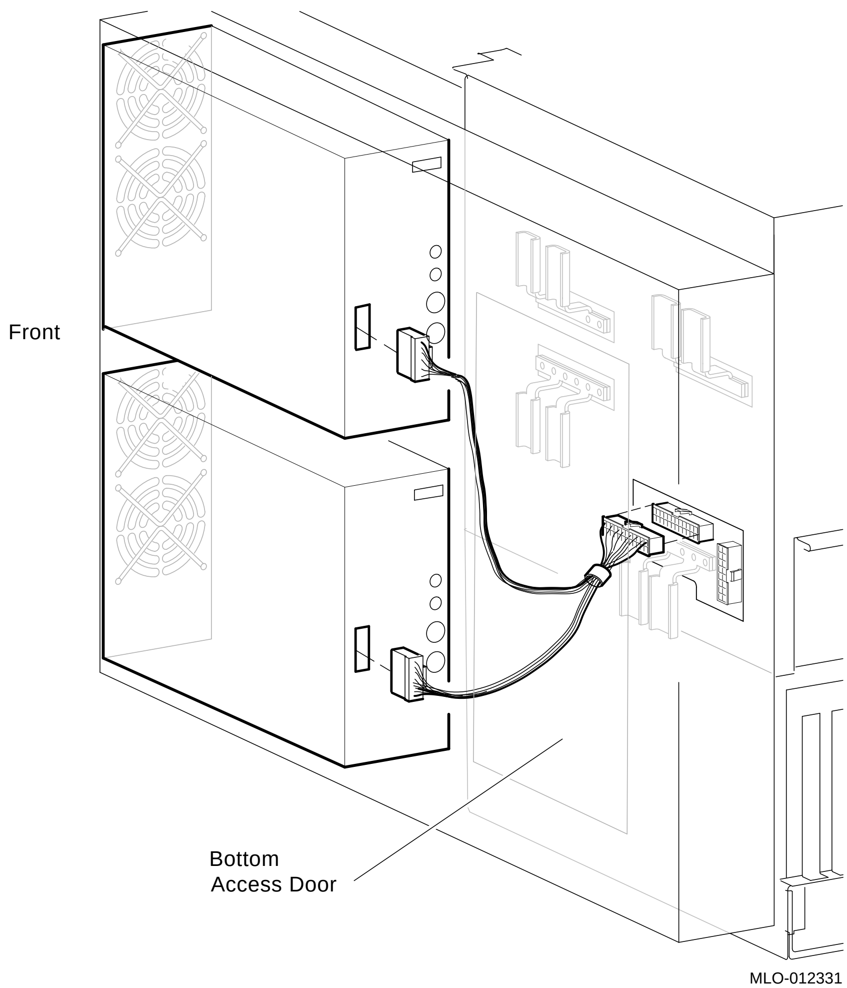


Figure 8–15 Power Supply 12V Cable Assembly (8-pin to 16-pin)

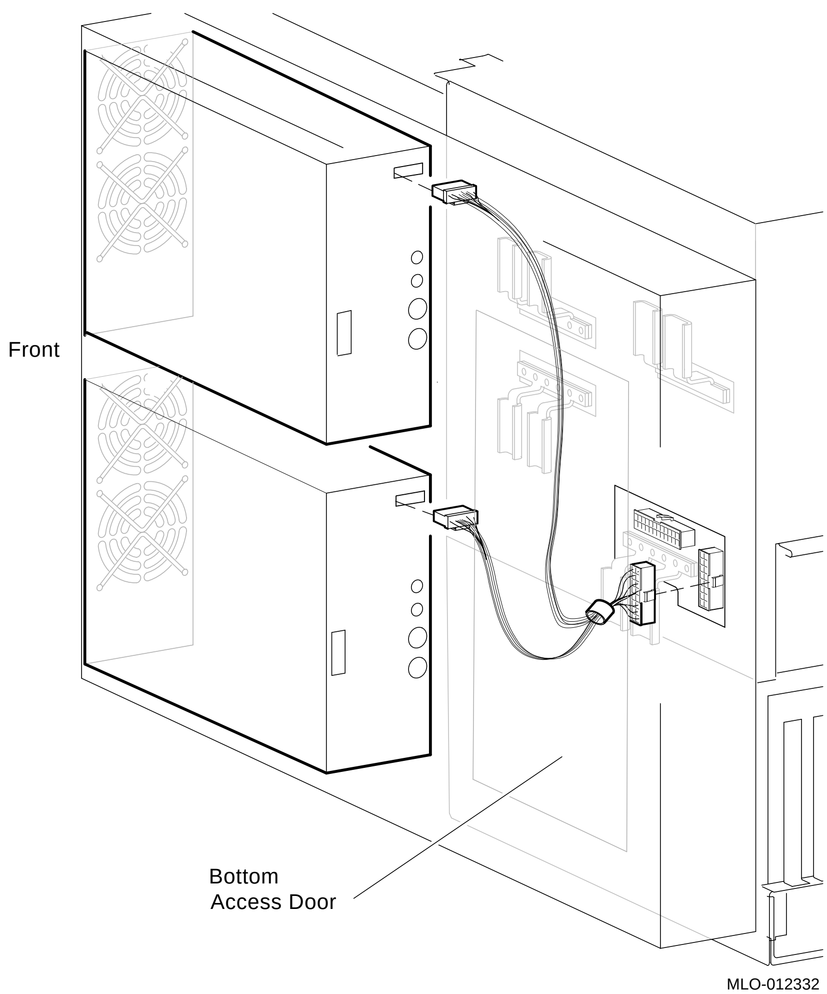


Figure 8–16 Remote I/O Cable (60-pin)

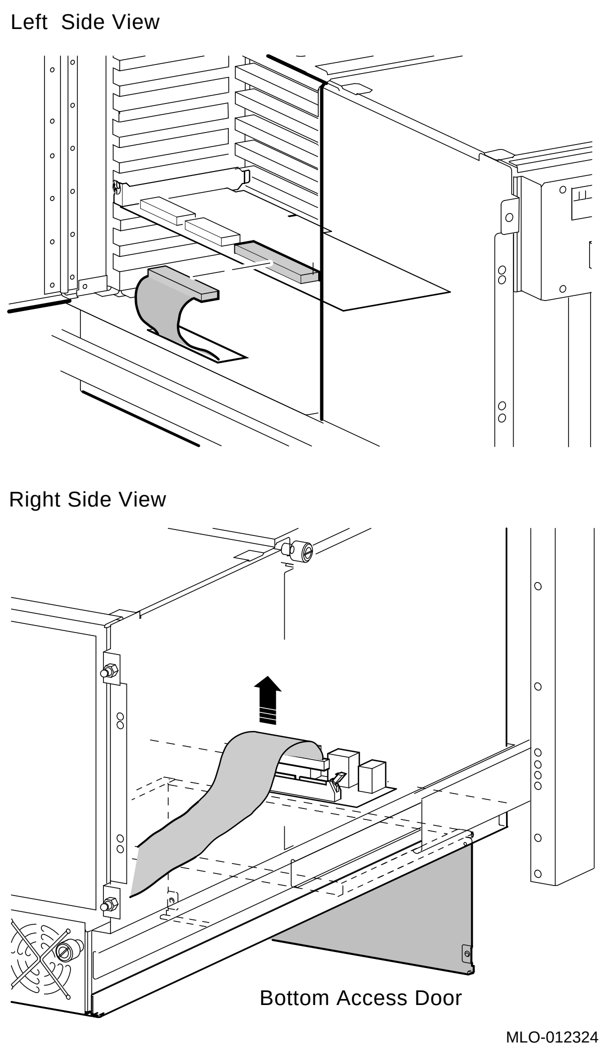


Figure 8–17 SCSI Multinode Cable (50-Pin)

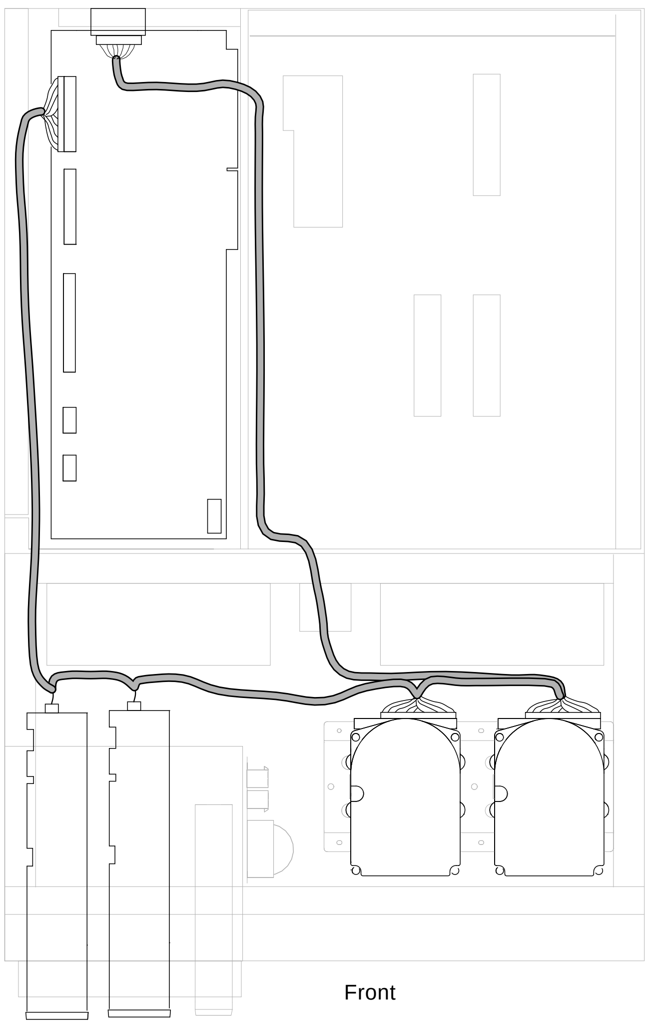
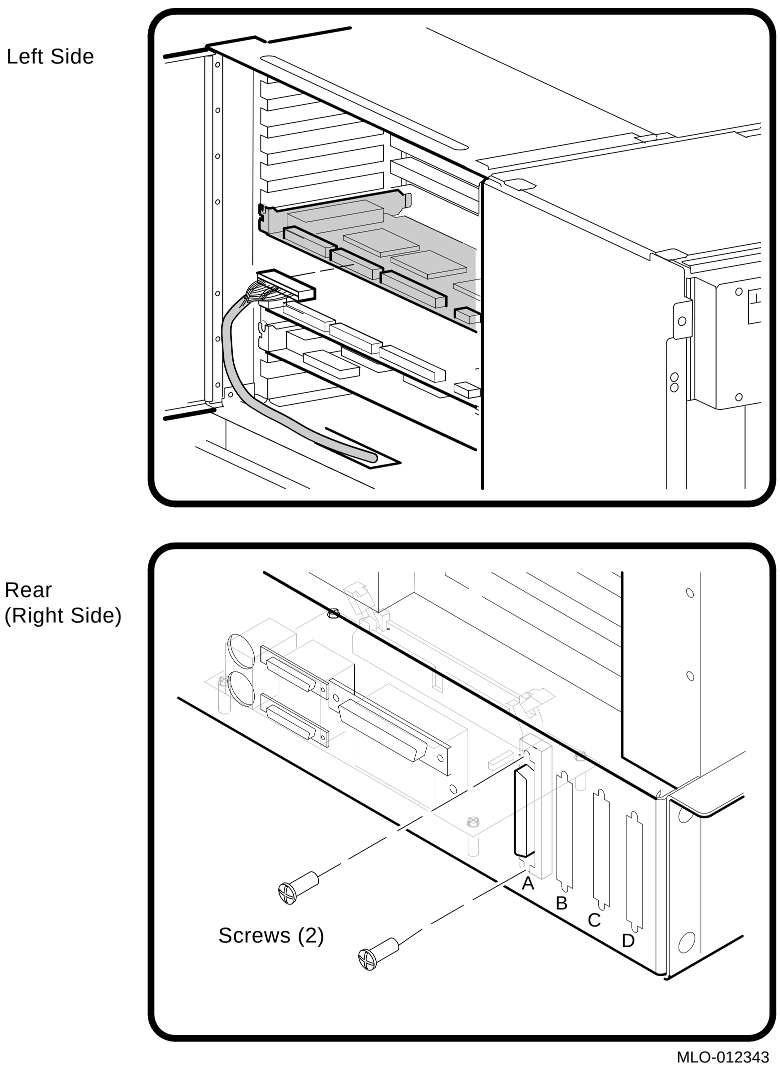


Figure 8–18 SCSI RAID Internal Cable (50-pin)



8.2.4 CPU Modules

Note

Different CPU types cannot be used within the same system. Example: A KN450 CPU module and a KN460 CPU module cannot be used in the same system.

Before replacing a CPU module, perform the following steps to verify which CPU is failing. After installing a new CPU, repeat this procedure to ensure that the new CPU configuration is working properly.

STEP 1: CHECK FOR ERRORS LOGGED TO THE CPU.

Verify that errors have been logged through the serial control bus before replacing a CPU module. Using the `show fru` and `show error` console commands, you can determine if errors are logged for a bad CPU.

If an event is logged for any other test than test number 00, the CPU should be replaced.

1. **Enter the `show fru` command to check for test-directed diagnostic (TDD) errors logged to the CPU.**

   In the following example, a test-directed diagnostic (TDD) error is logged for CPU0.

```
P00>>> show fru

                                Rev                    Events logged
 Slot   Option  Part#          Hw Sw   Serial#         SDD     TDD
   0    IO      B2110-AA       C4 0    KA347DWV06      00      00
   2    CPU0    B2020-AA       B2 9    ML33900048      00      01
   3    CPU1    B2020-AA       B2 9    KA34509090      00      00
   6    MEM2    B2022-CA       A1 0    ML34100009      00      00
   7    MEM3    B2022-CA       A1 0    ML34100008      00      00
         .
         .
         .
P00>>>
```

2. **Enter the `show error cpu0` command to verify that an error, other than test number 00, is currently logged for that CPU.**

```
P00>>> show error cpu0

CPU0 Module EEROM Event Log

Test Directed Errors
```

```
Entry: 0  Test Number: 02       Subtest Number: 02
Parameter 1: 00000000,00000010
Parameter 2: ffffffff,ffffffff
Parameter 3: fffffeff,ffffffff

CPU Event Counters
CPU Event Counters
C3_CA_NOACK     0
   .
   .
   .
C3_DT_PAR_E     0
C3_DT_PAR_O     0

B-Cache Correctable Errors

Entry   Syndrome        Offset L        Offset H        Count

No Entries Found
P00>>>
```

STEP 2: IF THE CPU HAS AN ERROR LOGGED, OTHER THAN FOR TEST NUMBER 00, PERFORM POWER SHUTDOWN AND REPLACE THE CPU MODULE.

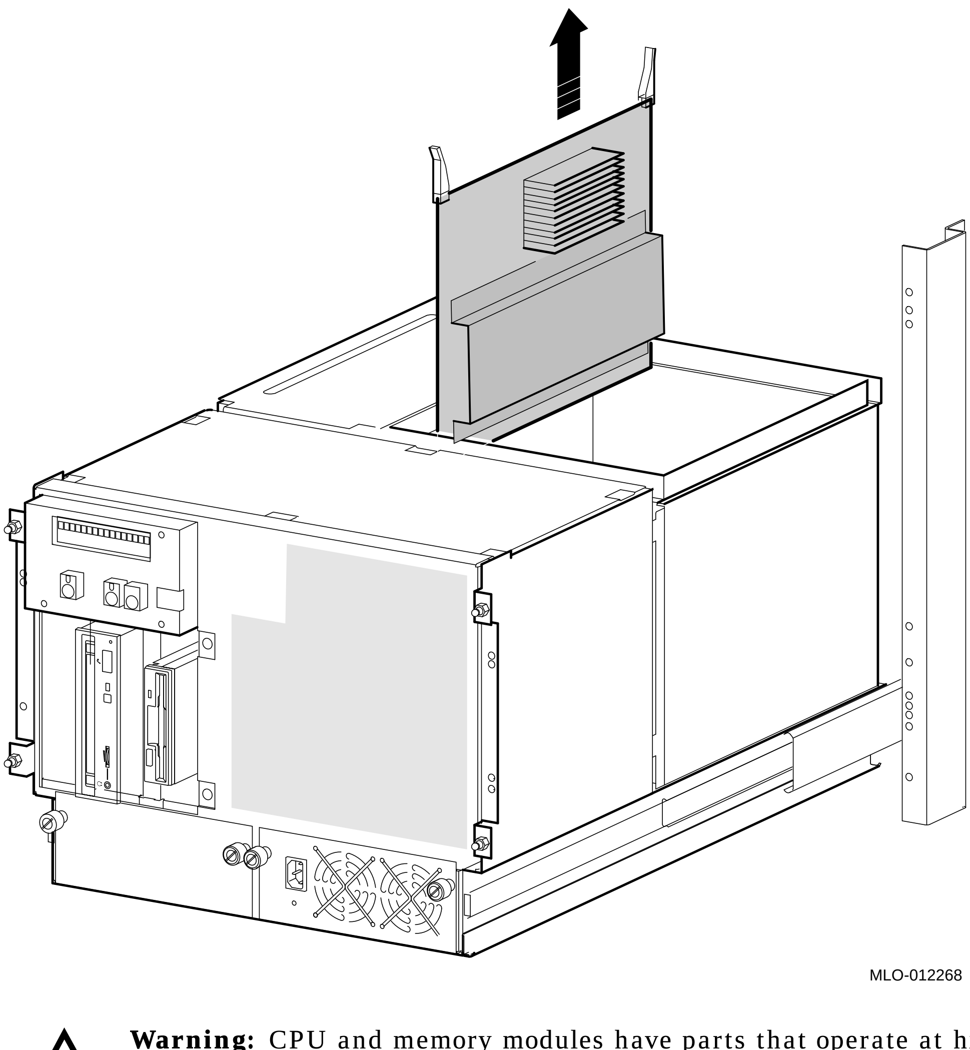
An event logged for test number 00 does not indicate a bad CPU. Test number 00 indicates that a CPU failover occurred sometime in the past.

Note

All systems must have a CPU module installed in system bus slot 2 (CPU0).

All system bus slots must be populated with a printed circuit board (PCB) module or a clear plastic module to assure proper airflow over each PCB module.

Figure 8–19 Removing CPU Modules



Warning: CPU and memory modules have parts that operate at high temperatures. Wait 2 minutes after power is removed before handling these modules.

STEP 3: VERIFY THAT ERRORS ARE NO LONGER LOGGED FOR THE CPU.

Use the `show fru` **command to verify that the errors are cleared.**

```
P00>>> show fru

                                Rev                    Events logged
 Slot   Option  Part#           Hw Sw   Serial#        SDD     TDD
   0    IO      B2110-AA        C4 0    KA347DWV06     00      00
   2    CPU0    B2020-AA        B2 9    ML33900048     00      00
   3    CPU1    B2020-AA        B2 9    KA34509090     00      00
   6    MEM2    B2022-CA        A1 0    ML34100009     00      00
   7    MEM3    B2022-CA        A1 0    ML34100008     00      00
        .
        .
        .
        .
        .
        .
P00>>>
```

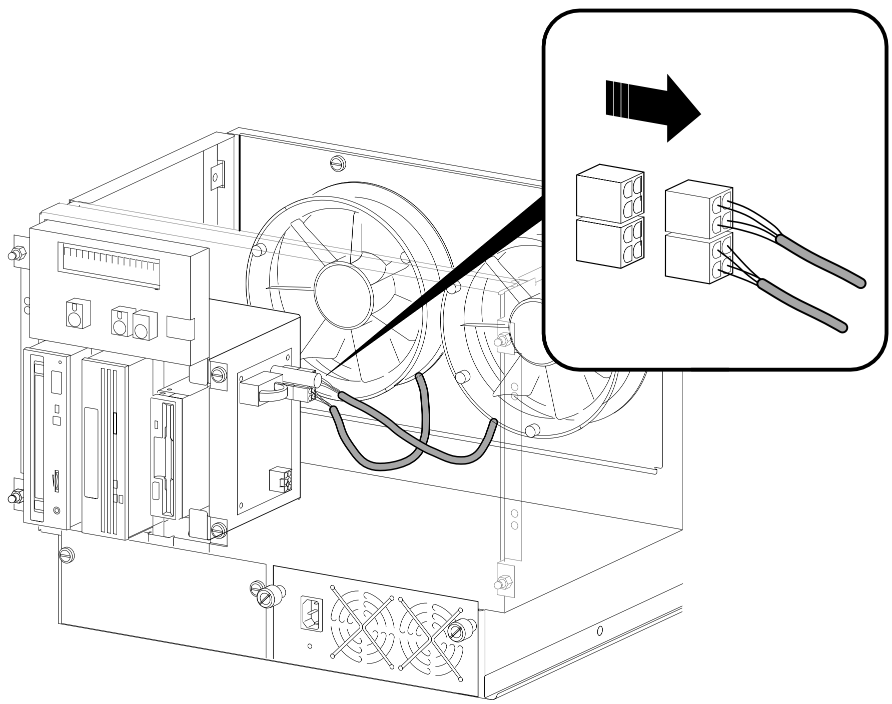
Note

To clear an event logged for test number 00 (CPU failover), use the `clear_error cpu#` command.

8.2.5 Fans

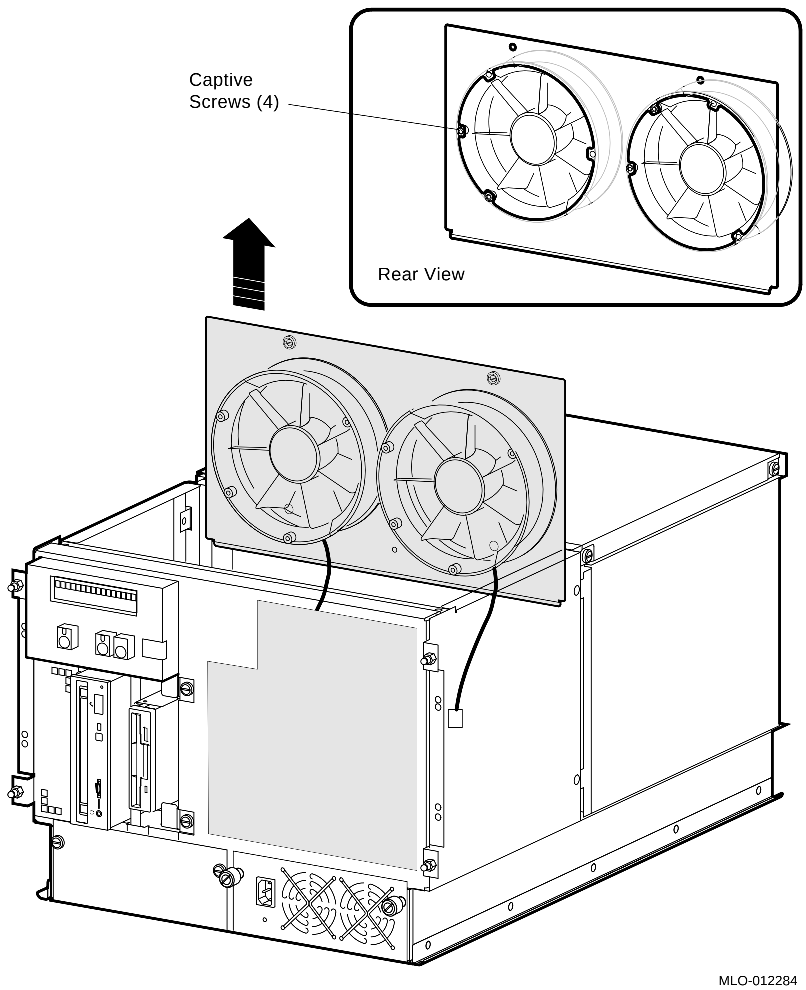
STEP 1: UNPLUG FANS.

Figure 8–20 Disconnecting Fan Cables



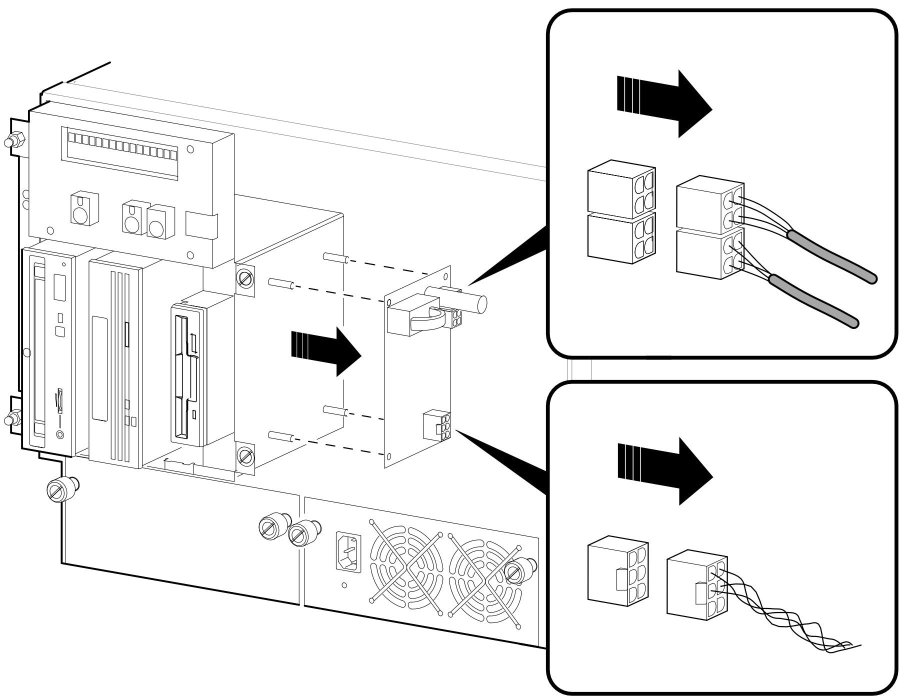
STEP 2: REMOVE FAN ASSEMBLY AND REPLACE FAILING FAN.

Figure 8–21 Removing Fan Assembly



8.2.6 Fan Speed Control Board

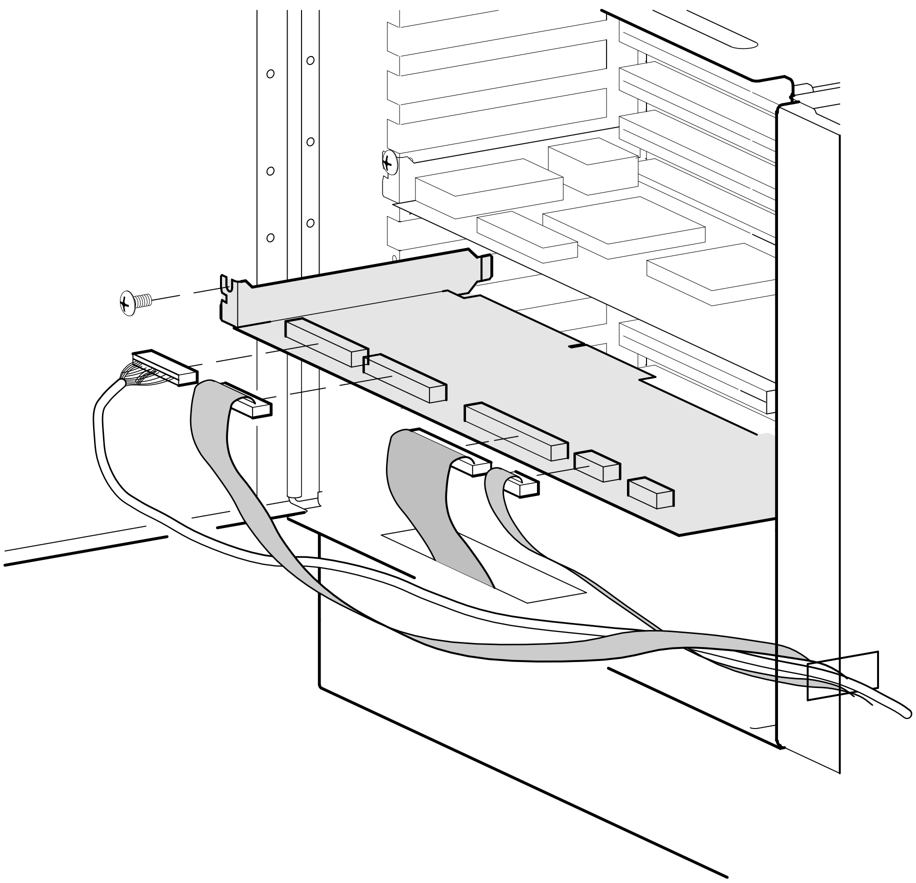
Figure 8–22 Removing Fan Speed Control Board



8.2.7 Standard I/O Module

STEP 1: DISCONNECT THE CABLES AND REMOVE THE MODULE.

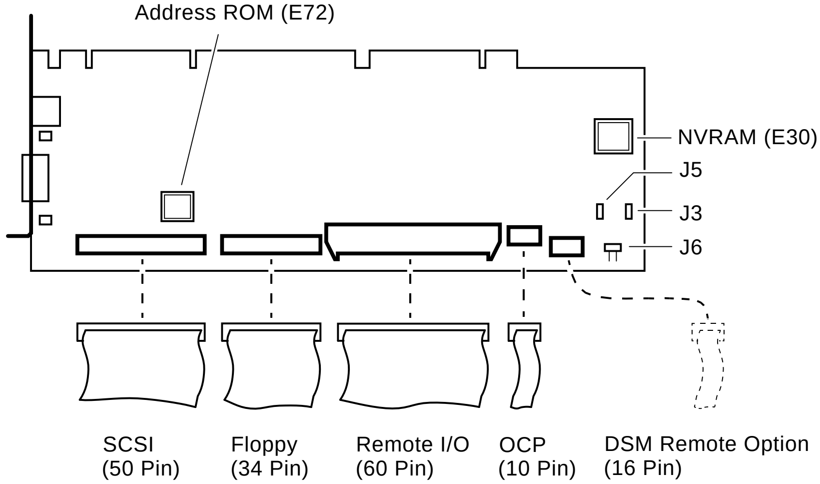
Figure 8–23 Removing Standard I/O Module



STEP 2: MOVE CHIPS TO NEW MODULE.

Move the socketed Ethernet station address ROM (position E72) and NVRAM chip (position E30) to the replacement standard I/O module and set jumpers to match previous settings.

Figure 8–24 Standard I/O Module: Jumpers, Connectors, and Swapable Chips

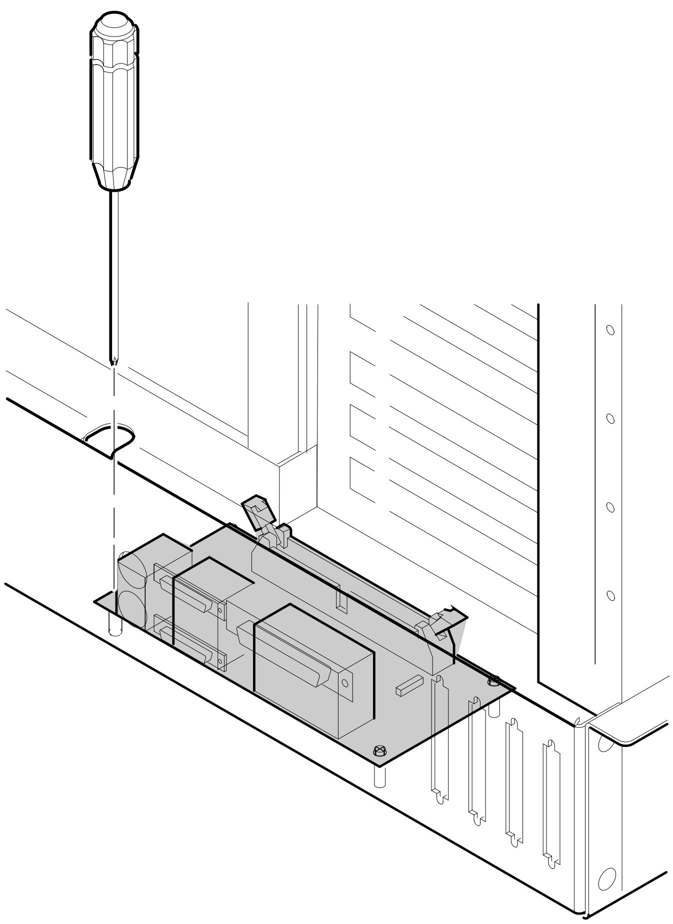


J3–Power supply mode: When installed, dual power supplies operate in redundant mode.
J5–Program voltage: Internal use only.
J6–Fail-Safe: When installed, selects the fail-safe loader firmware.

8.2.8 Remote I/O Module

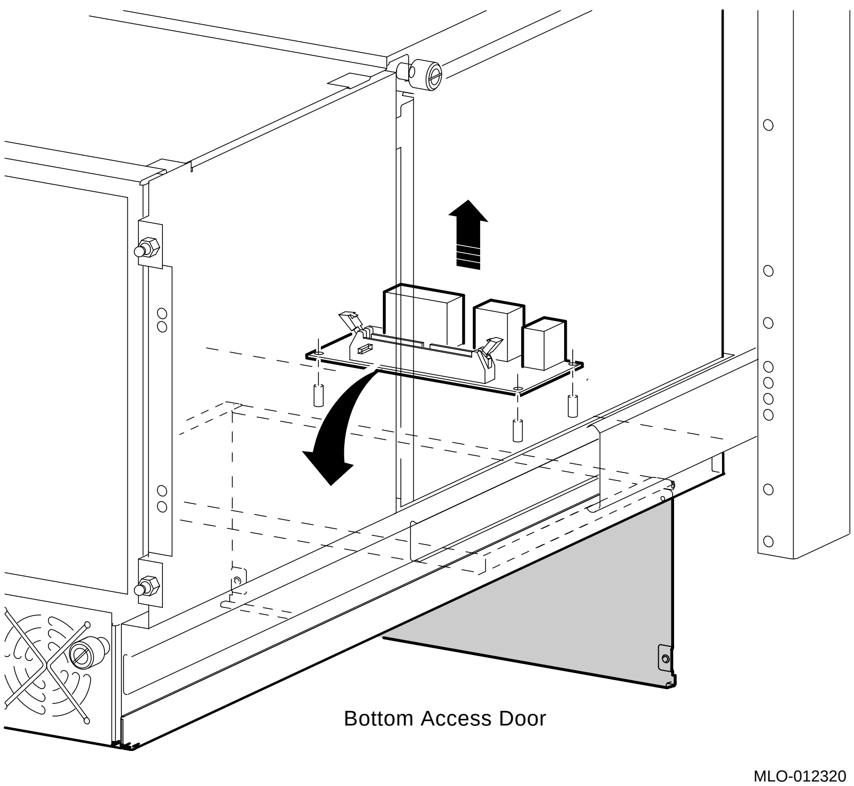
STEP 1: REMOVE SCREW AT REAR CUTOUT.

Figure 8–25 Removing Remote I/O Screw at Rear Cutout



STEP 2: REMOVE REMOTE I/O MODULE THOUGH BOTTOM COVER.

Figure 8–26 Removing the Remote I/O Panel



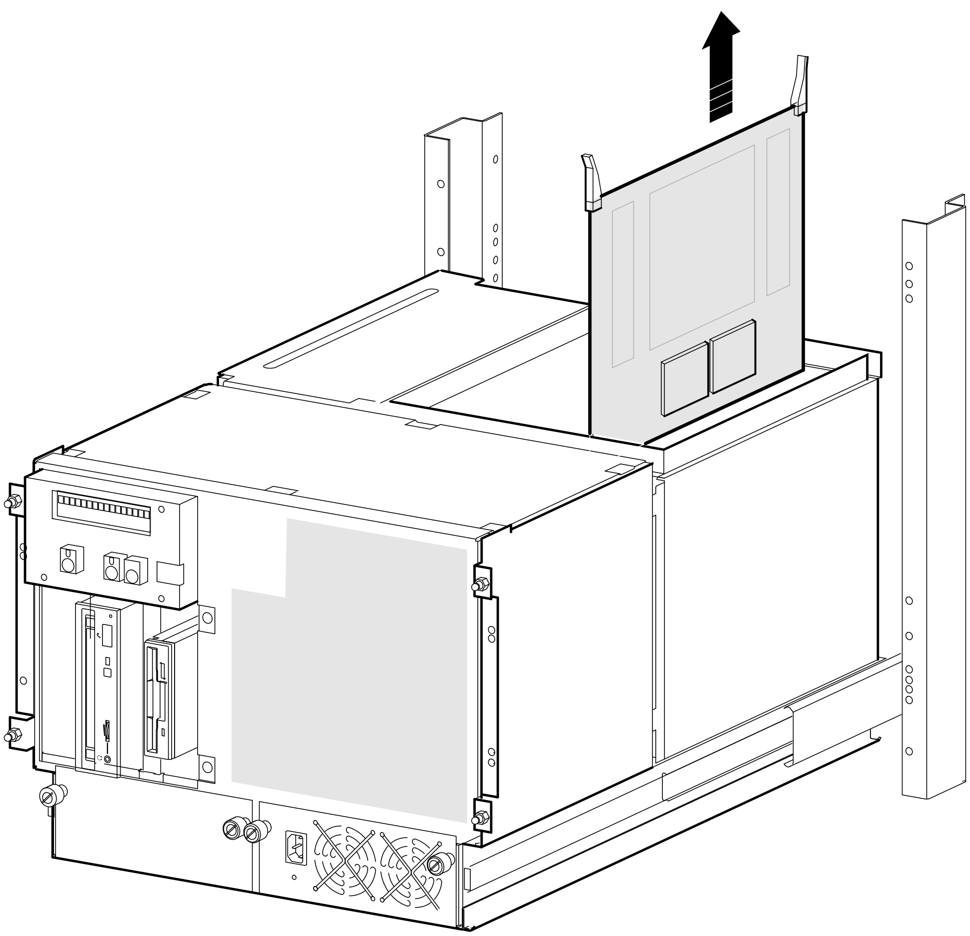
8.2.9 Memory Modules

Note

All system bus slots must be populated with a printed circuit board (PCB) module or a clear plastic module to assure proper airflow over each PCB module.

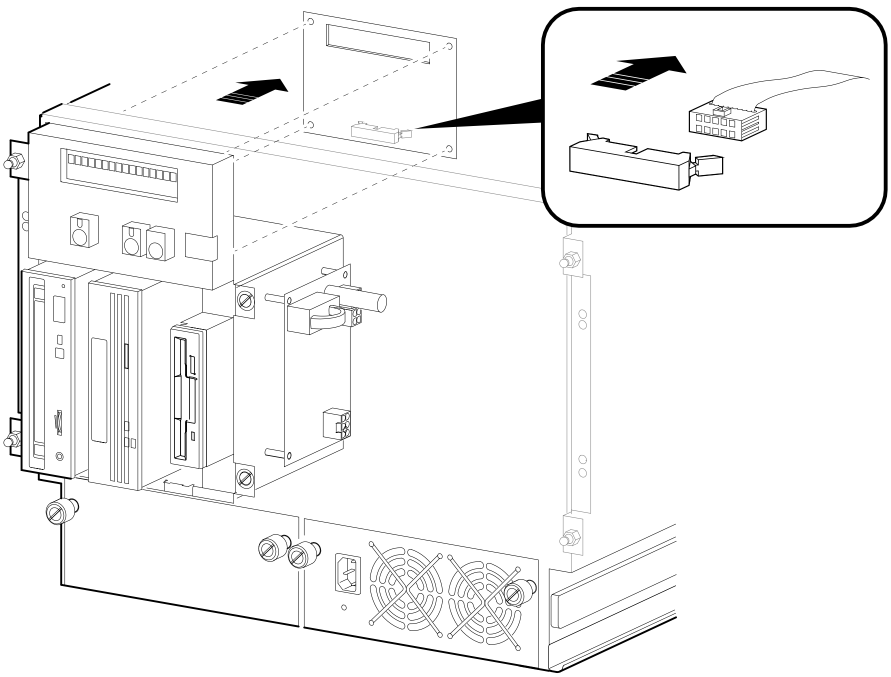
Warning: Memory and CPU modules have parts that operate at high temperatures. Wait 2 minutes after power is removed before handling these modules.

Figure 8–27 Removing Memory Modules



8.2.10 OCP Module

Figure 8–28 Removing OCP Module



8.2.11 Power Supply

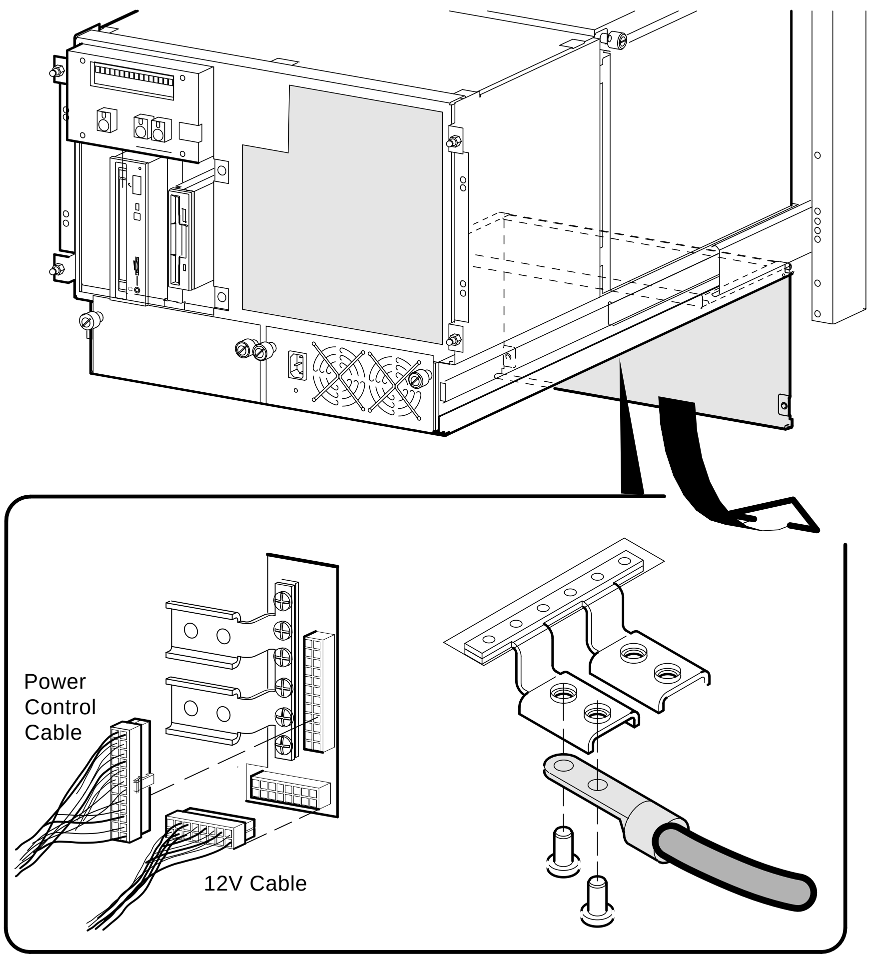
STEP 1: REMOVE POWER SUPPLY CONTROL AND 12V CABLES.

STEP 2: UNSCREW 3V AND 5V LEADS FROM POWER BUS BARS.

Use a number two Phillips screwdriver to remove the power supply leads.

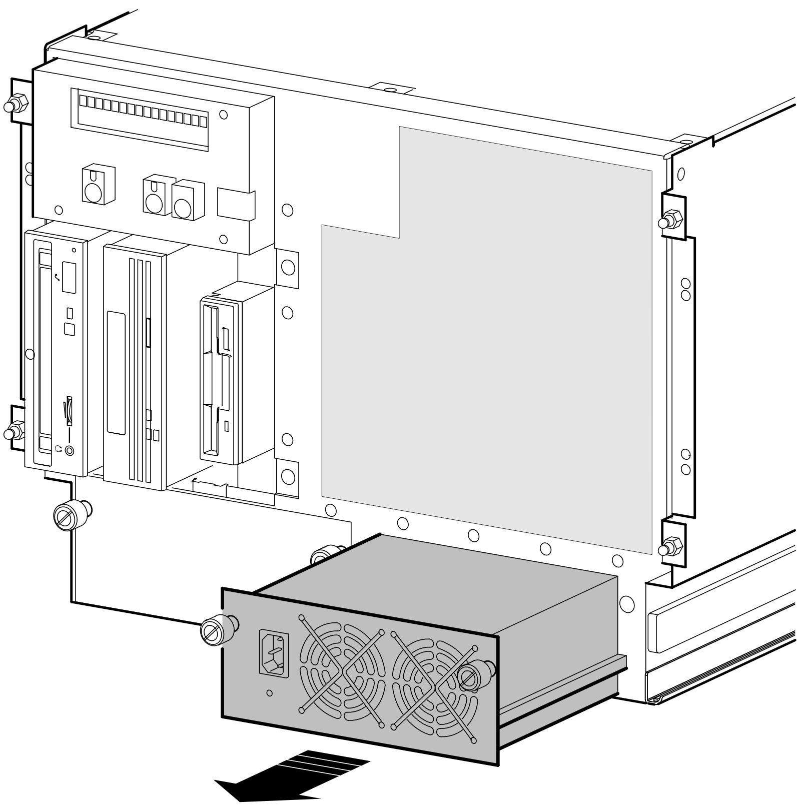
When reinstalling cables, refer to Figure 8–37.

Figure 8–29 Removing Power Supply Cables



STEP 3: REMOVE POWER SUPPLY.

Figure 8–30 Removing Power Supply

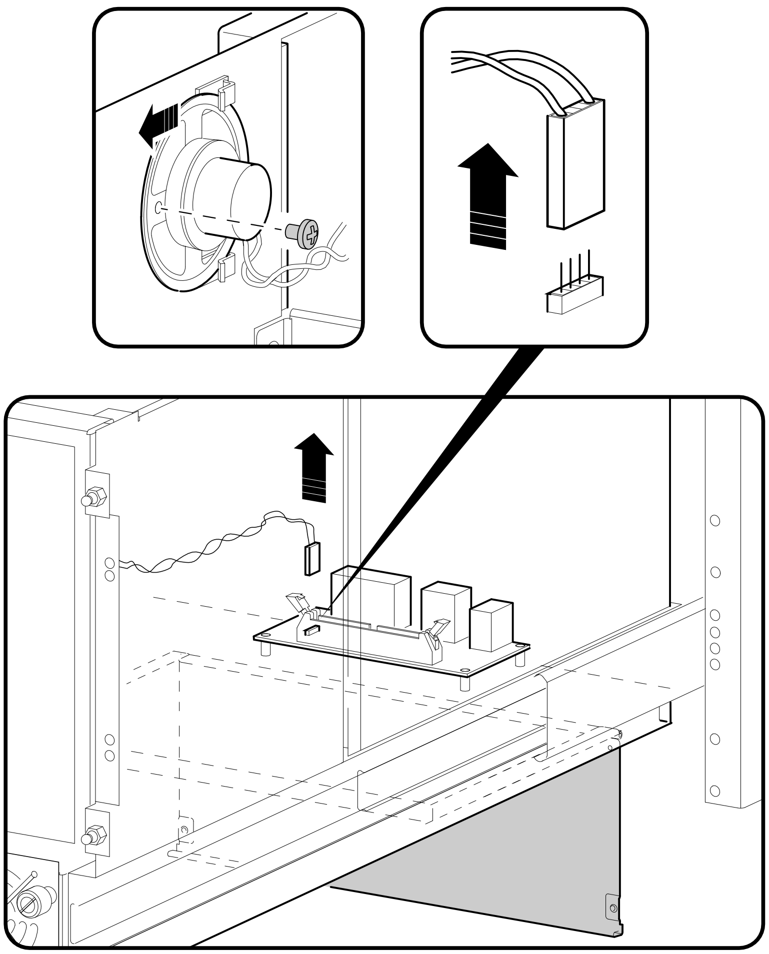


MLO-012271

Warning: Hazardous voltages contained within. Do not service. Return to factory for service.

8.2.12 Speaker

Figure 8–31 Removing Speaker

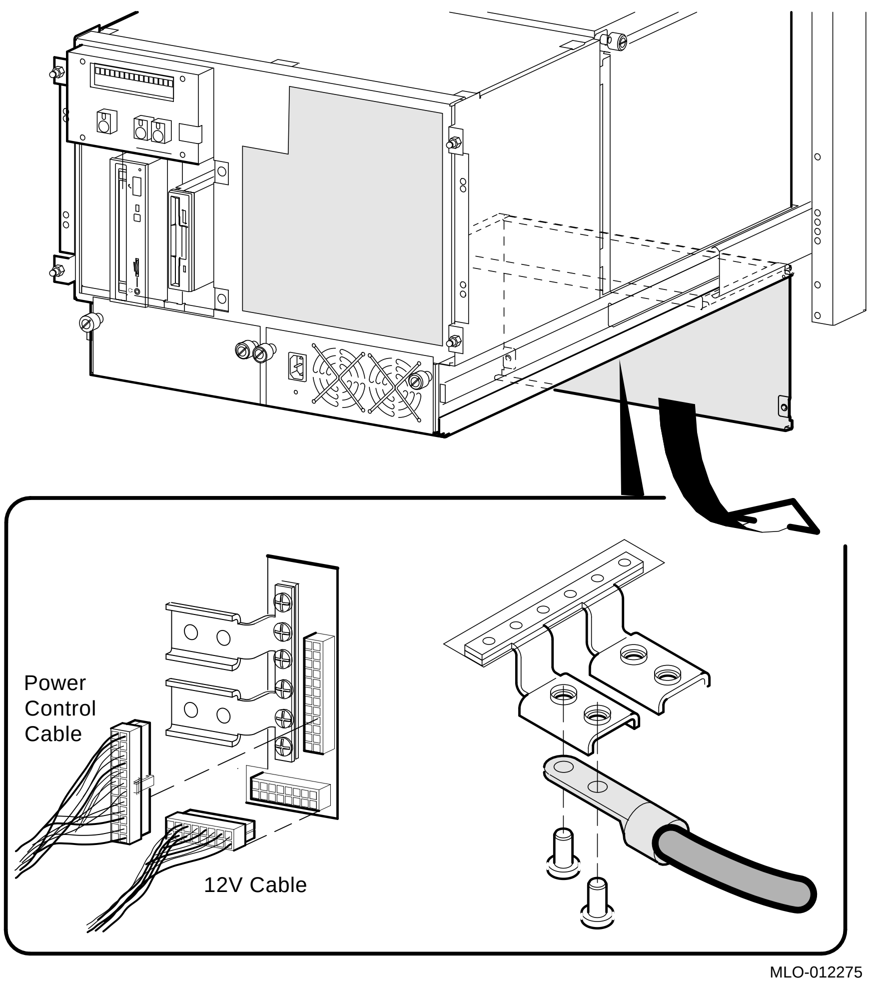


8.2.13 Motherboard

STEP 1: REMOVE ALL POWER SUPPLY CABLES FROM MOTHERBOARD.

From the bottom cover, remove the power supply control and 12V cables from their connectors beneath the motherboard. Unscrew the 3V and 5V leads from the power bus bars. When reinstalling cables, refer to Figure 8–37.

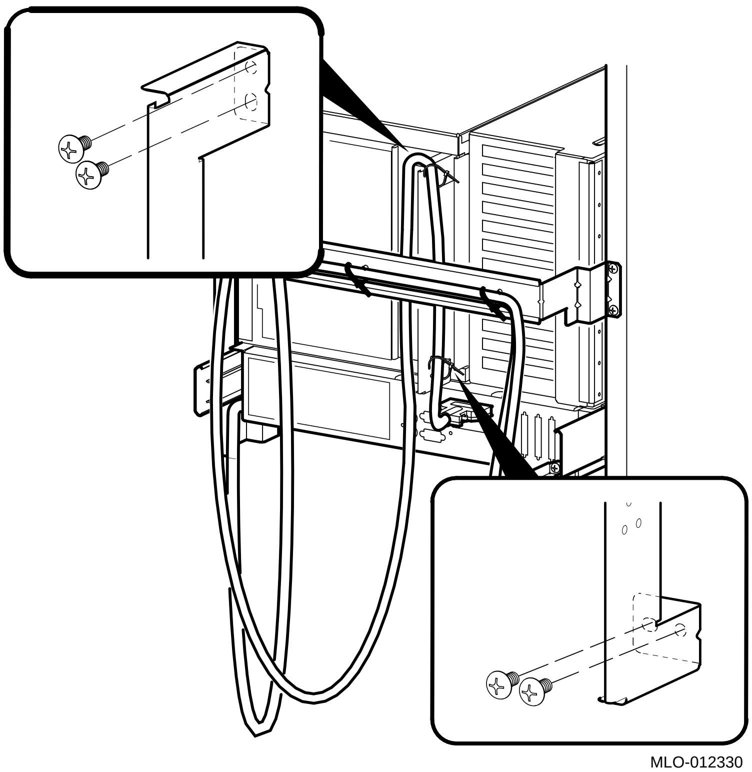
Figure 8–32 Removing Power Supply Cables from Motherboard



STEP 2: REMOVE CABLE BRACKET FROM REAR.

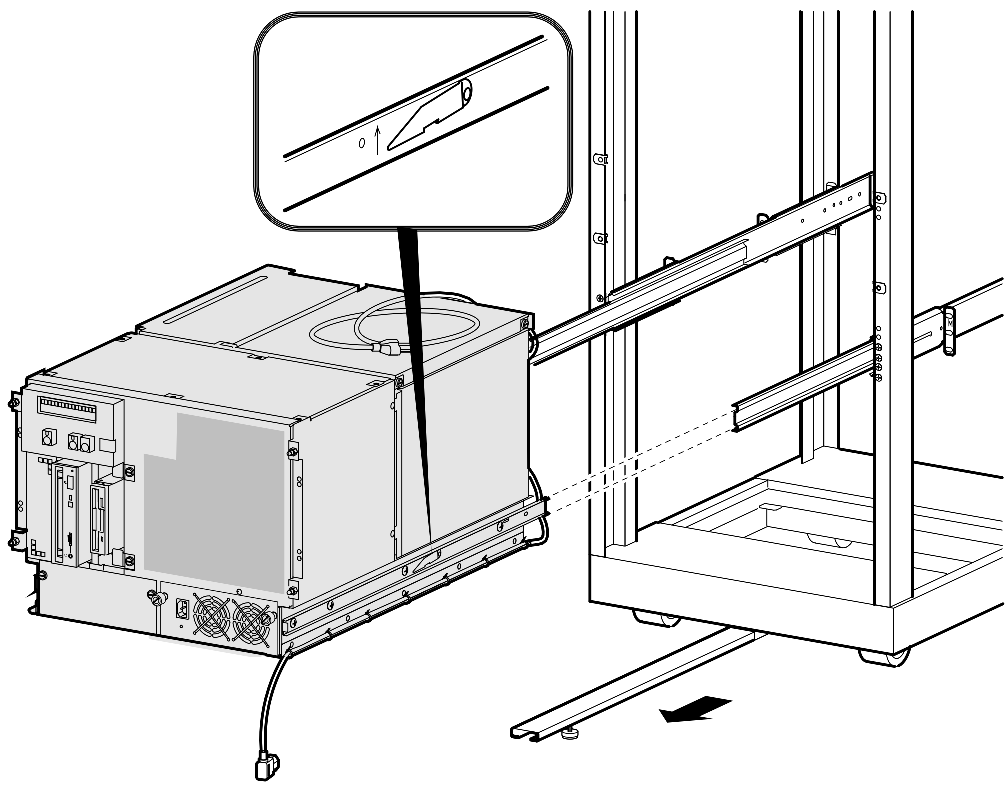
Cables can remain attached to the cable bracket.

Figure 8–33 Removing Cable Bracket from Rear of System



STEP 3: REMOVE ENCLOSURE FROM CABINET.

Figure 8–34 Removing Enclosure from Cabinet



Warning

Use sufficient personnel and proper equipment when lifting and moving the rackmount server system. The fully loaded system weighs 45.5 kg (100 lb.)

STEP 4: REMOVE CPU AND MEMORY MODULES.

Warning: Memory and CPU modules have parts that operate at high temperatures. Wait 2 minutes after power is removed before handling these modules.

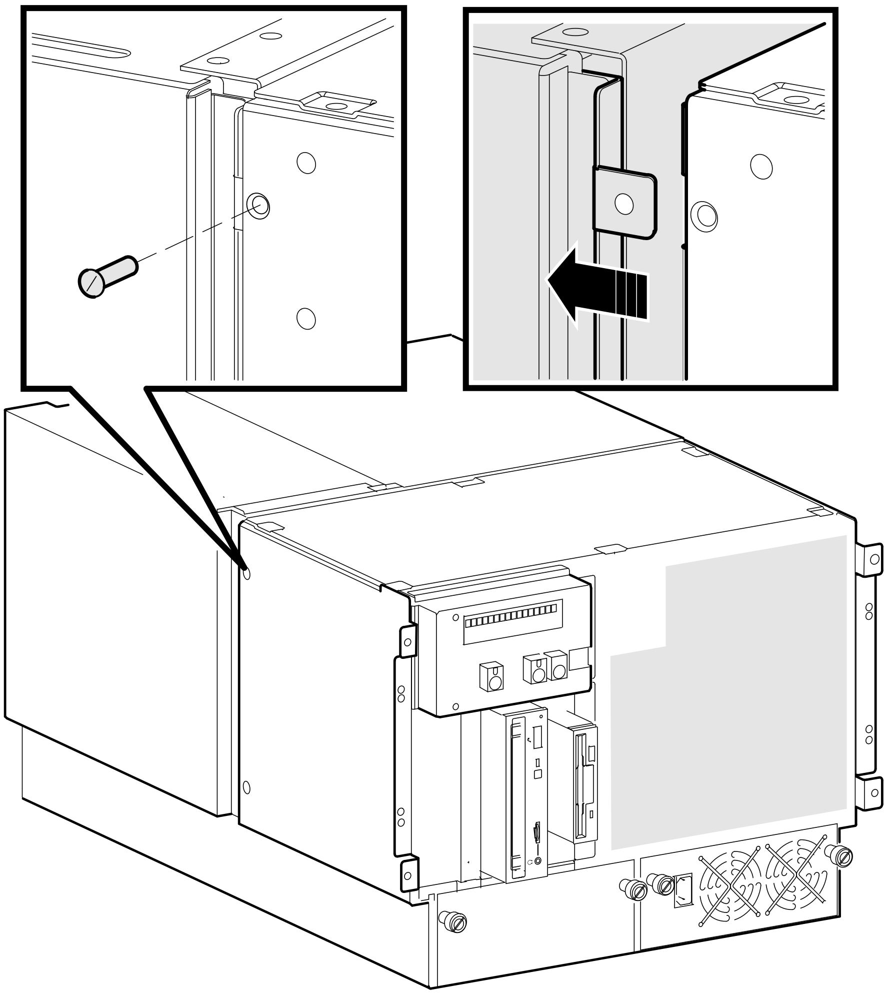
STEP 5: REMOVE ANY CABLES EXITING THE PCI/EISA BUS COMPARTMENT.

Unplug and remove the standard I/O cables from the PCI/EISA bus compartment. Remove any other cables that exit from the PCI/EISA bus compartment. If you are going to replace the PCI/EISA bus daughter board, remove all modules from the compartment as well.

STEP 6: SEPARATE THE FRONT AND REAR HALVES OF THE ENCLOSURE.

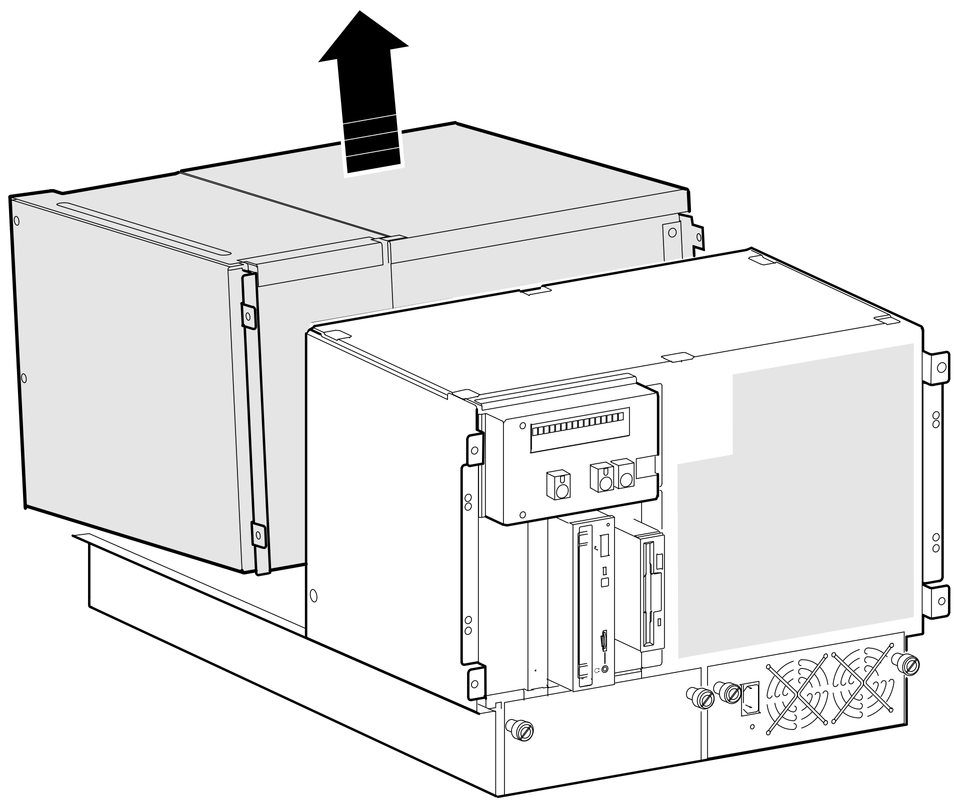
Remove the four screws and pull the rear half back until it separates from the front.

Figure 8–35 Separating Rackmount Enclosure



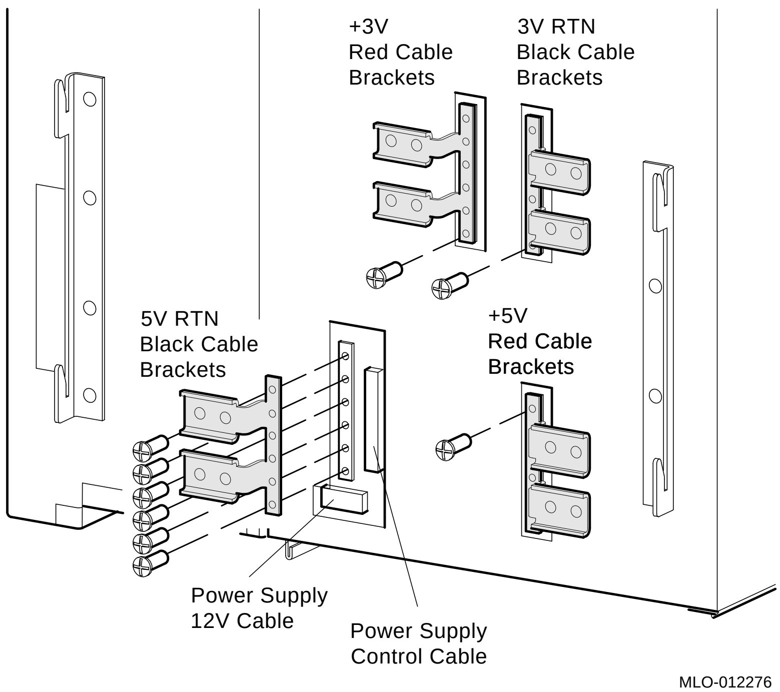
STEP 7: LIFT OFF REAR HALF AND STAND ON REAR.

Figure 8–36 Lifting Off Rear Half



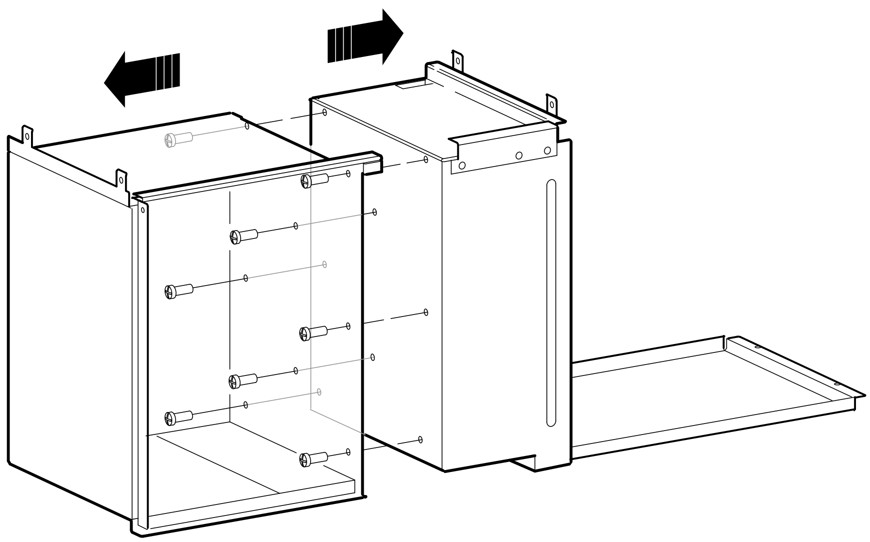
STEP 8: REMOVE FOUR POWER BUS BARS.

Figure 8–37 Removing Power Bus Bar



STEP 9: SEPARATE SYSTEM BUS AND PCI/EISA BUS COMPARTMENTS

Figure 8–38 Separating System Bus and PCI/EISA Bus Compartments



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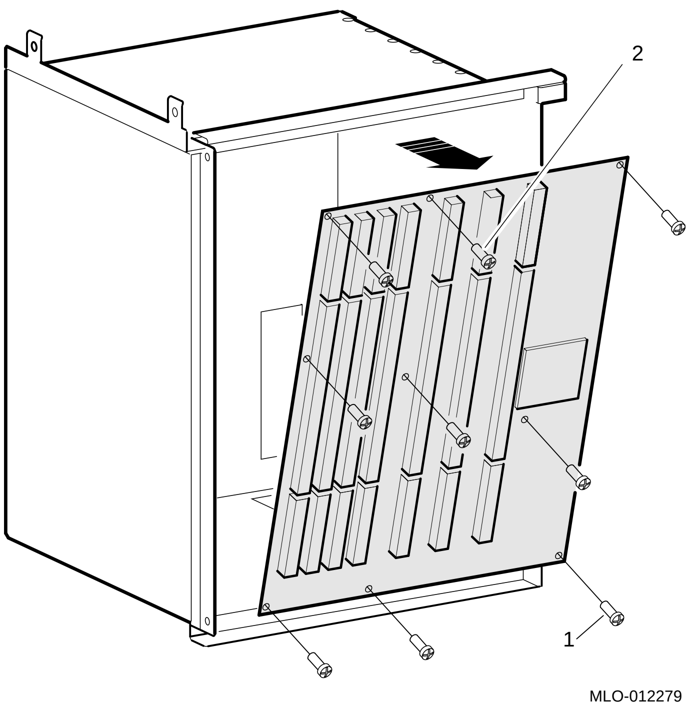
STEP 10: REMOVE SYSTEM BUS MOTHERBOARD.

Figure 8–39 Removing System Bus Motherboard

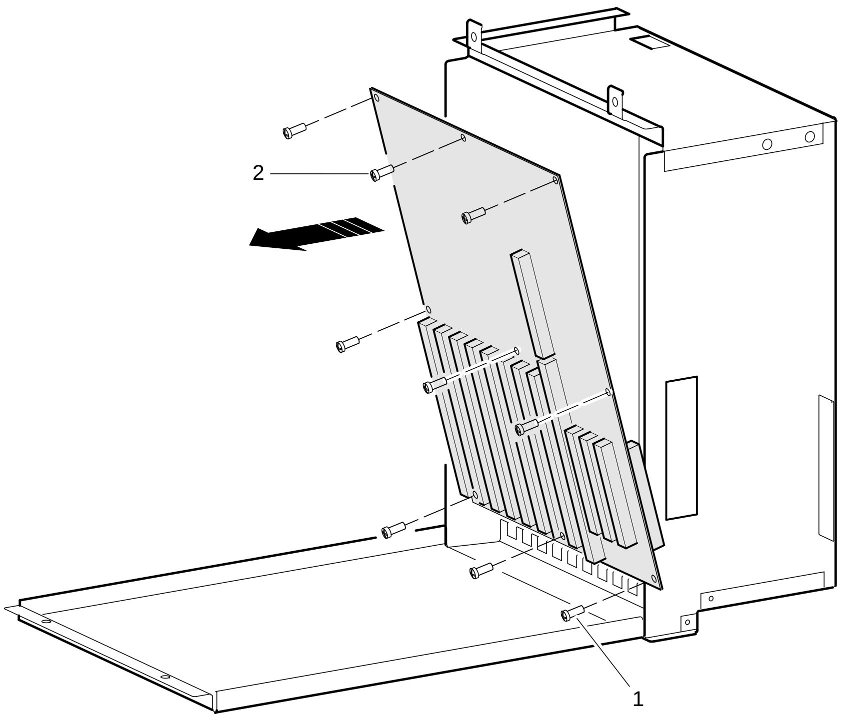


Note

When replacing module, install screws in order indicated.

STEP 11: REMOVE PCI/EISA DAUGHTER BOARD.

Figure 8–40 Removing PCI/EISA Daughter Board



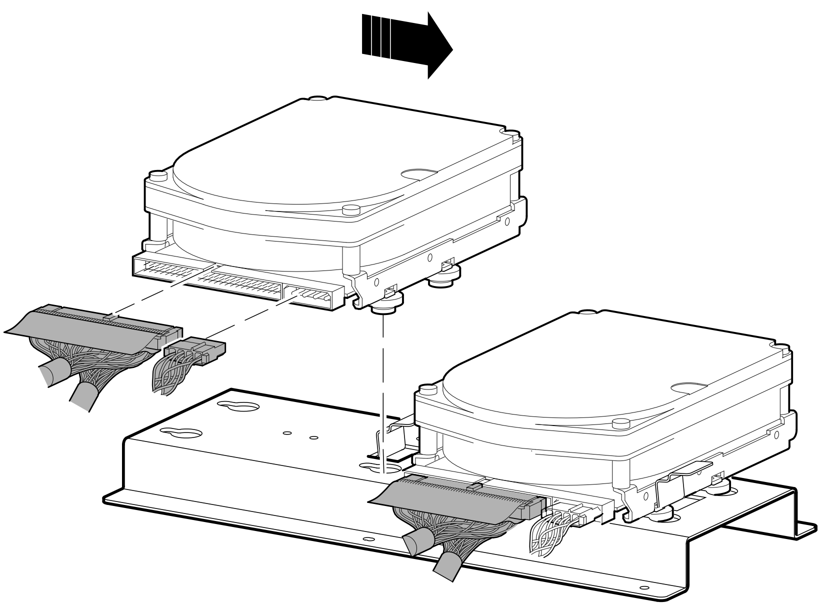
Note

When replacing module, install screws in order indicated.

8.2.14 Fixed Disk Drives

Removing the fan assembly provides more room to access storage device connecters.

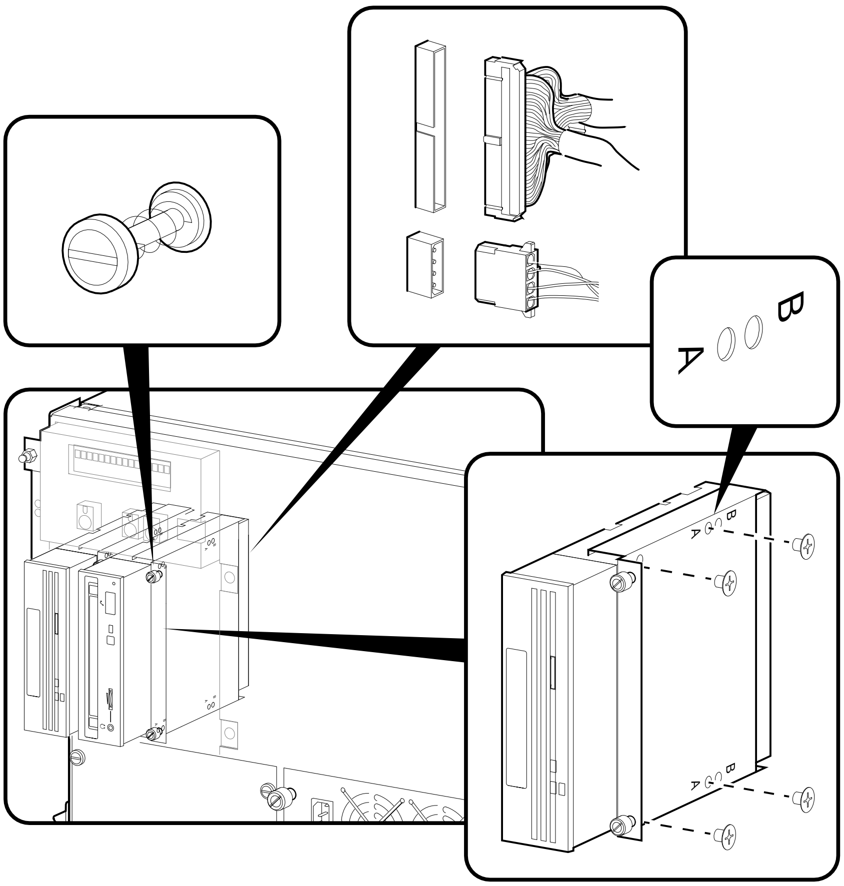
Figure 8–41 Removing Fixed Disk Drives



8.2.15 Removable Media

Removing the fan assembly provides more room to access storage device connecters. Slide drive to the right and lift to remove.

Figure 8–42 Removing a Removable-Media Drive

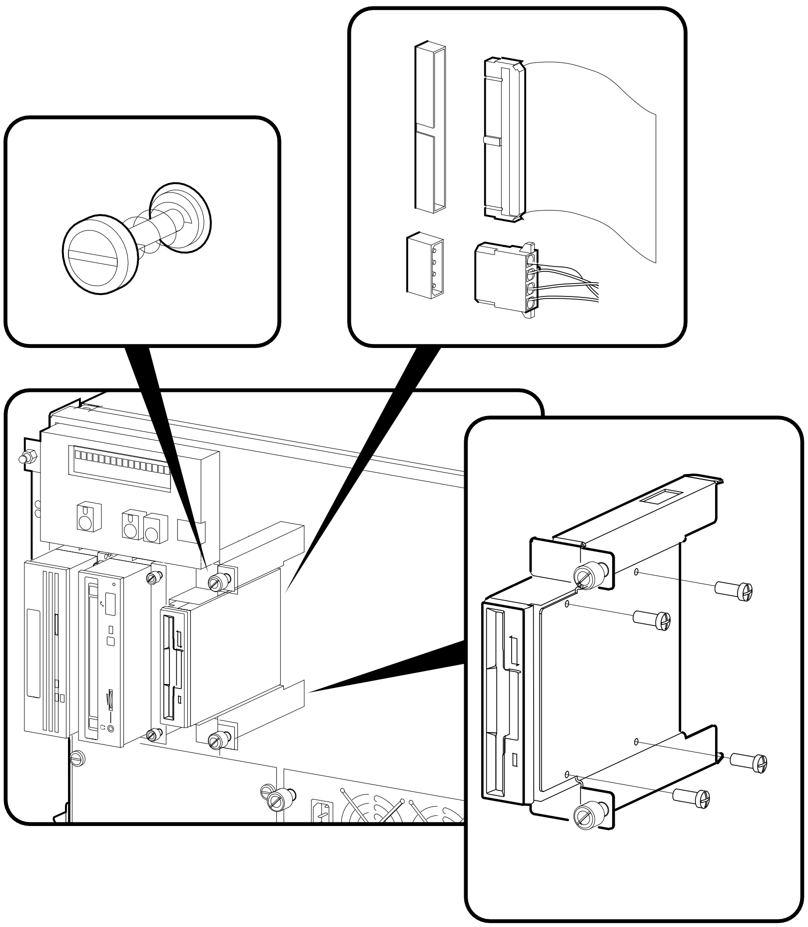


Note

RRDnn and TLZ0n drives use the set of bracket holes marked “A” in Figure 8–42.

The TZK11 drive uses the set of bracket holes marked “B” in Figure 8–42.

Figure 8–43 Removing Floppy Drive



Glossary

10BASE-T Ethernet network

IEEE standard 802.3-compliant Ethernet products used for local distribution of data. These networking products characteristically use twisted-pair cable.

ARC

User interface to the console firmware for operating systems that require firmware compliance with the *Windows NT Portable Boot Loader Specification*. ARC stands for Advanced RISC Computing.

AUI Ethernet network

Attachment unit interface. An IEEE standard 802.3-compliant Ethernet network connected with standard Ethernet cable.

autoboot

A system boot initiated automatically by software when the system is powered up or reset.

availability

The amount of scheduled time that a computing system provides application service during the year. Availability is typically measured as either a percentage of uptime per year or as system unavailability, the number of hours or minutes of downtime per year.

BA350 storage shelf

A StorageWorks modular storage shelf used for disk storage in some AlphaServer systems.

BA720 enclosure

The enclosure that houses the AlphaServer 2000 deskside pedestal system.

BA740 enclosure

The enclosure that houses the AlphaServer 2100 large pedestal system.

BA741 enclosure

The enclosure that houses the AlphaServer 2100R rack-mountable system and AlphaServer 2200 cabinet system.

backplane

The main board or panel that connects all of the modules in a computer system.

backup cache

A second, very fast cache memory that is closely coupled with the processor.

bandwidth

Term used to express the rate of data transfer in a bus or I/O channel. It is expressed as the amount of data that can be transferred in a given time, for example megabytes per second.

battery backup unit

A battery unit that provides power to the entire system enclosure (or to an expander enclosure) in the event of a power failure. Another term for uninterruptible power supply (UPS).

boot

Short for bootstrap. To load an operating system into memory.

boot device

The device from which the system bootstrap software is acquired.

boot flags

A flag is a system parameter set by the user. Boot flags contain information that is read and used by the bootstrap software during a system bootstrap procedure.

boot server

A computer system that provides boot services to remote devices such as network routers.

bootstrap

The process of loading an operating system into memory.

bugcheck

A software condition, usually the response to software's detection of an "internal inconsistency," which results in the execution of the system bugcheck code.

bus

A collection of many transmission lines or wires. The bus interconnects computer system components, providing a communications path for addresses, data, and control information or external terminals and systems in a communications network.

bystander

A system bus node (CPU, standard I/O, or memory) that is not addressed by a current system bus commander.

byte

A group of eight contiguous bits starting on an addressable byte boundary. The bits are numbered right to left, 0 through 7.

cache memory

A small, high-speed memory placed between slower main memory and the processor. A cache increases effective memory transfer rates and processor speed. It contains copies of data recently used by the processor and fetches several bytes of data from memory in anticipation that the processor will access the next sequential series of bytes.

card cage

A mechanical assembly in the shape of a frame that holds modules against the system and storage backplanes.

carrier

The individual container for all StorageWorks devices, power supplies, and so forth. In some cases because of small form factors, more than one device can be mounted in a carrier. Carriers can be inserted in modular shelves. Modular shelves can be mounted in modular enclosures.

CD–ROM

A read-only compact disc. The optical removable media used in a compact disc reader.

central processing unit (CPU)

The unit of the computer that is responsible for interpreting and executing instructions.

client-server computing

An approach to computing whereby a computer—the "server"—provides a set of services across a network to a group of computers requesting those services—the "clients."

cluster

A group of networked computers that communicate over a common interface. The systems in the cluster share resources, and software programs work in close cooperation.

cold bootstrap

A bootstrap operation following a power-up or system initialization (restart). On Alpha AXP based systems, the console loads PALcode, sizes memory, and initializes environment variables.

commander

In a particular bus transaction, a CPU or standard I/O that initiates the transaction.

command line interface

One of two modes of operation in the AlphaServer operator interface. The command line interface supports the OpenVMS and DEC OSF/1 operating systems. It allows you to configure and test the system, examine and alter system state, and boot the operating system.

console mode

The state in which the system and the console terminal operate under the control of the console program.

console program

The code that the executes during console mode.

console subsystem

The subsystem that provides the user interface for a computer system when the operating system is not running.

console terminal

The terminal connected to the console subsystem. It is used to start the system and direct activities between the computer operator and the console subsystem.

CPU failover

On multiprocessor systems, functionality that allows the system to power up and boot the operating system even if only one CPU is working.

data bus

A bus used to carry data between two or more components of the system.

data cache

A high-speed cache memory reserved for the storage of data. Abbreviated as D-cache.

DECchip 21064 processor

The CMOS, single-chip processor based on the Alpha AXP architecture and used on many AlphaGeneration computers.

DEC OSF/1 Version 2.0 for AXP systems

A general-purpose operating system based on the Open Software Foundation OSF/1 2.0 technology. DEC OSF/1 V2.0 runs on the range of AlphaGeneration systems, from workstations to servers.

DEC VET

Digital DEC Verifier and Exerciser Tool. A multipurpose system diagnostic tool that performs exerciser-oriented maintenance testing.

diagnostic program

A program that is used to find and correct problems with a computer system.

direct-mapping cache

A cache organization in which only one address comparison is needed to locate any data in the cache, because any block of main memory data can be placed in only one possible position in the cache.

direct memory access (DMA)

Access to memory by an I/O device that does not require processor intervention.

DRAM

Dynamic random-access memory. Read/write memory that must be refreshed (read from or written to) periodically to maintain the storage of information.

DSSI

Digital's proprietary data bus that uses the System Communication Architecture (SCA) protocols for direct host-to-storage communications.

DSSI cluster

A cluster system that uses the DSSI bus as the interconnect between DSSI disks and systems.

DUP server

Diagnostic Utility Program server. A firmware program on-board DSSI devices that allows a user to set host to a specified device in order to run internal tests or modify device parameters.

ECC

Error correction code. Code and algorithms used by logic to facilitate error detection and correction.

EEPROM

Electrically erasable programmable read-only memory. A memory device that can be byte-erased, written to, and read from.

EISA bus

Extended Industry Standard Architecture bus. A 32-bit industry-standard I/O bus used primarily in high-end PCs and servers.

EISA Configuration Utility (ECU)

A feature of the EISA bus that helps you select a conflict-free system configuration and perform other system services. The ECU must be run whenever you change, add, or remove an EISA or ISA controller.

environment variables

Global data structures that can be accessed only from console mode. The setting of these data structures determines how a system powers up, boots the operating system, and operates.

Ethernet

IEEE 802.3 standard local area network.

ERF/UERF

Error Report Formatter. ERF is used to present error log information for OpenVMS. UERF is used to present error log information for DEC OSF/1.

Factory Installed Software (FIS)

Operating system software that is loaded into a system disk during manufacture. On site, the FIS is bootstrapped in the system.

fail-safe loader (FSL)

A program that allows you to power up without initiating drivers or running power-up diagnostics. From the fail-safe loader you can perform limited console functions.

Fast SCSI

An optional mode of SCSI-2 that allows transmission rates of up to 10 megabytes per second.

FDDI

Fiber Distributed Data Interface. A high-speed networking technology that uses fiber optics as the transmissions medium.

FIB

Flexible interconnect bridge. A converter that allows the expansion of the system enclosure to other DSSI devices and systems.

field-replaceable unit

Any system component that a qualified service person is able to replace on site.

firmware

Software code stored in hardware.

fixed-media compartments

Compartments that house nonremovable storage media.

Flash ROM

Flash-erasable programmable read-only memory. Flash ROMs can be bank- or bulk-erased.

FRU

Field-replaceable unit. Any system component that a qualified service person is able to replace on site.

full-height device

Standard form factor for 5 1/4-inch storage devices.

half-height device

Standard form factor for storage devices that are not the height of full-height devices.

halt

The action of transferring control of the computer system to the console program.

hose

The interface between the card cage and the I/O subsystems.

hot swap

The process of removing a device from the system without shutting down the operating system or powering down the hardware.

initialization

The sequence of steps that prepare the computer system to start. Occurs after a system has been powered up.

instruction cache

A high-speed cache memory reserved for the storage of instructions. Abbreviated as I-cache.

interrupt request lines (IRQs)

Bus signals that connect an EISA or ISA module (for example, a disk controller) to the system so that the module can get the system's attention via an interrupt.

I/O backplane

One of two backplanes on the AlphaServer 2000 system. The I/O backplane contains three PCI option slots and seven EISA option slots. It also contains a SCSI channel, diskette controller, two serial ports, and a parallel printer port.

ISA

Industry Standard Architecture. An 8-bit or 16-bit industry-standard I/O bus, widely used in personal computer products. The EISA bus is a superset of the ISA bus.

LAN

Local area network. A high-speed network that supports computers that are connected over limited distances.

latency

The amount of time it takes the system to respond to an event.

LED

Light-emitting diode. A semiconductor device that glows when supplied with voltage. A LED is used as an indicator light.

loopback test

Internal and external tests that are used to isolate a failure by testing segments of a particular control or data path. A subset of ROM-based diagnostics.

machine check/interrupts

An operating system action triggered by certain system hardware-detected errors that can be fatal to system operation. Once triggered, machine check handler software analyzes the error.

mass storage device

An input/output device on which data is stored. Typical mass storage devices include disks, magnetic tapes, and CD–ROM.

MAU

Medium attachment unit. On an Ethernet LAN, a device that converts the encoded data signals from various cabling media (for example, fiber optic, coaxial, or ThinWire) to permit connection to a networking station.

memory interleaving

The process of assigning consecutive physical memory addresses across multiple memory controllers. Improves total memory bandwidth by overlapping system bus command execution across multiple memory modules.

menu interface

One of two modes of operation in the AlphaServer operator interface. Menu mode lets you boot and configure the Windows NT operating system by selecting choices from a simple menu. The EISA Configuration Utility is also run from the menu interface.

modular shelves

In the StorageWorks modular subsystem, a shelf contains one or more modular carriers, generally up to a limit of seven. Modular shelves can be mounted in system enclosures, in I/O expansion enclosures, and in various StorageWorks modular enclosures.

MOP

Maintenance Operations Protocol. A transport protocol for network bootstraps and other network operations.

motherboard

The main circuit board of a computer. The motherboard contains the base electronics for the system (for example, base I/O, CPU, ROM, and console serial line unit) and has connectors where options (such as I/Os and memories) can be plugged in.

multiprocessing system

A system that executes multiple tasks simultaneously.

node

A device that has an address on, is connected to, and is able to communicate with other devices on a bus. Also, an individual computer system connected to the network that can communicate with other systems on the network.

NVRAM

Nonvolatile random-access memory. Memory that retains its information in the absence of power.

OCP

Operator control panel.

open system

A system that implements sufficient open specifications for interfaces, services, and supporting formats to enable applications software to:

- Be ported across a wide range of systems with minimal changes
- Interoperate with other applications on local and remote systems
- Interact with users in a style that facilitates user portability

OpenVMS AXP operating system

A general-purpose multiuser operating system that supports AlphaGeneration computers in both production and development environments. OpenVMS AXP software supports industry standards, facilitating application portability and interoperability. OpenVMS AXP provides symmetric multiprocessing (SMP) support for AXP multiprocessing systems.

operating system mode

The state in which the system console terminal is under the control of the operating system. Also called program mode.

operator control panel

The panel located behind the front door of the system, which contains the power-up/diagnostic display, DC On/Off button, Halt button, and Reset button.

PALcode

Alpha AXP Privileged Architecture Library code, written to support Alpha AXP processors. PALcode implements architecturally defined behavior.

PCI

Peripheral Component Interconnect. An industry-standard expansion I/O bus that is the preferred bus for high-performance I/O options. Available in a 32-bit and a 64-bit version.

portability

The degree to which a software application can be easily moved from one computing environment to another.

porting

Adapting a given body of code so that it will provide equivalent functions in a computing environment that differs from the original implementation environment.

power-down

The sequence of steps that stops the flow of electricity to a system or its components.

power-up

The sequence of events that starts the flow of electrical current to a system or its components.

primary cache

The cache memory that is the fastest and closest to the processor.

processor module

Module that contains the CPU chip.

program mode

The state in which the system console terminal is under the control of a program other than the console program.

RAID

Redundant array of inexpensive disks. A technique that organizes disk data to improve performance and reliability. RAID has three attributes:

- It is a set of physical disks viewed by the user as a single logical device.
- The user's data is distributed across the physical set of drives in a defined manner.
- Redundant disk capacity is added so that the user's data can be recovered even if a drive fails.

redundant

Describes duplicate or extra computing components that protect a computing system from failure.

reliability

The probability a device or system will not fail to perform its intended functions during a specified time.

responder

In any particular bus transaction, memory, CPU, or I/O that accepts or supplies data in response to a command/address from the system bus commander.

RISC

Reduced instruction set computer. A processor with an instruction set that is reduced in complexity.

ROM-based diagnostics

Diagnostic programs resident in read-only memory.

script

A data structure that defines a group of commands to be executed. Similar to a VMS command file.

SCSI

Small Computer System Interface. An ANSI-standard interface for connecting disks and other peripheral devices to computer systems. Some devices are supported under the SCSI-1 specification; others are supported under the SCSI-2 specification.

self-test

A test that is invoked automatically when the system powers up.

serial control bus

A two-conductor serial interconnect that is independent of the system bus. This bus links the processor modules, the I/O, the memory, the power subsystem, and the operator control panel.

serial ROM

In the context of the CPU module, ROM read by the DECchip microprocessor after reset that contains low-level diagnostic and initialization routines.

SIMM

Single in-line memory module.

SMP

Symmetric multiprocessing. A processing configuration in which multiple processors in a system operate as equals, dividing and sharing the workload.

SRM

User interface to console firmware for operating systems that expect firmware compliance with the *Alpha System Reference Manual (SRM)*.

standard I/O module

Module that provides a standard set of I/O functions on some AXP servers. It resides in a dedicated slot in the EISA bus card cage.

storage array

A group of mass storage devices, frequently configured as one logical disk.

StorageWorks

Digital's modular storage subsystem (MSS), which is the core technology of the Alpha AXP SCSI-2 mass storage solution. Consists of a family of low-cost mass storage products that can be configured to meet current and future storage needs.

superpipelined

Describes a pipelined processor that has a larger number of pipe stages and more complex scheduling and control.

superscalar

Describes a processor that issues multiple independent instructions per clock cycle.

symmetric multiprocessing (SMP)

A processing configuration in which multiple processors in a system operate as equals, dividing and sharing the workload.

symptom-directed diagnostics (SDDs)

An approach to diagnosing computer system problems whereby error data logged by the operating system is analyzed to capture information about the problem.

system backplane

One of two backplanes on the AlphaServer 2000 system. The system backplane supports up to two CPU modules, up to two memory modules, and an expansion I/O module.

system bus

The hardware structure that interconnects the CPUs and memory modules. Data processed by the CPU is transferred throughout the system via the system bus.

system disk

The device on which the operating system resides.

TCP/IP

Transmission Control Protocol/Internet Protocol. A set of software communications protocols widely used in UNIX operating environments.
TCP delivers data over a connection between applications on different computers on a network; IP controls how packets (units of data) are transferred between computers on a network.

test-directed diagnostics (TDDs)

An approach to diagnosing computer system problems whereby error data logged by diagnostic programs resident in read-only memory (RBDs) is analyzed to capture information about the problem.

thickwire

One-half inch, 50-Ohm coaxial cable that interconnects the components in many IEEE standard 802.3-compliant Ethernet networks.

ThinWire

Ethernet cabling and technology used for local distribution of data communications. ThinWire cabling is thinner than thickwire cabling.

Token Ring

A network that uses tokens to pass data sequentially. Each node on the network passes the token on to the node next to it.

twisted pair

A cable made by twisting together two insulated conductors that have no common covering.

uninterruptible power supply (UPS)

A battery-backup option that maintains AC power to a computer system if a power failure occurs.

warm bootstrap

A subset of the cold bootstrap operation. On AlphaGeneration systems, during a warm bootstrap, the console does not load PALcode, size memory, or initialize environment variables.

wide area network (WAN)

A high-speed network that connects a server to a distant host computer, PC, or other server, or that connects numerous computers in numerous distant locations.

Windows NT

“New technology” operating system owned by Microsoft, Inc. The AlphaServer systems currently support the Windows NT, OpenVMS, and DEC OSF/1 operating systems.

write back

A cache management technique in which data from a write operation to cache is written into main memory only when the data in cache must be overwritten.

write-enabled

Indicates a device onto which data can be written.

write-protected

Indicates a device onto which data cannot be written.

write through

A cache management technique in which data from a write operation is copied to both cache and main memory.

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