

CHALLENGE™ / Onyx™ XL Rackmount Installation Instructions

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Introduction

This manual introduces the Everest rackmount graphics and server systems (Model CMNA010) and provides the information necessary to install, configure, and test them. The information contained here is intended for Silicon Graphics® system support engineers (SSEs) or Silicon Graphics-trained personnel only.

This revision of the *CHALLENGE™/Onyx™ XL Rackmount Installation Instructions* includes the new AC power requirements, updated System Controller messages, as well as the optional Cardcage 3 installation and configuration instructions.

Product Overview

The Everest rack-mounted server system is sold as the CHALLENGE™ XL Rackmount and the graphics system is sold as the Onyx™ XL Rackmount. Both configurations consist of an Everest system board set mounted in a 19-inch rack chassis. Graphics machines include VTX™ and RealityEngine²™ board sets. A SCSI drive enclosure, capable of supporting eight half-height or four full-height drives, is also part of the standard configuration.

The rackmount chassis evolved from the POWER Center™ systems. The physical dimensions of the chassis are virtually identical to the POWER Center, except that the Everest chassis is 6 inches deeper. External views of the Everest rackmount chassis are shown in Figure I-1.

The most important departure from previous system chassis is the *midplane*. The midplane is a backplane that has connectors mounted on both sides. It is located in approximately the center of the chassis and supports both a front and a rear cardcage (see Figure I-2).

Another feature not seen on earlier systems is the System Controller. This component monitors the status of the system using an array of sensors as well as a direct serial link to the master CPU board. If the sensors indicate a problem, the System Controller can shut down the system without any input from the CPU.

The third important departure from previous chassis is the power distribution scheme. Referred to internally as “pay--as-you-go,” the Everest power subsystem uses from one to three modular *off-line switchers* (OLS) to convert the AC line power to the appropriate backplane voltage. A variety of power boards (DC-to-DC converters) are installed in the cardcages to convert the backplane voltage to voltages suitable for the boards and drives. The power boards vary in the voltages they supply and in the amperage available for a

given voltage. As system power requirements change, the power boards can be added or removed from the system.

Chapter 1, “Chassis Tour,” identifies the physical location and function of each of the Everest system components. Functional descriptions of both board sets are provided in Chapter 2, “Theory of Operations,” Steps to installing a rackmount system are provided in Chapter 3, “Installation.”

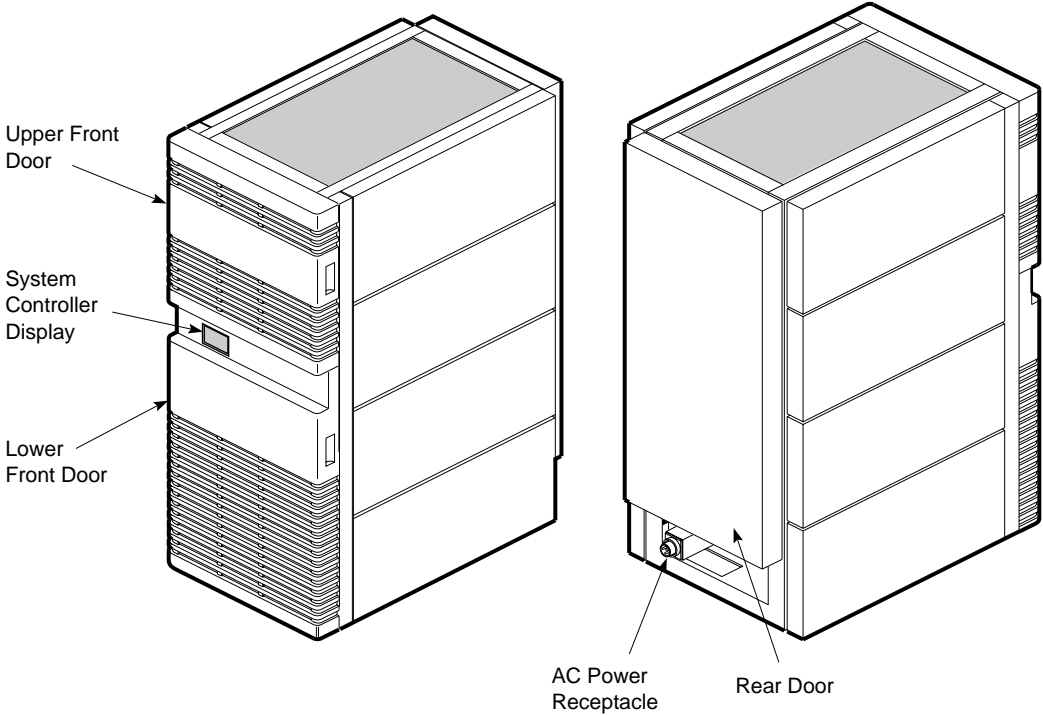


Figure I-1 Rackmount Chassis Front and Rear External Views

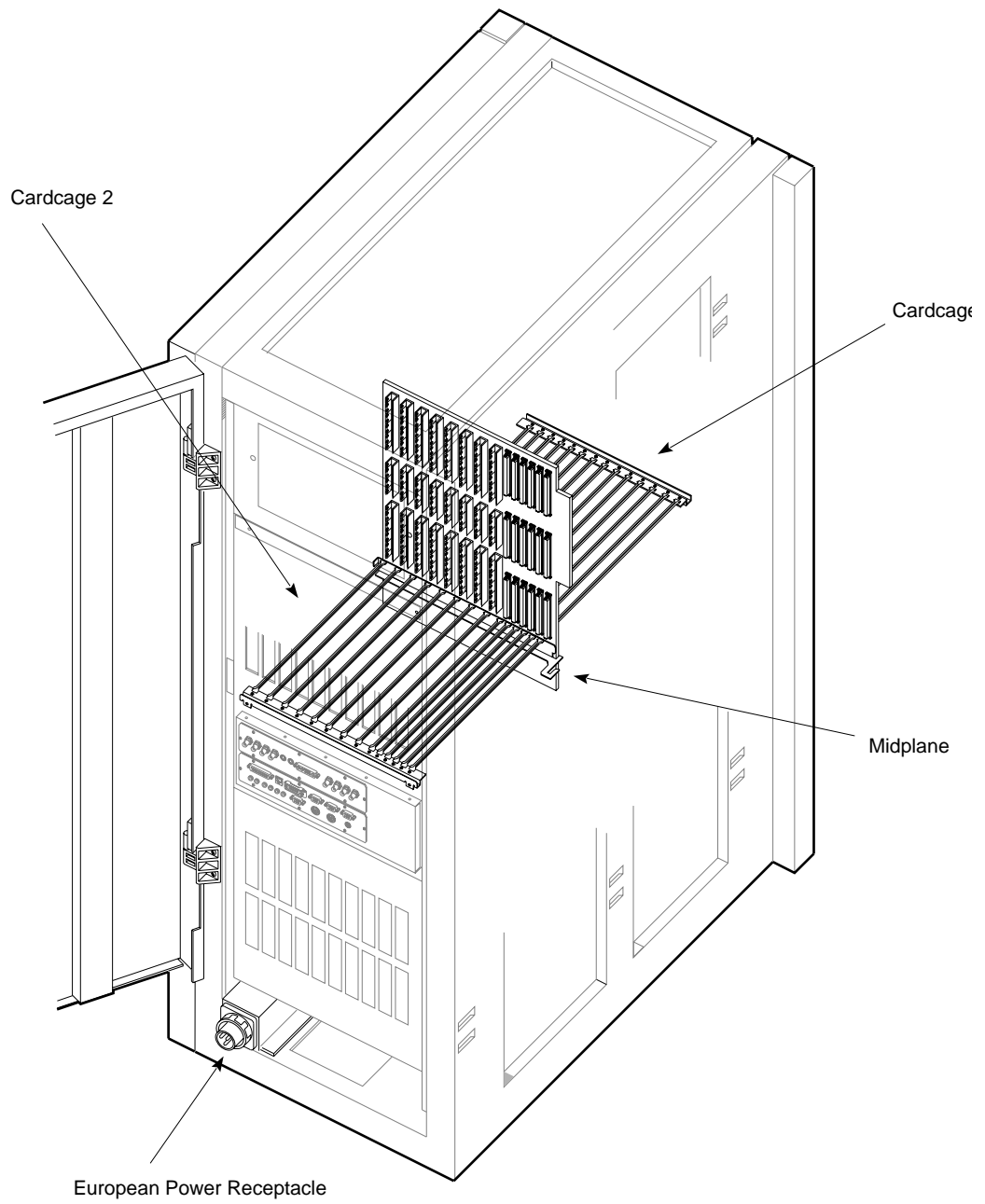


Figure I-2 Rackmount Chassis Midplane and Standard Cardcages

Chapter 1

Chassis Tour

This chapter describes the physical features of the Challenge/Onyx rackmount system. It provides an overview of the chassis components, a description of the I/O panel connectors, and information about board slot designations.

1.1 Overview

Table 1-1 through Table 1-16 provide an abbreviated tour of the rackmount chassis. The brief descriptions of the chassis components include the various in-house names they have had, as well as pointers to following sections that contain additional information. Table 1-17 through Table 1-32 give similar descriptions and pointers for all of the available boards.

Product/Component Name	Description
Challenge/Onyx rackmount system. <i>Terminator</i> was the rackmount chassis project name.	A system chassis that evolved from the 19-slot POWER Center. The physical dimensions are similar, but the internal arrangement of the rackmount chassis allows a significant increase in capacity.

Table 1-1 Rackmount Chassis Component - Challenge/Onyx Rackmount System

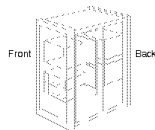


Figure 1-1 Rackmount Chassis Component - Challenge/Onyx Rackmount System

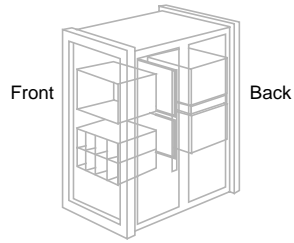


Figure 1-2 Rackmount Chassis Component - Challenge/Onyx Rackmount System

Product/Component Name	Description
Blower Assemblies	<p>Fans that pull air up through the chassis and exhaust it through the top of the system. There are two blower assemblies: front and rear. Each have their own access doors and can be removed and replaced independently. See Section 3.10.4, "Blower (Fan) Assembly."</p> <p>Note that the off-line switchers have their own fans and do not depend upon the blower assemblies for cooling.</p>

Table 1-2 Rackmount Chassis Component - Blower Assemblies

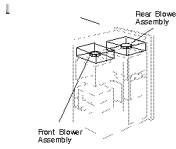


Figure 1-3 Rackmount Chassis Component - Blower Assemblies

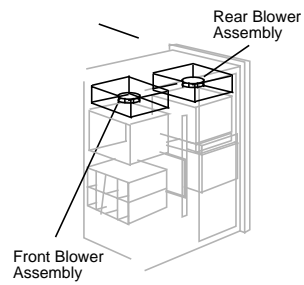


Figure 1-4 Rackmount Chassis Component - Blower Assemblies

Product/Component Name	Description
Midplane	A backplane that has bus connectors on both sides. The Challenge server midplane provides 15 Everest bus (Ebus) and 6 VMEbus connectors to cardcages 1 and 2. The Onyx graphics midplane has 11 Everest bus, 4 VMEbus, and 5 graphics bus connectors in cardcages 1 and 2. See Section 1.2, “Cardcages, Backplanes, and I/O Panels.”

Table 1-3 Rackmount Chassis Component - Midplane

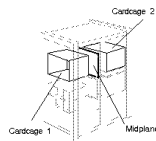


Figure 1-5 Rackmount Chassis Component - Midplane

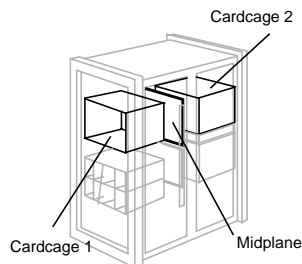


Figure 1-6 Rackmount Chassis Component - Midplane

Product/Component Name	Description
Optional backplane and cardcage (cardcage 3)	A third backplane and cardcage. In server systems, a 20-slot VMEbus backplane/cardcage is supplied. graphics machines are provided with 6 VMEbus slots and 12 graphics bus slots. See Section 1.2, “Cardcages, Backplanes, and I/O Panels.”

Table 1-4 Rackmount Chassis Component - Optional Backplane and Cardcage (Cardcage 3)

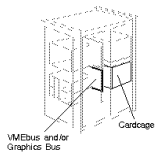


Figure 1-7 Rackmount Chassis Component - Optional Backplane and Cardcage (Cardcage 3)

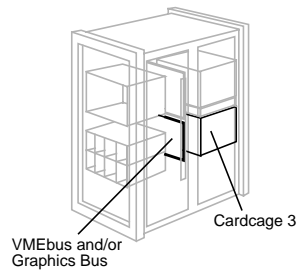


Figure 1-8 Rackmount Chassis Component - Optional Backplane and Cardcage (Cardcage 3)

Product/Component Name	Description
Native VME™	The VMEbus slots located on the system midplane. Note that the number of slots varies between the server and graphics midplanes (server midplane shown). See Section 1.2, “Cardcages, Backplanes, and I/O Panels.”

Table 1-5 Rackmount Chassis Component - Native VME™

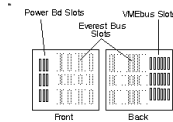


Figure 1-9 Rackmount Chassis Component - Native VME™

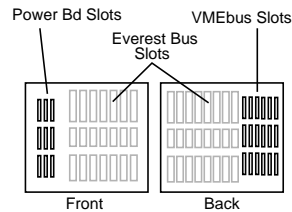


Figure 1-10 Rackmount Chassis Component - Native VME™

Product/Component Name	Description
Expansion VME	The additional VMEbus slots available with the optional cardcage (Cardcage 3). See Section 3.11, “Optional Third Cardcage (Cardcage 3) and Power Supply Tray.”

Table 1-6 Rackmount Chassis Component - Expansion VME

Product/Component Name	Description
POWERmodules (Pay-as-you-go power supplies)	Combination of modular off-line switchers (OLSs) and power boards. Up to three 1900-watt OLSs can be installed, along with a variety of power boards. See Section 1.6, "Power Supplies and Power Distribution."

Table 1-7 Rackmount Chassis Component - POWERmodules (Pay-as-you-go power supplies)

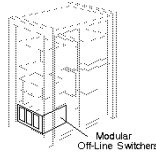


Figure 1-11 Rackmount Chassis Component - POWERmodules (Pay-as-you-go power supplies)

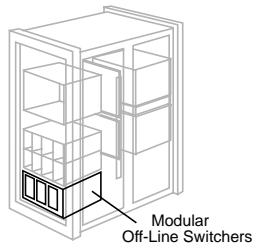


Figure 1-12 Rackmount Chassis Component - POWERmodules (Pay-as-you-go power supplies)

Product/Component Name	Description
Power boards (System Controller, 505, 512, 512S)	DC voltage convertors that step down the 48 volts output by the off-line switchers to voltage levels required by the buses and boards. Three configurations can be installed in cardcage 1 and 2, on backplane of cardcage 3, and on the SCSI backplane. See Section 1.6, "Power Supplies and Power Distribution."

Table 1-8 Rackmount Chassis Component - Power Boards (System Controller, 505, 512, 512S)

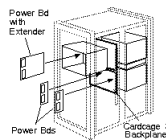


Figure 1-13 Rackmount Chassis Component - Power Boards (System Controller, 505, 512, 512S)

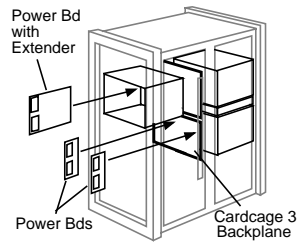


Figure 1-14 Rackmount Chassis Component - Power Boards (System Controller, 505, 512, 512S)

Product/Component Name	Description
SCSIBox 2 drive enclosure (Known internally as the “Stubbi” SCSI drive box)	Similar to a standard SCSI drive box, but can be installed in a shallower enclosure. Each box supports 4 full-height or 8 half-height drives. Accepts same types of Front Loading Devices (FLDs) as used with the POWER Center products, but uses a different sled assembly. One box is standard, a second identical box is available as an option. See Section 1.4, “SCSI Drive Boxes,” and Section 3.6, “Storage Devices.”

Table 1-9 Rackmount Chassis Component - SCSIBox 2 Drive Enclosure

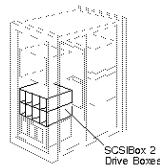


Figure 1-15 Rackmount Chassis Component - SCSIBox 2 Drive Enclosure

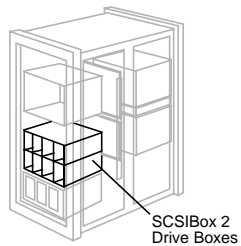


Figure 1-16 Rackmount Chassis Component - SCSIBox 2 Drive Enclosure

Product/Component Name	Description
Dual SCSI buses	Two configurable SCSI buses that are distributed to each of the SCSI drive box backplanes. Note that all machines are cabled for the optional drive box. See Section 3.6, "Storage Devices."

Table 1-10 Rackmount Chassis Component - Dual SCSI Buses

Product/Component Name	Description
Front-loading Device (FLD)	A SCSI drive mounted on a P8 drive sled, that can be installed without any cabling. Connectors on the sled mate with a set of corresponding connectors located at the rear of the drive box. See Section 1.5, "Front-loading Devices," and Section 3.6, "Storage Devices."

Table 1-11 Rackmount Chassis Component - Front-loading Device (FLD)

Product/Component Name	Description
Graphics I/O panel	This I/O panel is directly above the main I/O. It contains all of the interface ports to the first (or only) graphics board set. See Section 2.2.

Table 1-12 Rackmount Chassis Component - Graphics I/O panel

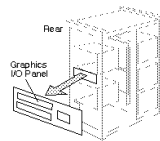


Figure 1-17 Rackmount Chassis Component - Graphics I/O panel

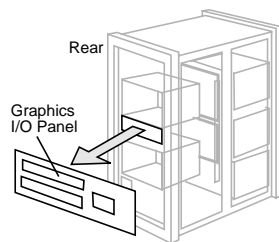


Figure 1-18 Rackmount Chassis Component - Graphics I/O panel

Product/Component Name	Description
Main I/O Panel (Fixed I/O)	This I/O panel is located between the upper and lower I/O panels for the two rear cardcages. The panel consists of the basic IO4 interfaces (video, keyboard, parallel port, powered and unpowered serial connectors). See Section 1.2, “Cardcages, Backplanes, and I/O Panels.”

Table 1-13 Rackmount Chassis Component - Main I/O Panel (Fixed I/O)

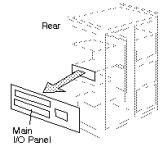


Figure 1-19 Rackmount Chassis Component - Main I/O Panel (Fixed I/O)

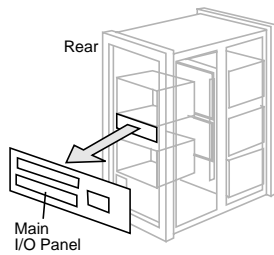


Figure 1-20 Rackmount Chassis Component - Main I/O Panel (Fixed I/O)

Product/Component Name	Description
System Status Panel	A swing-out panel on the front of the system that provides status information, including CPU-use meters, and provides access to System Controller functions. It also contains the key switch for turning on and turning off the machine as well as for placing the machine in maintenance mode. See Section 1.3, “System Controller.”

Table 1-14 Rackmount Chassis Component - System Status Panel

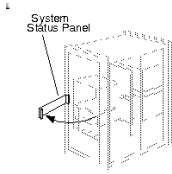


Figure 1-21 Rackmount Chassis Component - System Status Panel

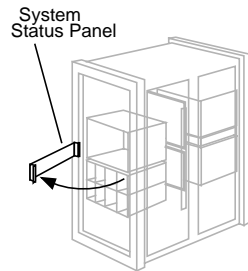


Figure 1-22 Rackmount Chassis Component - System Status Panel

Product/Component Name	Description
System Controller	An independent, microprocessor-controlled system monitor. Powers up and helps boot the system. Tracks and displays system status on the System Status Panel display and can shut down the system if necessary. See Section 1.3, "System Controller."

Table 1-15 Rackmount Chassis Component - System Controller

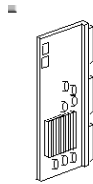


Figure 1-23 Rackmount Chassis Component - System Controller

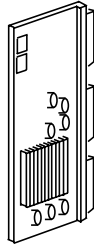


Figure 1-24 Rackmount Chassis Component - System Controller

Product/Component Name	Description
ChallengeVault (T2 Expansion Rack)	This expansion rack is based on the rack-mounted chassis and has identical physical dimensions. The expansion rack has 7 drive shelves capable of housing a maximum of 56 half-height drives.

Table 1-16 Rackmount Chassis Component - ChallengeVault (T2 Expansion Rack)

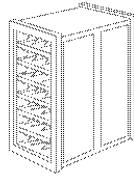


Figure 1-25 Rackmount Chassis Component - ChallengeVault (T2 Expansion Rack)

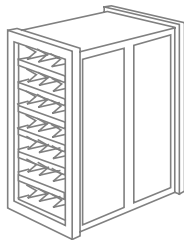


Figure 1-26 Rackmount Chassis Component - ChallengeVault (T2 Expansion Rack)

The following tables, Table 1-17 through Table 1-32, list various products and boards that are available for Challenge and Onyx rackmount systems.

Product/Board Name	Description
IP19	Everest CPU Board

Table 1-17 System Board - IP19

Product/Board Name	Description
MC3	Everest Memory Board

Table 1-18 System Board - MC3

Product/Board Name	Description
IO4 Board (IO4 base board)	Basic Everest interface board. This board has network interfaces, parallel and serial ports, and two SCSI buses. Two additional Flat Cable Interfaces (FCIs) are used to connect to the VMEbus and to a graphics board set. See Section 2.4, "Everest I/O (POWERchannel 2) Subsystem."

Table 1-19 System Board - IO4 Board (IO4 base board)

Product/Board Name	Description
Interface Modules (Mezzanine boards)	These boards provide a variety of additional interfaces (including network interfaces) by mounting directly to the IO4 board. See Section 2.4, "Everest I/O (POWERchannel 2) Subsystem."

Table 1-20 System Board - Interface Modules (Mezzanine boards)



Figure 1-27 System Board - Interface Modules (Mezzanine boards)

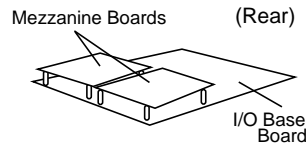


Figure 1-28 System Board - Interface Modules (Mezzanine boards)

Product/Board Name	Description
SCSI Interface Module (S mezzanine)	The SCSI mezzanine board provides 3 SCSI-1 channels. Compatible with the WD95 SCSI controller chip. See Section 2.4, "Everest I/O (POWERchannel 2) Subsystem."

Table 1-21 System Board - SCSI Interface Module (S mezzanine)

Product/Board Name	Description
VME Channel Adapter Module (VCAM)	This board provides the interface between the Ebus and either the VMEbus or graphics bus. The VCAM mounts directly onto the IO4 board. This board is standard equipment and always installed on the first IO4 board. See Section 2.4, "Everest I/O (POWERchannel 2) Subsystem."

Table 1-22 System Board - VME Channel Adapter Module (VCAM)

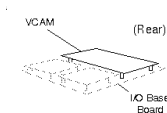


Figure 1-29 System Board - VME Channel Adapter Module (VCAM)

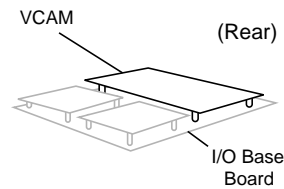


Figure 1-30 System Board - VME Channel Adapter Module (VCAM)

Product/Board Name	Description
Flat Cable Interface Modules (Long and Short)	These boards provide additional Flat Cable Interfaces. The Short FCI Interface Module has the same dimensions as the other mezzanine cards and supplies one FCI channel. The Standard FCI Interface Module is physically longer and provides two channels. Note that the long board cannot be used with a VCAM. See Section 2.4, "Everest I/O (POWERchannel 2) Subsystem."

Table 1-23 System Board - Flat Cable Interface Modules (Long and Short)

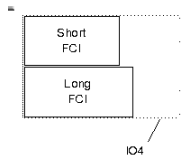


Figure 1-31 System Board - Flat Cable Interface Modules (Long and Short)

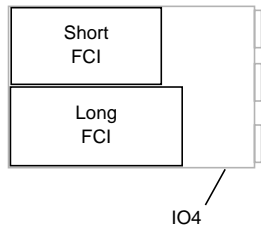


Figure 1-32 System Board - Flat Cable Interface Modules (Long and Short)

Product/Board Name	Description
Multi-net Interface Modules (AUI Ethernet, FDDI)	These boards provide multiple ports to the supported networks.

Table 1-24 System Board - Multi-net Interface Modules (AUI Ethernet, FDDI)

Product/Board Name	Description
Extender (Optional)	These are passive boards that mount between the power boards and the midplane. Their purpose is to make the power boards more accessible by bringing them out from the midplane. These are not normally shipped on systems, but may be encountered occasionally in the field.

Table 1-25 System Board - Extender (Optional)

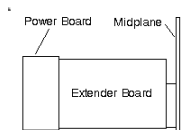


Figure 1-33 System Board - Extender (Optional)

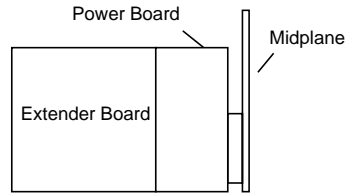


Figure 1-34 System Board - Extender (Optional)

Product/Board Name	Description
IO4 Filter	This board provides noise suppression for signals going between the IO4 board and the main I/O panel. It contains a fuse.

Table 1-26 System Board - IO4 Filter

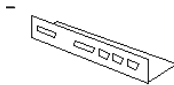


Figure 1-35 System Board - IO4 Filter

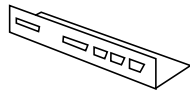


Figure 1-36 System Board - IO4 Filter

Product/Board Name	Description
Video Filter (EF7)	This board supplies noise suppression for signals going between the graphics boards and the graphics I/O panel. It contains a fuse.

Table 1-27 System Board - Video Filter (EF7)

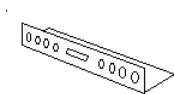


Figure 1-37 System Board - Video Filter (EF7)

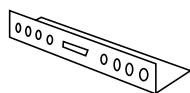


Figure 1-38 System Board - Video Filter (EF7)

Product/Board Name	Description
SCSI Channel Adapter Boards	Small boards that mount directly to the SCSI bus connectors on the IO4 board. Used to configure the SCSI bus for single-ended or differential operation. Color-coded: red = differential, green = single-ended. See Section 2.4, "Everest I/O (POWERchannel 2) Subsystem."

Table 1-28 System Board - SCSI Channel Adapter Boards

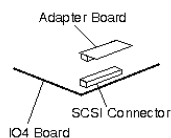


Figure 1-39 System Board - SCSI Channel Adapter Boards

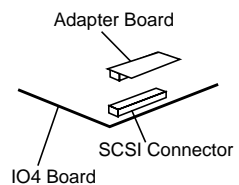


Figure 1-40 System Board - SCSI Channel Adapter Boards

Product/Board Name	Description
RealityEngine ² Graphics Board Set (Mirage) VTX Graphics Board Set	Multiple-board graphics sets that evolved from RealityEngine ² . Composed of the following boards: one GE10 board, one Display Generator, and one, two, or four Raster Memory boards. (A three-board configuration is not supported.) VTX differs in that it uses the GE10V board instead of the GE10. See Section 2.6, "RealityEngine2 and VTX Graphics Subsystems."

Table 1-29 System Board - RealityEngine² Graphics Board Set (Mirage)/VTX Graphics Board Set

Product/Board Name	Description
Geometry Engine [®] (GE10)	Processes commands and data from the host. First stage in the graphics pipeline.

Table 1-30 System Board - Geometry Engine[®] (GE10)

Product/Board Name	Description
Raster Memory [™] (RM4)	Scans and converts triangle data into pixel data.

Table 1-31 System Board - Raster Memory[™] (RM4)

Product/Board Name	Description
Display Generator [™] (DG2)	Receives digital data from the Raster Memory and processes it to produce an analog signal for display.

Table 1-32 System Board - Display Generator[™] (DG2)

Figure 1-21 shows the components that are visible with the cabinet doors open.

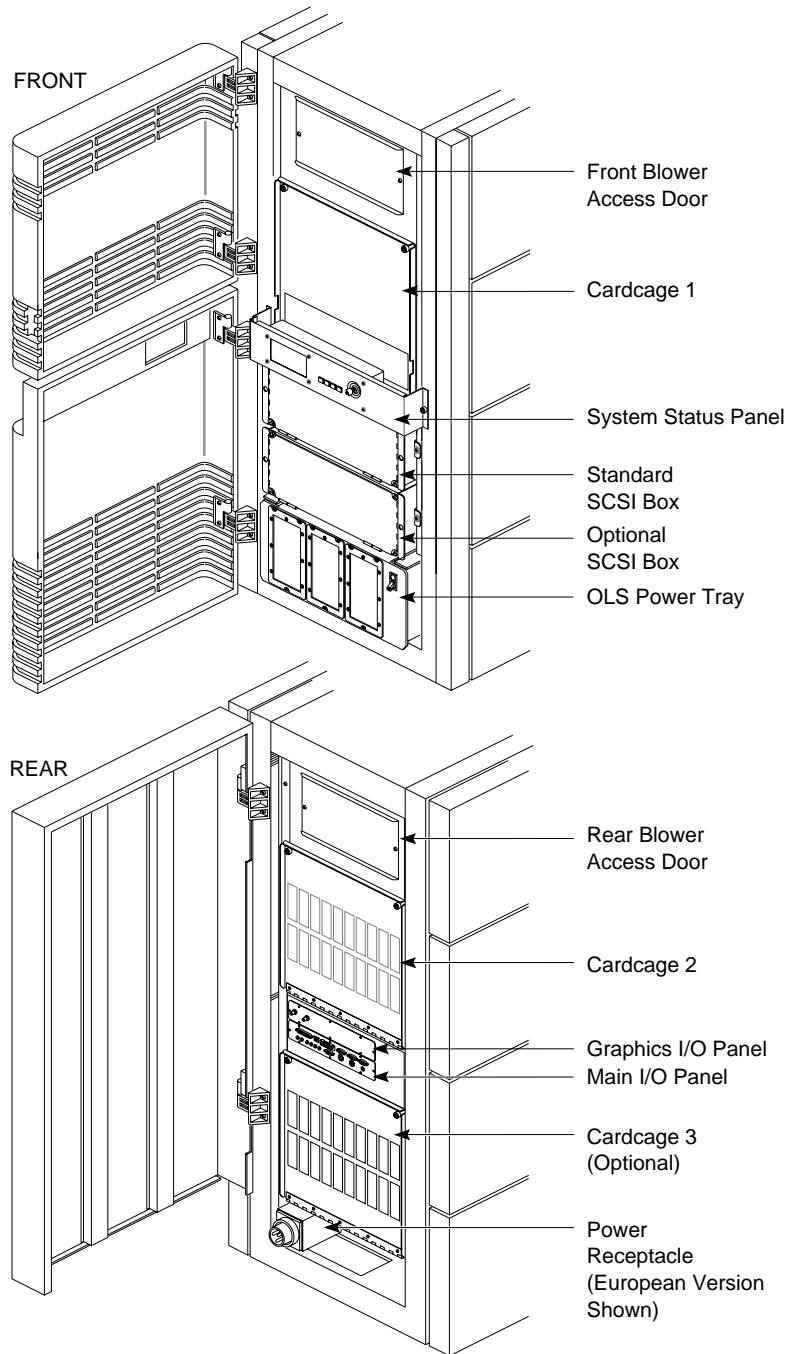


Figure 1-41 Front and Rear Internal Views of the Rackmount Chassis

Note: The Onyx graphics system is shown in Figure 1-21. The Challenge server is identical except that the graphics I/O panel is replaced by a blank plate.

1.2 Cardcages, Backplanes, and I/O Panels

The Everest midplane supports two cardcages: cardcage 1 at the front of the cabinet and cardcage 2 at the rear. Cardcage 1 houses the CPU boards, memory boards, and the System Controller board. These require no external cabling. Cardcage 1 also provides three slots for the power boards.

Cardcage 2 receives all of the I/O and graphics boards (if installed). All basic I/O connections from the first (or only) IO4 board are routed to the main I/O panel, located at the rear of the cabinet. All additional I/O connections are routed to connectors on the cardcage 2 I/O panel.

In graphics workstations, connections from the first (or only) RealityEngine² or VTX board set are routed to the graphics I/O panel. Additional graphics boards are cabled to connectors on the cardcage 2 I/O panel.

An optional cardcage (cardcage 3) can be installed in the lower rear portion of the system cabinet. Servers can be fitted with a cardcage that provides 20 additional VMEbus slots. Graphics systems can be fitted with either the optional server cardcage or a second version that provides 6 VMEbus slots and 12 graphics bus slots. Cardcage 3 uses a conventional backplane that mounts to the rear of the cardcage. In a server, the rear of the backplane provides four slots for the power boards. In a graphics system, the rear of the backplane provides 6 slots for the power boards.

Table 1-33 lists the type and number of bus slots supported in each of the three server cardcages. Table 1-34 lists the graphics system's bus slots.

Buses Supported	Cardcage 1	Cardcage 2	Cardcage 3
Ebus	7 slots	8 slots	—
VMEbus	—	6 slots	20 slots
Power Board	3 slots	—	4 slots (backplane; 1 512 power board and 3 505 power boards)

Table 1-33 Challenge Server System Cardcage Bus Slots

Buses Supported	Cardcage 1	Cardcage 2	Cardcage 3
Ebus	6 slots	5 slots	—
VMEbus	—	4 slots	6 slots

Table 1-34 Onyx Graphics System Cardcage Bus Slots

Buses Supported	Cardcage 1	Cardcage 2	Cardcage 3
Graphics bus	—	6 slots (5 plus 1 dedicated slot for GE10)	12 slots
Power Board	4 slots	—	6 slots (backplane; 1 512 power board and 5 505 power boards)

Table 1-34 Onyx Graphics System Cardcage Bus Slots

1.2.1 Main I/O Panel for the Server and Graphics Systems

The main I/O panel consists of a filter board and a set of I/O panel connectors that bring all of the basic I/O ports out from the IO4 board to the rear of the system cabinet. The ports available on the main I/O panel include the AUI Ethernet, keyboard, video, a parallel port, an RS-422 serial port, and both powered and unpowered RS-232 serial ports. The main I/O panel connector layout is shown in Figure 1-22.

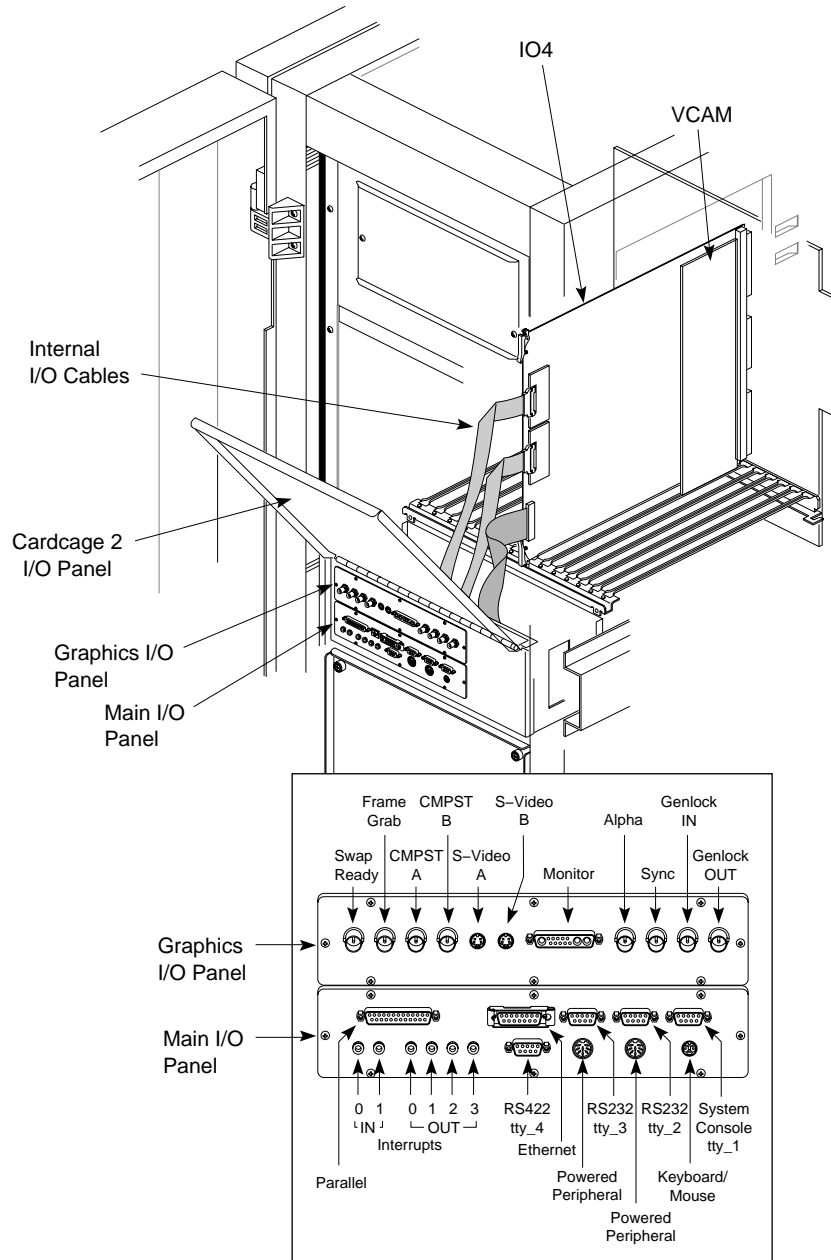


Figure 1-42 Main I/O Panels

1.2.2 Graphics I/O Panel (Onyx Systems)

The graphics I/O panel consists of a filter board and a set of connectors that bring all of the VTX/RealityEngine² video interfaces out from the graphics board set to the rear of the system cabinet. The ports available on the graphics I/O panel include S-Video channels A and B, the Frame Grab input port, Swap Ready, Genlock IN, Genlock OUT, Alpha sync, the

video and external sync connectors, and red, green, and blue BNC connectors. The internal cabling and the external connector layout are shown in Figure 1-22.

Note: On server systems, the graphics I/O panel is replaced with a blank filler panel.

1.3 System Controller

The System Controller board contains a microprocessor with battery-backed memory. It has a direct serial link to master the CPU board, as well as a series of sensors that monitor midplane voltages and cabinet temperature. The System Controller performs the following three basic tasks:

Controls the system power-up, boot arbitration, and power-down processes.

The System Controller sequentially applies power to the various system components. If a sensed voltage level is out of range, the System Controller can abort the power-up. Once the system is powered up, the System Controller initiates the power-on tests and polls the available CPU boards looking for a bootmaster CPU. When the bootmaster CPU is identified, the System Controller relinquishes control of the process. The System Controller also manages the power-down process, controlling the enable lines that apply the various voltages.

Provides passive monitoring during normal system operation.

The System Controller continues to monitor system voltage levels and cabinet temperatures. An event history is maintained in NVRAM that can be used to diagnose the cause of system problems such as shutdowns and boot problems.

Acts as an independent system watchdog.

The System Controller can independently act to shut the system down if its sensors indicate a condition that warrants it. The bootmaster CPU can also instruct the System Controller to initiate a shutdown.

1.3.1 Keypad and Display

The operator interface to the System Controller is called the System Status Panel. This consists of a 240 x 128-pixel LCD, four function buttons (Menu, Execute, Scroll Up, and Scroll Down), a key switch, and two LEDs (Power On and Fault). The function buttons and display mount on a hinged panel at the front of the cabinet. The System Controller function buttons and display are shown in Figure 1-23.

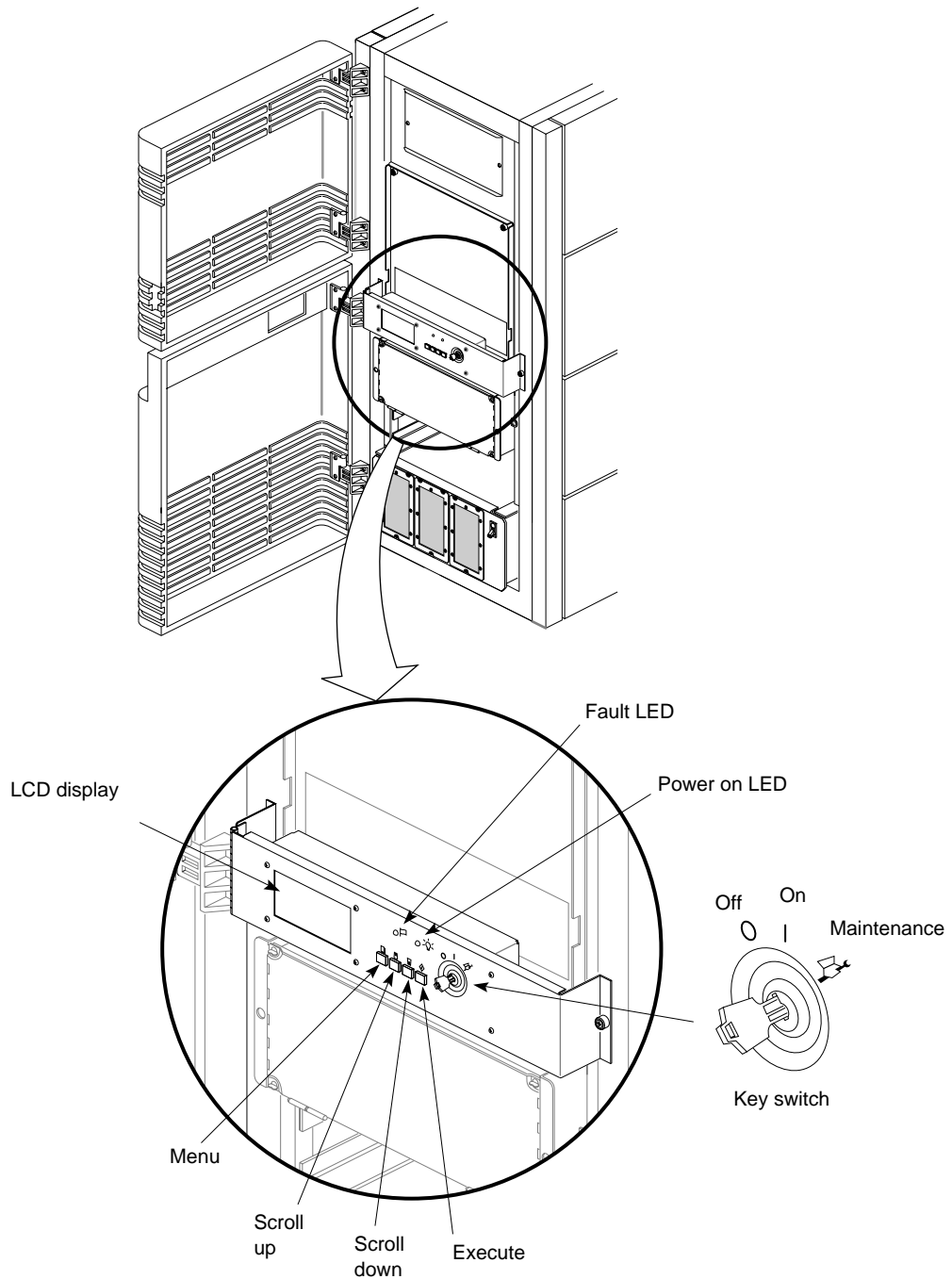


Figure 1-43 System Status Panel

Key Switch

The key switch has three positions: **Off**, **On**, and **Maintenance** (represented by an icon of a hand holding a wrench). The **Off** position shuts down voltages from the OLS to the rest of the system. (Note that the OLS is still powered on until the system breakers are shut off). The **On** position enables normal system operations. The **Maintenance** position enables the *RESET* and *NMI* functions.

Menu Button Pressing the Menu button will sequentially display the executable options.

Execute Button Pressing this button executes the option currently being displayed.

Scroll Up/Scroll Down Buttons

These buttons allow you to step sequentially through the available screens on the LCD display.

Power On LED

This LED lights whenever 48 VDC is present.

Fault LED

This LED lights whenever the System Controller senses a fault.

Refer to Appendix E, “System Controller Error and Status Messages,” for a complete listing of all of the System Controller status and error messages.

1.4 SCSI Drive Boxes

There are two types of SCSI drive boxes available:

- In its standard configuration, the rackmount system is shipped with a single SCSI drive enclosure (SCSI box) that is capable of holding four full-height or eight half-height SCSI devices.
- A second type of drive enclosure, called SCSIBox 2 (known internally as “Stubbi SCSI”) is available as an option. The SCSIBox 2 does not have traditional internal power supplies. Instead, a 512S power board is mounted on the SCSI backplane to convert the incoming 48 VDC to +5 and +12 VDC for use by the drives. This design feature allows the SCSIBox 2 to be installed in a shallower enclosure than a standard SCSI box (hence the nickname “Stubbi”).

A SCSIBox 2 is shown in Figure 1-24. The rear view shows the 512S power board. Power supplies are further described in Section 1.6, “Power Supplies and Power Distribution.”

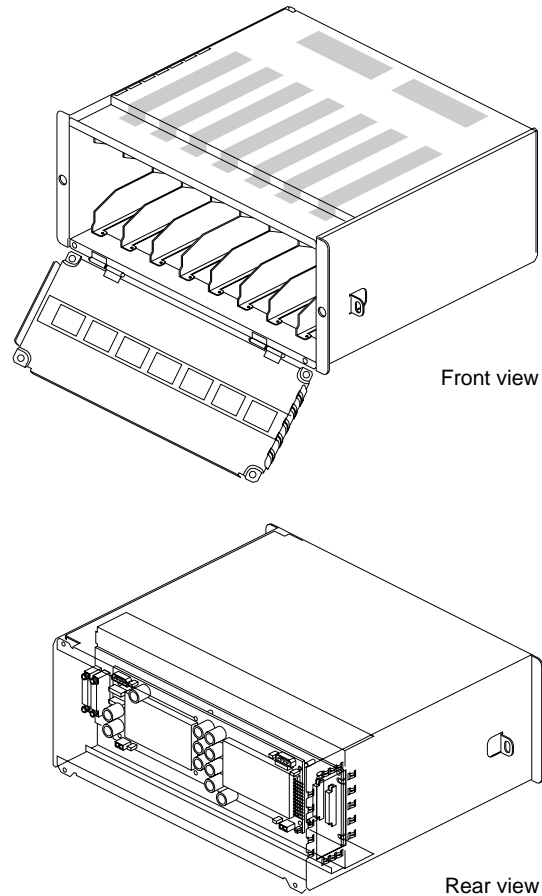


Figure 1-44 SCSIBox Drive Enclosure

1.5 Front-loading Devices

SCSI Front-loading Devices (FLDs) are the only type of storage drives that can be installed in the rackmount chassis. The storage devices used with the SCSIBox have what are known as *P8* drive sleds. These drive sleds and corresponding drive trays are lower profile and more compact than those used with previous products.

A single delrin wheel on the drive tray is used to align the sled when it is installed. The self-aligning connectors are also an improvement over the previous design. The locking mechanism now has a lever, rather than a push button. The drive sleds also contain the logic used to adapt the mounted drive to either a differential or single-ended SCSI bus. Detailed explanations of the adapter logic and the supported configurations are provided in Chapter 3, "Installation."

1.5.1 Drive Sled EMI Shielding

Warning: If you install the EMI shield upside down in a P8 drive sled, there is a high risk of an electrical short in the drive. The EMI shield is copper and is coated on one side with clear plastic insulation. The insulated side of the shield must be placed against the drive.

The EMI shield has a tab at the front that is angled. When the tab is angled up, the EMI shield is oriented correctly.

The following are some tips for verifying which side of the EMI shield is insulated and which is bare copper:

- Rub each side with your fingernail. The copper side will scratch slightly. The plastic side will not show any marks.
- Use an ohmmeter or continuity checker against each side.

Once you determine the insulated side of a particular EMI shield, you may wish to mark the shielded side for future reference (for example, using a permanent marking pen).

1.5.2 Drive Sled Installation

A drive and its sled are shown in Figure 1-25. Figure 1-26 shows a drive being installed in the SCSIBox.

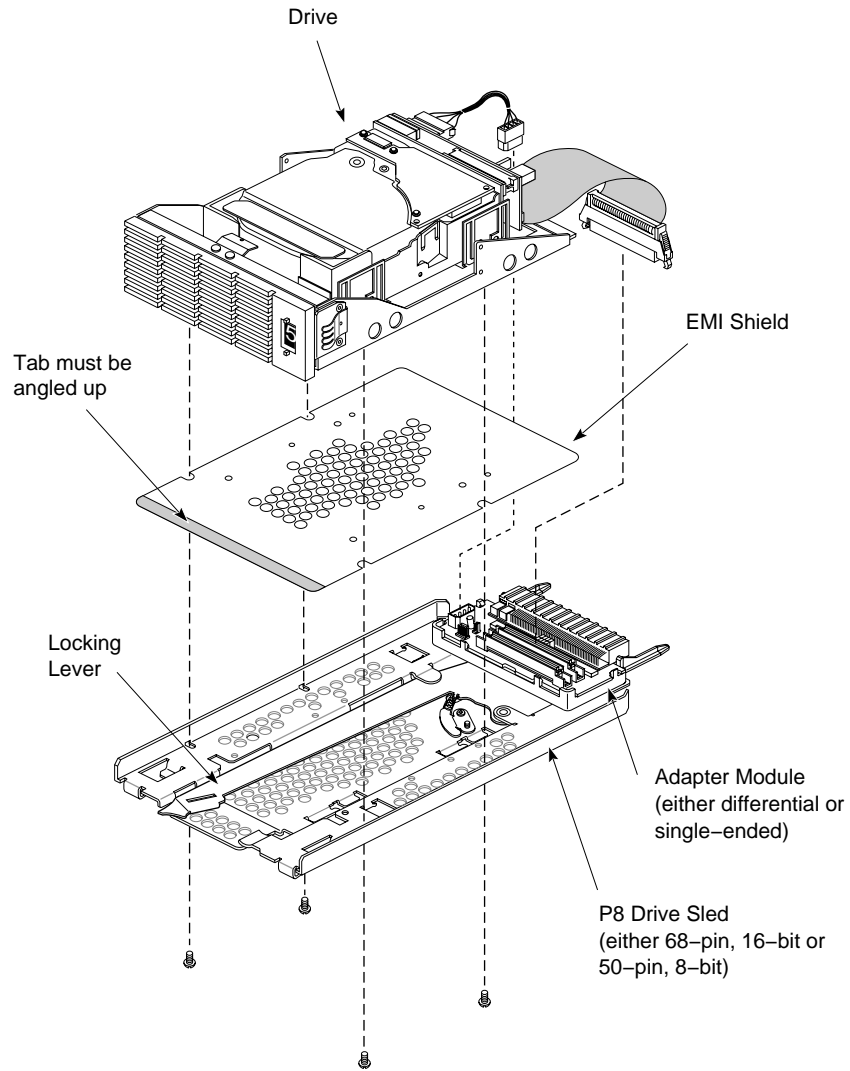


Figure 1-45 SCSI Drive and Drive Sled

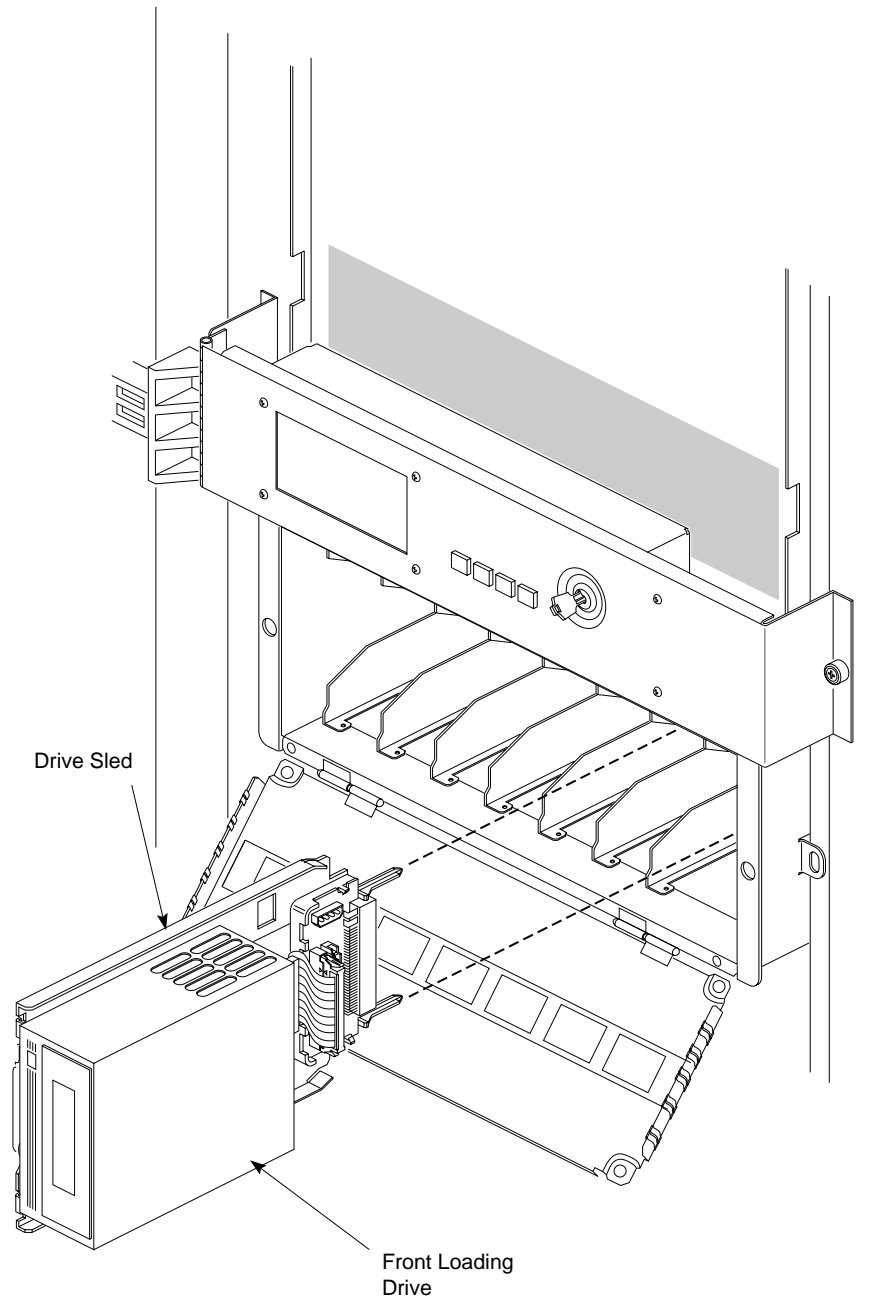


Figure 1-46 Installing a Front Loading Device in a SCSIBox 2

1.6 Power Supplies and Power Distribution

The rackmount chassis supports a maximum of three 1900-watt off-line switchers (OLSs). The OLSs convert the AC input to 48 VDC at 37 amps and distribute the regulated voltage to the chassis midplane and backplane.

1.6.1 Chassis Wiring

Note: For a complete description of power requirements, including important information about branch-circuit wiring and grounding (earthing) requirements, see the *Challenge/Onyx Site Preparation Guide* (P/N 108-7040-020). There are additional considerations for systems that use the optional cardcage 3. See Section 3.11.1 through Section 3.11.3 in Chapter 3, “Installation.”

A rackmount chassis is wired in one of three different configurations, depending upon on the country to which the system is being sent and the power requirements of the system itself. See Figure 1-27 through Figure 1-29 for illustrations of the circuits.

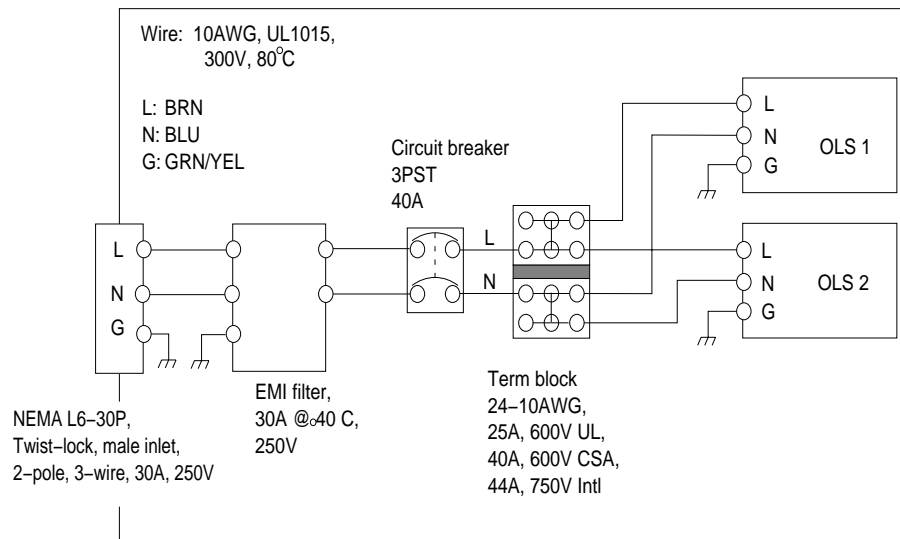


Figure 1-47 Rackmount Chassis Wiring Diagram for 220VAC, 3-wire, 1-phase Power (U.S., Canada, and Japan)

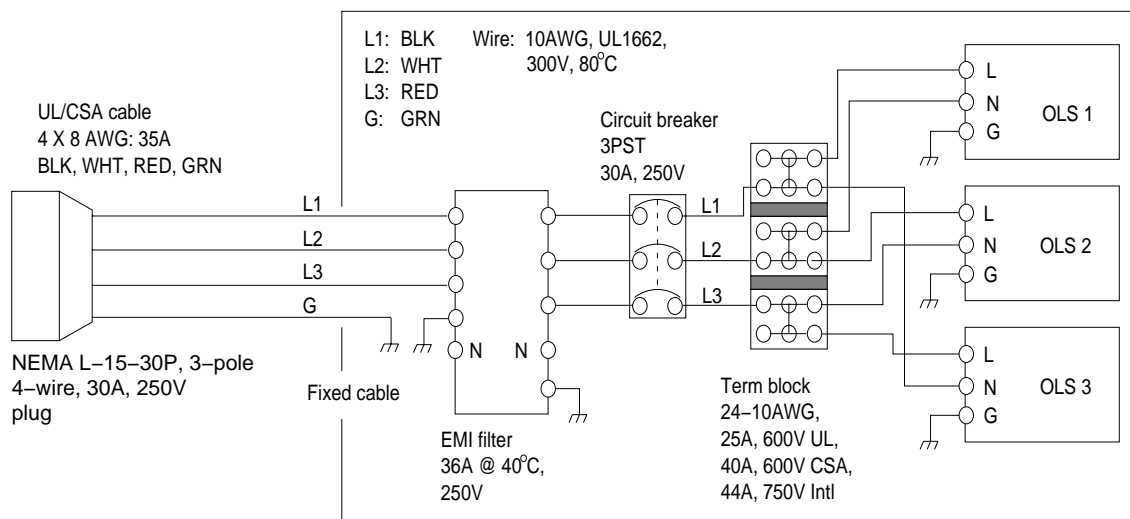


Figure 1-48 Rackmount Chassis Wiring Diagram for 220VAC, 4-wire, 3-phase Power (U.S., Canada, and Japan)

and Japan)

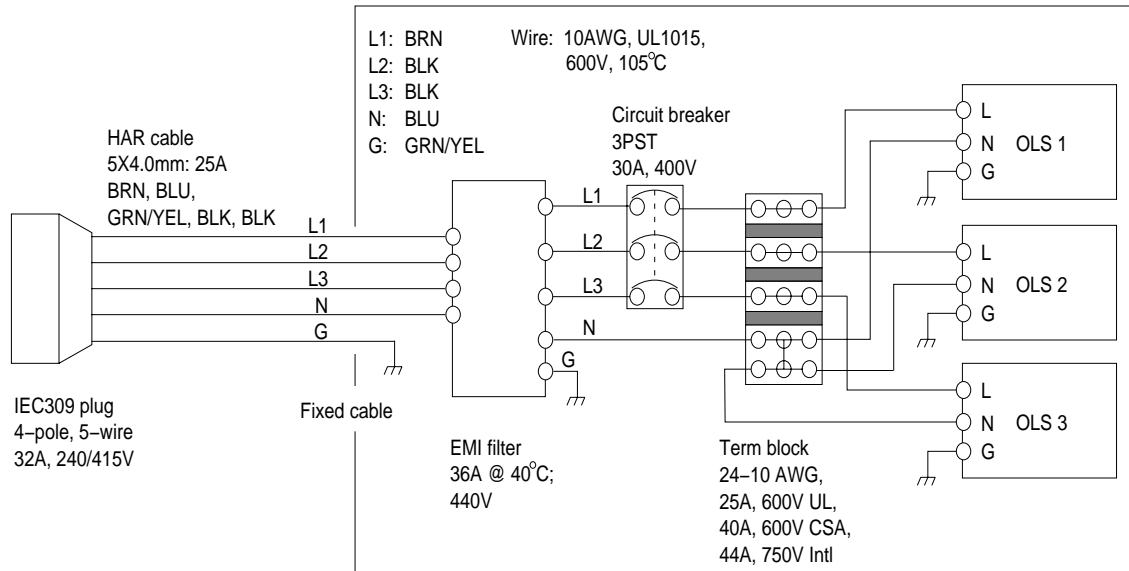


Figure 1-49 Rackmount Chassis Wiring Diagram for 400VAC, 5-wire, 3-phase Power (International)

1.6.2 Power Boards

The OLSs provide DC current to the midplane and backplane. In turn, DC regulators, installed on the CPU, Memory, VCAM, and GE10 boards, step down the midplane/backplane voltage for use by those boards.

Note: The IO4 board draws -5V and -12V from the VCAM, and converts -5V to +1.5V for IBus termination voltage.

Additional power boards supply the DC voltages required by the Ebus, graphics bus, and VMEbus. These power boards are available in different voltages and amperages, allowing the power distribution subsystem to be tailored to the voltage needs of a particular system configuration.

Five types of power board are available for the rackmount systems:

- the System Controller board supplies 1.6 VDC to the Ebus
- the 505 power board provides 5 VDC to the boards installed in Cardcage 3
- the dual 505 (sometimes referred to as the 505x2), which supplies 5 VDC to boards installed in Cardcage 1 and Cardcage 2
- the 512 power board generates both 5 and 12 VDC for use by the boards
- the 512S power board supplies 5 and 12 VDC to the SCSI drive box backplane.

Table 1-35 shows configurations of OLSs and power boards for rackmount systems:

System Configuration	OLSs Installed	Power Boards Installed
Challenge	2	3 (1 512, 1 dual 505, 1 System Controller)
Onyx	2	4 (1 512, 2 dual 505, 1 System Controller)
Challenge with VME Cardcage 3	3 (requires 3-phase power)	7 (2 512, 1 dual 505, 3 505, 1 System Controller)
Onyx with Cardcage 3	3 (requires 3-phase power)	10 (2 512, 2 dual 505, 5 505, 1 System Controller)

Table 1-35 OLS and Power Board Configurations for Rackmount Systems

Rackmount system are usually shipped with two OLSs. A third OLS, three-phase power, and an expanded OLS tray are required when the optional third cardcage (Cardcage 3) is installed in either the server or graphics systems.

The System Controller, 505, and 512 power boards are available in configurations that support both the midplane and the optional third cardcage. The midplane configuration mounts to an extender board and is installed in a Cardcage 1 board slot. The version designed for the optional Cardcage 3 is attached directly to the front of the backplane. (This requires removal of any SCSI drive boxes for access.) Both configurations of these power boards are shown in Figure 1-30.

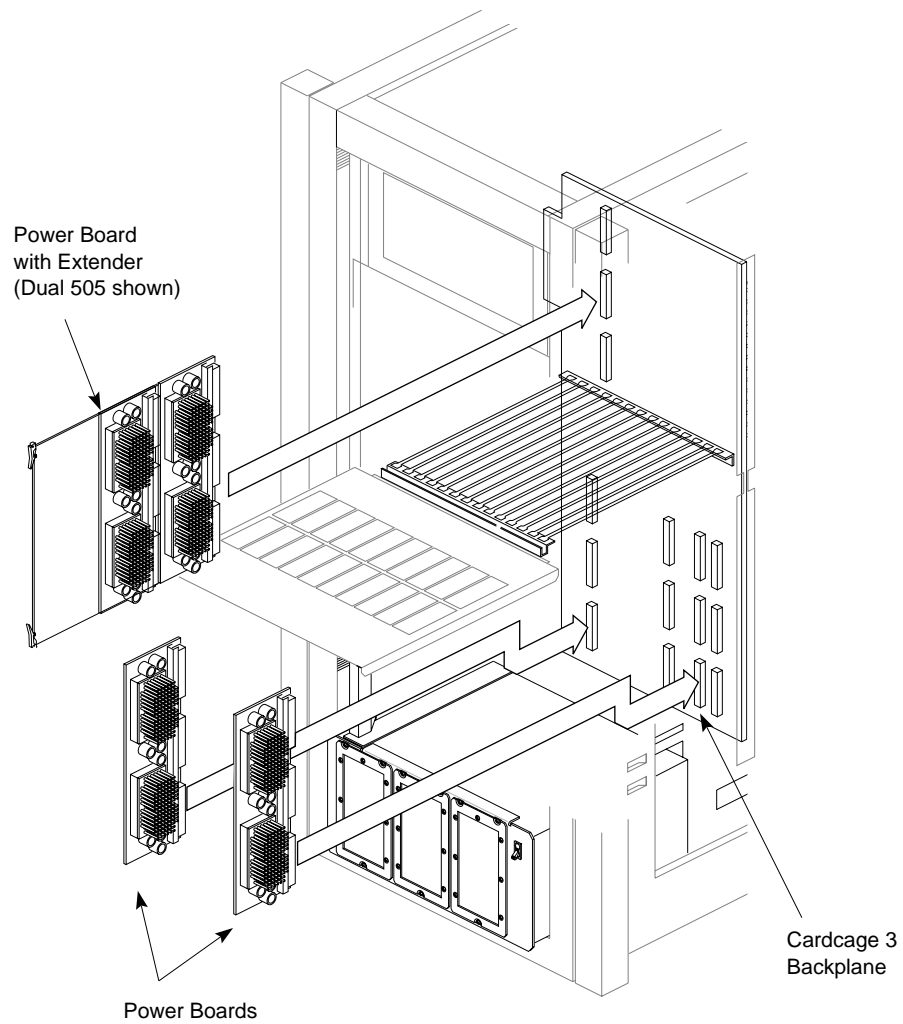


Figure 1-50 Power Board Locations Cardcage 1 and Cardcage 3

SGIVIDEO: [cc3powerboards.mv](#)

[Installing Power Boards on the Cardcage 3 Backplane](#)

The video clip above shows how to install power boards on the front of the Cardcage 3 backplane behind the OLSs.

The 512S is the only power board that is not designed to attach to either the midplane or the backplane. The 512S mounts directly on the SCSI backplane of the SCSIBox 2 (see Figure 1-31).

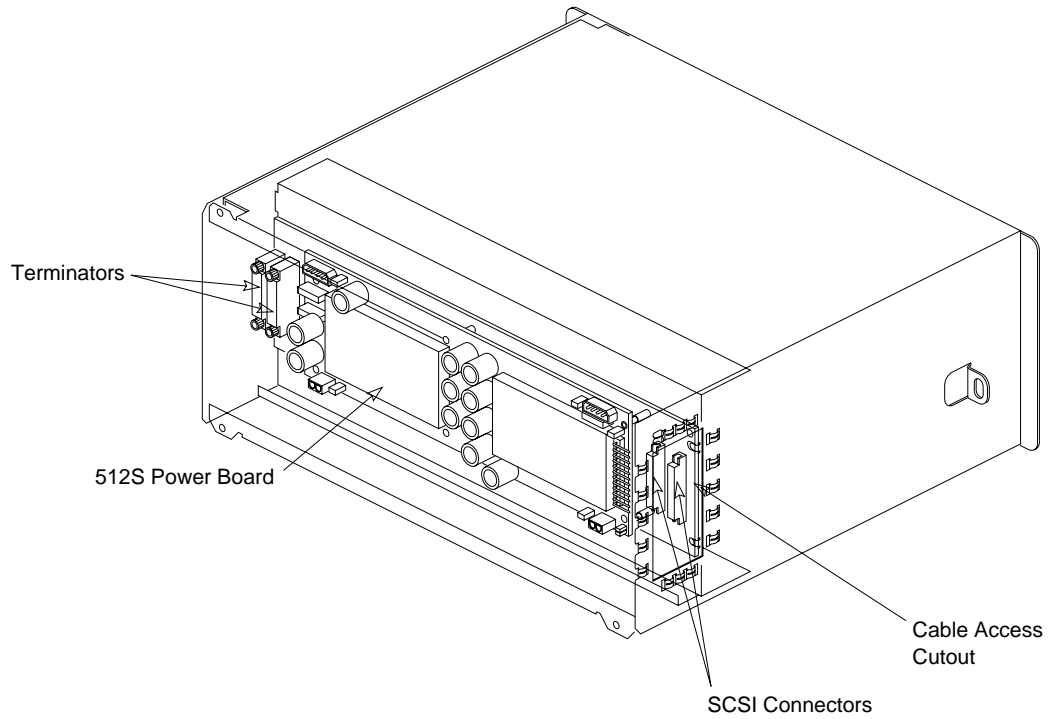


Figure 1-51 SCSIBox 2 Power Board

Chapter 2

Theory of Operations

This chapter provides a functional overview of the Everest board set. Each of the boards making up the Everest board set is described, as well as the optional mezzanine boards, the VCAM, the I/O panel filter boards, and the SCSI channel configuration boards. Functional overviews of the RealityEngine² and VTX graphics board sets are also provided in this chapter.

Figure 2-1 is a simplified block diagram of the Everest graphics workstation. The primary differences between the server and the graphics workstation are their respective midplanes and the installed boards.

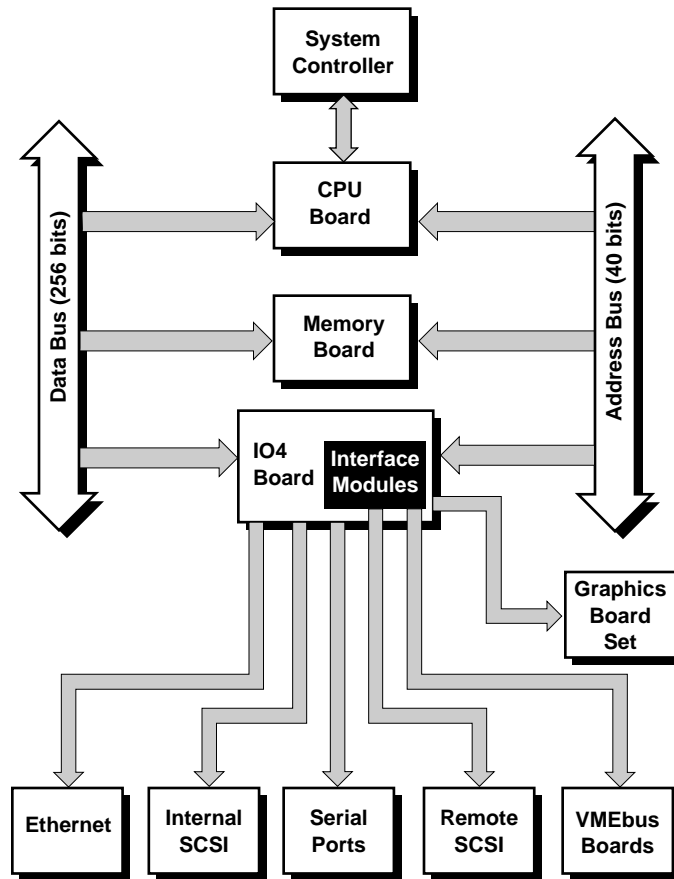


Figure 2-1 Graphics System Functional Block Diagram

2.1 Everest Board Set Overview

The Everest board set comprises the IP19 CPU board, the MC3 memory board, the IO4 Interface board, and a VCAM board. Additionally, a number of optional mezzanine boards can be attached to the IO4 board. All of these boards are described in detail in the following sections.

The principal features of the Everest board set are:

- Four R4400 microprocessors per CPU board (maximum)
- 1200 MB/second, 256-bit system data bus
- 40-bit address bus
- Address and data bus interface application-specific integrated circuits (ASICs) on each board
- Can support a single VTX subsystem or multiple RealityEngine² (RE2) graphics subsystems

- Can support up to 2 GB of interleaved memory per memory board
- Supplies dual 8- or 16-bit SCSI channels for each SCSIBox 2
- Additional Flat Cable Interface (FCI), VMEbus, and SCSI ports available on optional Interface Modules

2.1.1 Networking Solutions

The IO4 board (described in Section 2.4.1, “IO4 Board”) provides a single Ethernet AUI connection. However, the design of the Everest system allows for the following additional network solutions:

- native VMEbus network boards
- network boards attached to the F mezzanine connectors
- a VME network board attached through the flat-cable interface (FCI)

2.2 Everest CPU Board (IP19)

The IP19 is a multiprocessor CPU board that supports two or four R4400 microprocessors. The board logic is divided or “sliced” so that each of the microprocessors has its own dedicated supporting logic, which allows each microprocessor to run independently of the others. The only portion of the CPU board circuitry that is shared by the resident microprocessors is the bus arbitration logic. See Figure 2-2 for a functional block diagram illustrating the IP19 board.

Note that each microprocessor has its own cache and cache controller (CC Chip), but shares the Address (A Chip) and Data (D Chip) ASICs that provide the interface to the system (Everest) bus.

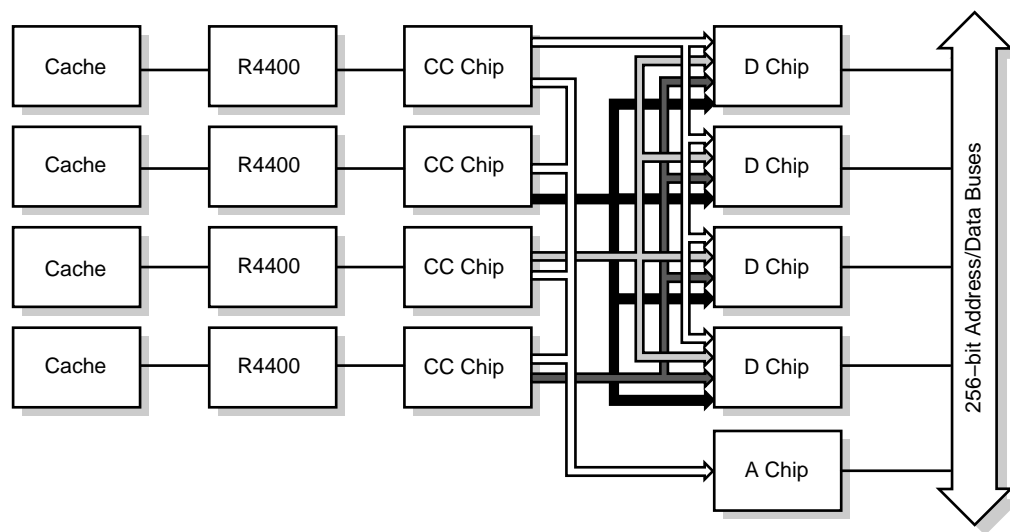


Figure 2-2 CPU Board (IP19) Functional Block Diagram

2.3 Everest Memory Board (MC3)

The Everest Memory Board (MC3) can support 32 DRAM SIMMs of either 16 or 64 MB. The minimum configuration is 64 MB and the maximum is 2 GB. The memory is arranged in 2 arrays of 4 banks each. Each bank has 144 four-bit wide DRAMs.

The MC3 communicates with the Everest bus through a series of ASICs. The Memory Address (MA) chip provides the interface between the memory array and the Everest address bus. This gate array includes bus arbitration logic, decode logic, and a pair of DRAM controllers.

Each DRAM controller generates the memory address and control lines needed to control two banks of DRAMs. These outputs are driven to the memory arrays through a single level of buffers. Control signals are also generated for the Memory Data ASICs (MD Chips).

The four MD Chips provide data buffering and error detection/correction for information transferred between the 576-bit memory array and the 256-bit Everest data bus. Each of these identical chips drives one quarter of the data bus. These ASICs are controlled by the MA Chip and perform no operations independently, except for notifying the MA Chip when an error has been detected.

Interleaving is supported between array leaves of equal memory size on the same board and between two or more memory boards with the same total memory capacity. A fully populated memory board uses two-way on-board interleaving. Two or four memory boards can be configured for up to eight-way interleaving. Figure 2-3 is a functional block diagram of the MC3 board.

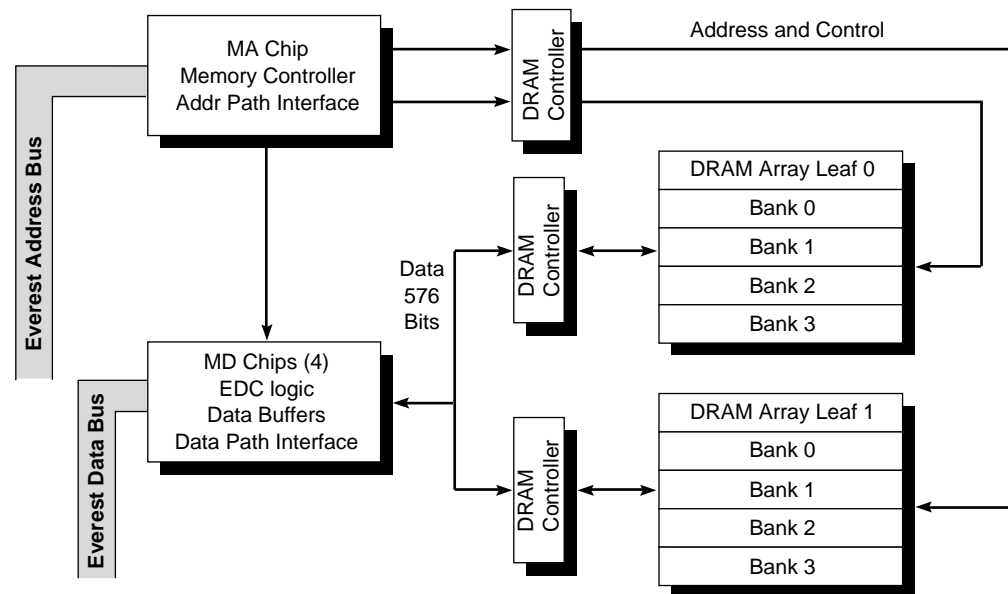


Figure 2-3 Everest Memory Board (MC3) Functional Block Diagram

2.4 Everest I/O (POWERchannel 2) Subsystem

The I/O subsystem consists of an IO4 board, a VCAM board, and some combination of optional plug-in mezzanine boards. Mezzanine boards include two types of FCI board, and a SCSI board.

The following sections describe the IO4 board and the mezzanine boards.

2.4.1 IO4 Board

The IO4 board supplies the system with a basic set of I/O controllers, including:

- three RS-232 ports
- one RS-422 port
- one AUI Ethernet connector
- a second-level boot flash EPROM
- a bi-directional parallel port
- NVRAM used to store system configuration information
- two Flat Cable Interfaces (FCIs)
- two SCSI-2 cable connections

Communication with the VME and SCSI buses, the installed graphics boards set(s), and the network are managed by a set of interface control chips. Two Flat Cable Interface (FCI) Controller chips (F Chips) handle the data transfers to and from any internal graphics board sets (if installed), and any VMEbus boards. The SCSI-2 Controller chip (S1) serves as an interface to the various SCSI-2 buses. The Everest Peripheral Controller (EPC) chip manages the data movement to and from the Ethernet, a parallel port, and various types of on-board PROMs and RAM. See Figure 2-4 for a functional block diagram of the IO4 board.

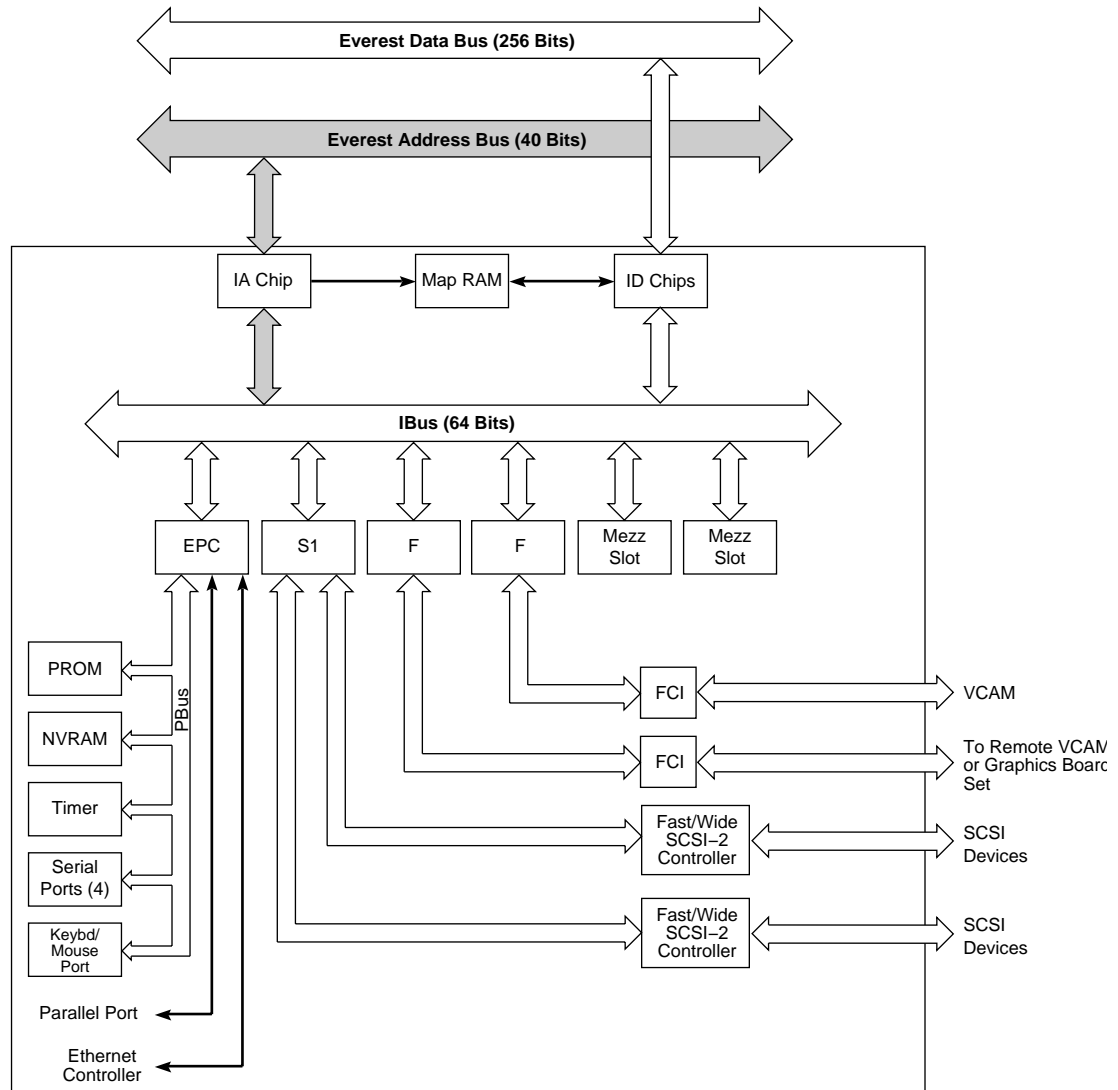


Figure 2-4 IO4 Board Functional Block Diagram

Chips on the IO4 board include the following:

F Chip

The F chip acts as an interface between the Ibus and the FCIs. This ASIC is primarily composed of FIFO registers and synchronizers that provide protocol conversion, buffer transactions in both directions, and translate 34-bit I/O addresses into 40-bit system addresses.

The F chip is always designated the slave on the FCI. The VME Cache Controller (VMECC) or the Flat Cable to Graphics (FCG), at the other end of the FCI, is always the master. The VMECC is the interface between the FCI and the VMEbus or HIPPI network board. The FCG connects the FCI to the graphics subsystem.

S1 Chip

The S1 chip provides the interface between the Ibus and up to three SCSI controller chips (although the IO4 board only contains two SCSI controller chips). Controller chips from several different manufacturers are supported by the S1 chip; however, only the Western Digital WD95A is used. The IO4 board is configured with two WD95A controllers, leaving one channel on the S1 chip unused.

EPC Chip

The Everest Peripheral Controller (EPC) chip provides an interface to the basic peripheral chips and interfaces required for system operation over the 16-bit Peripheral Bus (PBus). These devices and interfaces include: a network controller, a secondary boot EPROMs, a bi-directional parallel port, non-volatile RAM, the TOD clock (timer), three RS-232 ports, one RS-422 port, and six external interrupt lines (three in-coming and three out-going).

Both the network controller and the parallel port have DMA controllers built into the EPC to provide the necessary support. The only access to the PBus devices is through load/store instructions performed by one of the CPUs. In addition, the PBus devices have ten independent interrupt lines.

2.4.2 Interface Modules – Mezzanine, FCI, and VCAM

The I/O Interface Modules, or mezzanine boards, can provide the IO4 board with a variety of additional bus interfaces, network interfaces, and serial ports. The interface modules mount directly to the IO4 board. Brief descriptions of the available interface modules are provided in the following sections.

SCSI Mezzanine (S Mezz) Board

The SCSI mezzanine board duplicates the S Chip and SCSI control logic found on the IO4 board. The S mezz board supplies three additional SCSI-2 channels. The board is secured to the IO4 board with standoffs and screws.

Flat Cable Interface (F Mezz) Boards

The Flat Cable Interface board has two versions; the F mezz and the F mezz (Short). The F mezz board contains the same F Chip and control logic found on the IO4 board. It is approximately one inch longer than the other mezzanine boards, allowing it to pick up the FCI channel normally covered by the VCAM and provide two FCI interfaces. The F mezz board is used only in systems with multiple-IO4 boards and only on those boards that do not have the VCAM mounted. The short version of the F mezz board has the same dimensions as the other mezzanine boards and can be used when a VCAM is mounted on the IO4 board. It acts as a pass-through board, allowing a single FCI interface to pass out from the IO4.

VMEbus Channel Adapter Module (VCAM)

The VCAM provides the interface between the FCI and the VMEbus, manages the protocol and signal level conversion between the two buses, and supplies the DC voltages required by the VMEbus backplane. The

VMECC and some MSI TTL logic are installed on the VCAM, as well as a pass-through circuit connecting an F Chip on the IO4 board to the backplane for use by the graphics subsystem.

Table 2-1 lists the mezzanine boards and the supported configurations. Note that these are the only restrictions on the available configurations: the VCAM must be installed on the first (or only) IO4 board, and a standard-length F mezz board will not physically fit on an IO4 board that already has a VCAM mounted.

Host Board	VCAM	S Mezz (SCSI-I)	S Mezz (SCSI-II)	F Mezz	F Mezz (short)
IO4 (first or only)	Yes	Yes	Yes	No	Yes
IO4 (additional)	No	Yes	Yes	Yes	Yes

Table 2-1 Supported IO4, VCAM and Mezzanine Board Configurations

2.4.3 SCSI Channel Adapter Boards

The SCSI channel adapter boards configure the available SCSI channels on an IO4 board as either single-ended or differential. These boards mount directly to the IO4 board SCSI channel connectors and are color-coded. Table 2-2 shows the color-coding scheme:

SCSI Channel Adapter Board Color	Signal Configuration
Green	Single-ended
Red	Differential

Table 2-2 SCSI Channel Adapter Board Color-coding Scheme

2.5 Power Boards

Power boards are DC-to-DC converters that take the 48 VDC from the system midplane and step it down to levels appropriate for the buses, circuit boards, and SCSI drives. Four types of power board are used with the rackmount systems:

- The System Controller board supplies +1.5 VDC at 30 amps for use by the EBus. This board also provides power for the microprocessor on the System Controller and for the LCD display on the system status panel.
- The 505 power board generates +5 VDC at 80 amps for use by the boards. There is a single and a dual version of the 505 board; the dual version has two power bricks.
- The 512 power board generates +5 VDC at 40 amps and +12 VDC at 17 amps for the VMEbus.

- The 512S power board provides +5 VDC at 40 amps and +12 VDC at 17 Amps for the SCSI drive box.

The System Controller, 505, and 512 power boards are available both with and without extender boards. Used with extenders, the power boards are installed in cardcage 1 and supply the necessary voltages to the midplane. Used without extenders, these boards are attached directly to the front of the optional cardcage 3 backplane. The 512S is designed to attach to the SCSI backplane in the SCSIbox.

2.6 RealityEngine² and VTX Graphics Subsystems

The RealityEngine² (RE2) and VTX graphics subsystems consist of three board types: the Geometry Engine (GE10 or GE10V), the Display Generator (DG2), and the Raster Memory (RM4) board.

The RE2 board set uses a GE10 with 12 geometry engine processors installed. A maximum of 4 RM4 boards are supported, along with a 21-inch color monitor.

The VTX board set uses a GE10V with 6 geometry engine processors installed. The VTX supports a single RM4 board and a 19-inch color monitor.

The principal features of the RE2 and VTX graphics board sets are:

- greater texel storage capacity (4 MB versus 256 KB in PowerVision)
- more color and greater depth and spatial resolution
- RGB and simultaneous low-resolution composite video out
- supports most video standards, such as PAL, NTSC and HDTV (RE2 only)
- built-in genlocking
- greater z-buffering capability (32 bits versus 24 bits in PowerVision)
- supports full scene antialiasing (1K x 1K)
- 80 megapixels per second (Mpps) with 5-span system
- 160 megapixels per second with 10-span system
- real-time texture mapping
- antialiasing for polygons, vectors, and points
- quad buffering for interactive high-resolution stereoscopy
- hardware support for image processing
- standard NTSC/PAL/M ppsM/ppsSVHS output
- broadcast-quality video options available
- stereo in a window
- ultra-high quality color: 12 bits per component (48-bit RBGA, quad-buffered)

The primary board in both graphics subsystems is the GE10. The GE10 interfaces with the host system through a Flat Cable Interface (FCI) on the IO4 board. The FCI is a 64-bit wide bus that has a maximum transfer rate of 160 MB per second. Its purpose is to provide an interface on the IO4 board between the graphics subsystems and the Ibus. The FCI leaves the IO4 board and passes through the VCAM to enter the system midplane. The GE10 is installed in a dedicated slot on the midplane, which is connected directly to the FCI.

The GE10 communicates with the RM4(s) over the Triangle bus and with the DG2 board over the Video Control (VC) bus. The Video Control bus provides access to the color maps, window display modes, and cursor control modes. Communication between the RM4(s) and the DG2 board is over the Video bus. See Figure 2-5 for a block diagram of the RE2/VTX board set.

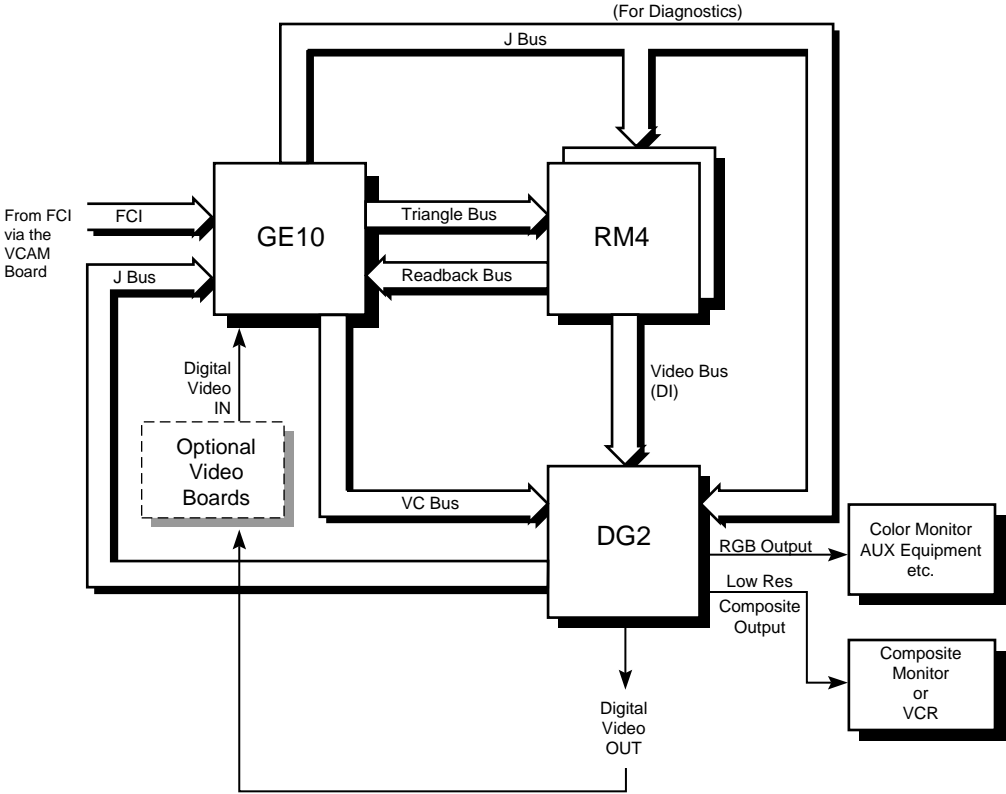


Figure 2-5 RE2/VTX Graphics Subsystem Functional Block Diagram

The RE2/VTX board set uses custom ASICs and parallel processing to reduce the amount of required hardware. This reduction can be seen when the RE2/VTX board set is compared to its predecessor, PowerVision. The RE2/VTX has three standard boards; PowerVision requires a minimum of four boards.

2.6.1 Geometry Engine (GE10/GE10V) Board

The Geometry Engine (GE10/GE10V) board processes Graphics Library® (GL) commands and data from the system CPU board and is the first stage of the graphics pipeline. There are two versions of the Geometry Engine:

- The GE10 contains 12 geometry engine processors and is used in the RE2 board set.
- The GE10V contains 6 geometry processors and is used in the VTX board set.

Figure 2-6 provides a block diagram that illustrates both versions of the Geometry Engine.

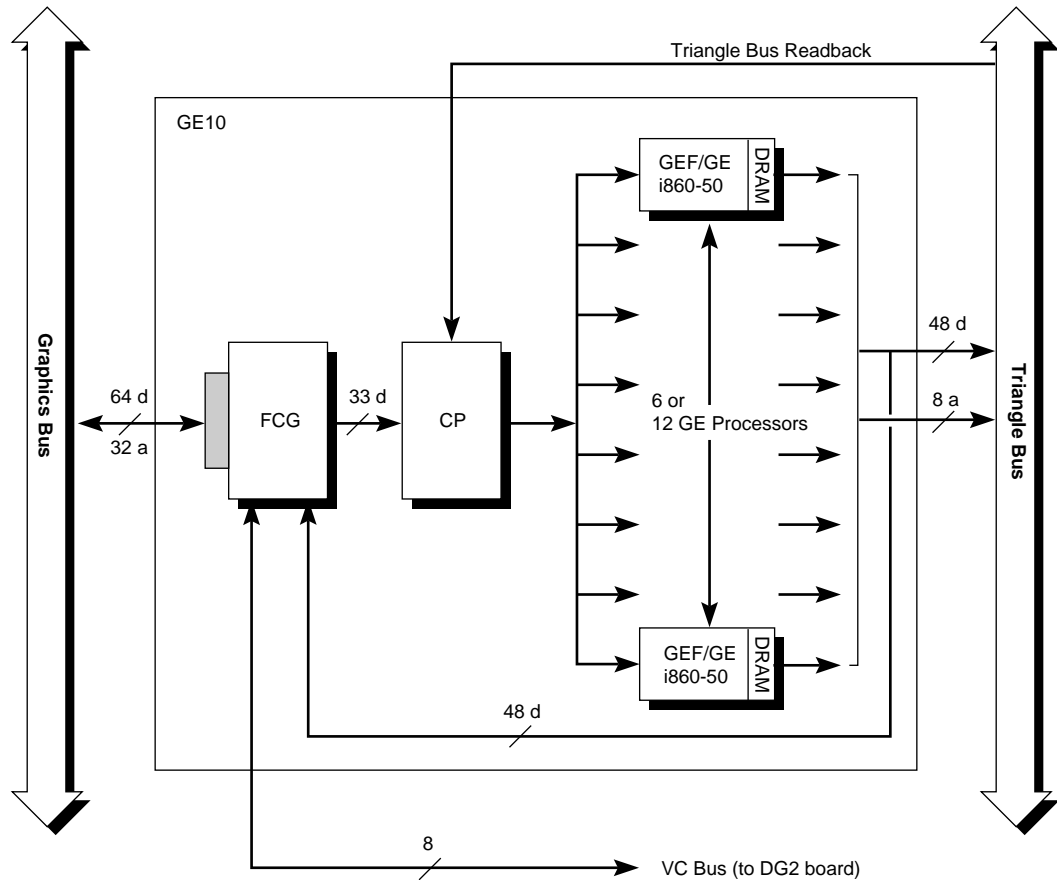


Figure 2-6 Geometry Engine Functional Block Diagram

The following discussion of the Geometry Engine refers to the GE10 board. However, unless otherwise noted the information applies to both the GE10 and GE10V.

The GE10 typically receives vertex data defining the location, orientation, color, and texture mapping coordinates of a polygon. If the polygon has more than three vertices, the GE10 subdivides the polygon into triangles. Triangles are the basic polygonal working units of the system. Data output from the GE10 geometry subsystem passes over the Triangle bus to the raster memory subsystem (RM4 board(s)).

The major components on the GE10 are the flat cable interface to graphics (FCG) ASIC, the command processor (CP), and the Geometry Engine (GE) processors.

The FCG ASIC interfaces data from the FCI via the VCAM to the graphics pipeline and transmits the data to the CP. The CP acts as the central distributing point for the data and instructions and reorders the input stream for efficient processing. The CP distributes data to the GE processors over a 32-bit bus.

The RE2 GE10 has 12 GE processors. The VTX GE10V has 6 GE processors. The GE processors contain an Intel™ i860XP floating point microprocessor, a 64-bit wide DRAM (which stores both code and instructions), and the Geometry Engine FIFO (GEF) ASIC chip. The Intel microprocessor can perform 100 million floating point operations per second (MFLOPS). See Figure 2-7 for a block diagram of the GE processor.

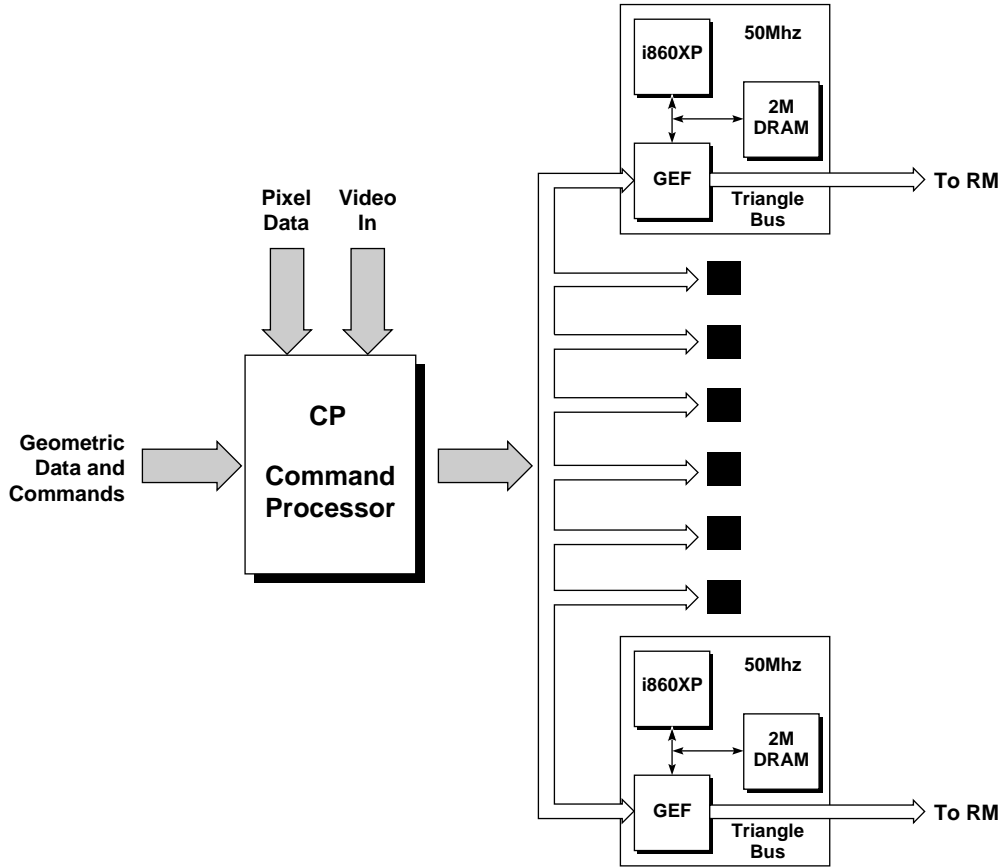


Figure 2-7 GE Processor Block Diagram

The GE10 ties into the display generator (DG2) board through the video control bus. This bus allows access to color maps, window display modes, cursor control as well as video format and timing control.

2.6.2 Raster Memory (RM4) Board

The Raster Memory (RM4) Board scans and converts triangle data from the triangle bus into pixel data. The RM4 then organizes the data into a series of *spans* (vertical strips of pixels) and transfers it to the frame buffer. Following the transfer to the frame buffer, the RM4 hands off control of the graphics subsystem to the DG2. The RM4 board is shown in Figure 2-8.

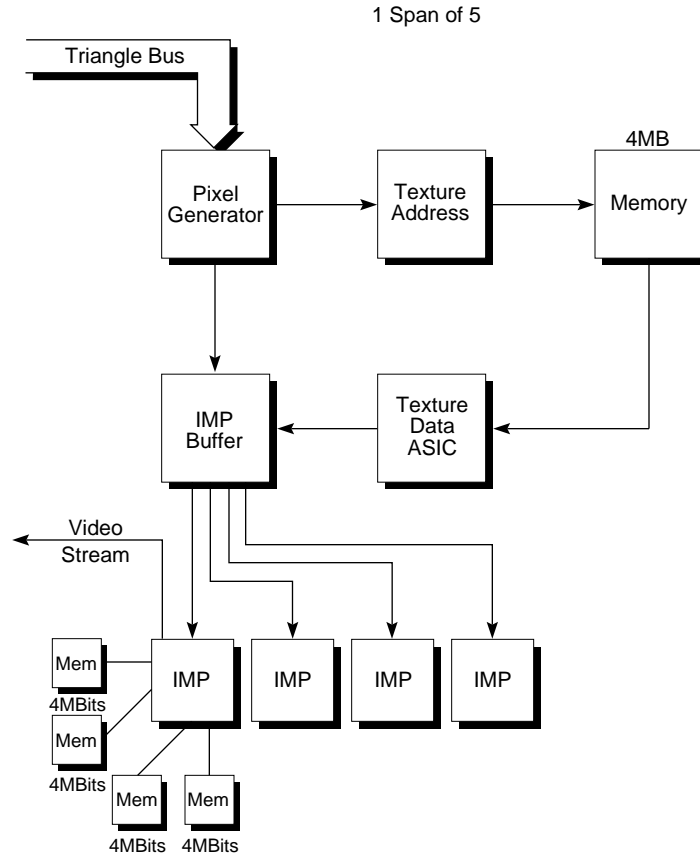


Figure 2-8 Raster Memory Board Block Diagram

The RM4 board is composed of the following main components:

- Pixel Generator (PG) ASIC
- Texture Address (TA) ASIC
- DRAM Texture Memory
- Texture Data (TD) ASIC
- Image Memory Processor (IMP) Buffer (IB) ASIC

To get pixels into the frame buffer, the pixel generators (PGs) must take the spans they have generated and redraw them from the top to the bottom pixel to find the parameter values for each of the polygon's interior pixels.

Triangles feed into five parallel pixel generators. The PGs walk the top and bottom edges of the triangles, identifying which pixels lie along those edges. For each x location in the pixel (or subpixel) grid, a pair is formed from the top and bottom pixels touched by each polygon. Each of the pixels in the span pair are then assigned parameters from the vertices of the polygon.

Two pixel data paths from the pixel generators facilitate the processing performance. One path processes the pixels for texture mapping. The other path bypasses texture processors to render non-textured primitives. If a pixel requires texture processing, the PGs calculate the texture coordinates of the pixel. This information goes to the Texture Address (TA) ASIC, which calculates the texture address information for texture memory.

The TD ASIC resamples the texture data. It resamples eight values for each pixel. Data is then sent to the Image Memory Processor (IMP) Buffer (IB), which distributes the data to the four IMP chips.

If no texture processing is required, the pixel goes straight to the IMP buffer. Once the IB creates the blended color, the pixel goes to one of four parallel image engine processors, which then passes the pixel to one of four image memory processors (IMPs).

Note: Each raster memory board has 20 IMPs. Each IMP contains four image engines, so there are 80 image engines per board.

The main responsibilities of the IMPs are as follows:

- filter the subpixel rendered image into the actual displayable frame buffer
- filter the subpixel z-buffer data
- decide whether to write the pixel based upon the z-buffer value
- perform the alpha blending of each new pixel with the pixel value that has already been rendered at the same location
- send the digital pixels to the display generator subsystem (DG2) over the pixel bus

The cost-reduced VTX supports one RM4 board. The RE2 board set can have up to four RM4 boards per pipeline. As more RM4 boards are added, the spans are interleaved, providing higher resolution and display quality. A 10-span system has 10 pixel generators, 160 image engines, and memory.

To differentiate the boards, the RM4s receive a 2-bit identity field from the video bus front plane, the DI1 (for pipeline 0) or the DI2 (for pipeline 1). This field identifies which of four addresses a board occupies.

2.6.3 Display Generator Subsystem (DG2)

The DG2 board receives digital frame buffer pixel data from the RM4 board over the video bus. The DG2 processes the pixel data through digital-to-analog converters (DACs) to generate an analog pixel stream for display. The principal components of the DG2 board are the XMAP ASICs, the function manager ASIC, and an NTSC/PAL encoder. See Figure 2-9 for a functional block diagram of the DG2 board.

XMAP ASICs

The ten XMAP ASICs on the DG2 board receive the serial stream of digital video data from the video control (VC) bus. The ASICs reorder data from the frame buffer to provide a left-to-right scan line display. The XMAPs also handle the lookup of the color-mapped pixels and generate the proper RGB color for each pixel.

DG2 Function Manager

The function manager ASIC controls these display and video control tasks for the DG2 board:

cursor display

video timing

pixel clock

genlocking

The function manager also contains the HLIST and VLIST display parameters that provide horizontal and vertical pixel display codes.

The video input format (VIF) processor, in the function manager, generates the video pixel clock time base. The processor can operate in free-running or in externally genlocked mode for synchronization. In genlock mode, the VIF syncs on an external source.

A video output format (VOF) processor in the function manager enables a master sync source to loop through the system (Genlock Out) to other equipment. The shadow RAM or SRAM stores previous display data to help support windowing.

NTSC/PAL Encoder

An NTSC/PAL encoder provides the circuitry to convert the separate red, green, and blue data into composite video output signals. These signals are available as composite and SVHS outputs.

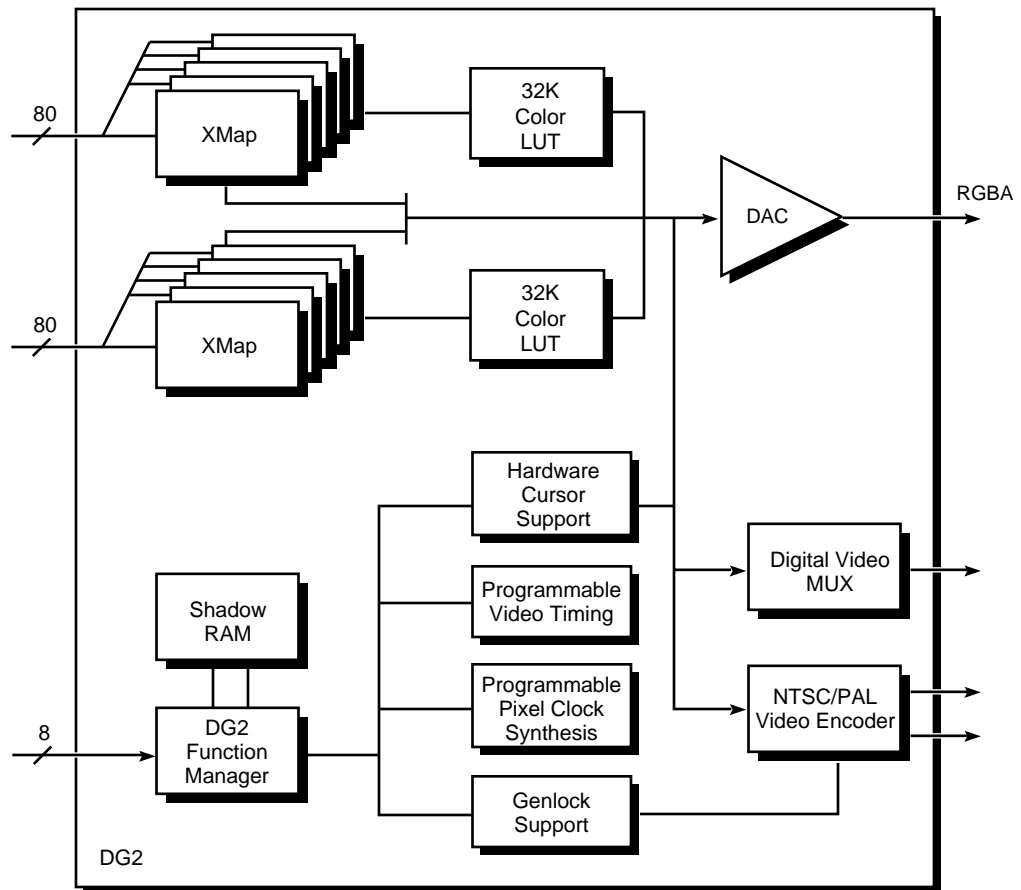


Figure 2-9 Display Generator Board Block Diagram

Chapter 3

Installation

This chapter describes how to unpack, cable, and configure the Challenge and Onyx rackmount systems.

3.1 Safety



Warning: Installation of this product requires specific training and technical knowledge. These instructions have been provided for use by Silicon Graphics® system support engineers (SSEs) or Silicon Graphics-trained personnel only. This equipment uses internal voltages that are hazardous if the equipment is improperly assembled or disassembled.

Warning: Wait 5 minutes after powering off a rackmount system before working on any part of the power supply or midplane/backplane. Because of the large amount of capacitance in the system, a significant fraction of the operating voltage remains on the midplane/backplane for up to 5 minutes after the system is powered down.

Warning: There is a danger of explosion if the lithium battery-powered integrated circuits on the IO4 and System Controller boards are incorrectly replaced. Replace only with Dallas Semiconductor P/N 051397. Discard the used parts according to the manufacturer's instructions.

Caution: Sixteen pico fuses are installed on the SCSI backplane. These are not field-replaceable, since they are soldered directly onto the backplane. For continued protection against the risk of fire, repair depots should replace only with the same type and rating of fuse. Fuse is 125V, 5A, and manufactured by Cooper Industries, Bussman Div., P/N MCR-5.

Caution: This equipment is extremely sensitive to damage from electrostatic discharge (ESD). ESD is an electrical charge caused by the build-up of electrical potential on clothing and other materials. You must use proper ESD preventive measures. See Section 3.1.1, "Electrostatic Discharge (ESD) Preventative Measures."

3.1.1 Electrostatic Discharge (ESD) Preventative Measures

Take the following precautions when installing and working with the system:

- attach a ground strap to your wrist when connecting and disconnecting boards and peripherals
- ensure that you and all electrical equipment that you handle during this installation are at ground potential to avoid damage from ESD
- keep the boards in the antistatic bags provided until they are needed
- remove boards from their antistatic bags only when you are properly grounded to the chassis ground with a ground strap

3.2 Restrictions and Important Notes

The backplanes and midplanes used for the graphics workstation and server configurations are not interchangeable.

Challenge/Onyx systems require IRIX™ 5.0 (Sherwood) or higher.

3.3 Site Requirements

Before continuing with this procedure, verify that the location where the system is to be installed meets the space, power and environmental guidelines found in the *Challenge/Onyx Site Preparation Guide* (P/N 108-7040-020).

3.4 Unpacking

Warning: In its maximum configuration, the rack-mounted system weighs approximately 1200 pounds. Use caution when unpacking and moving the system chassis. Ensure that the chassis remains on a level surface and that the chassis weight remains evenly distributed across the four casters. If the casters must be lifted over an obstacle, such as a door threshold, use proper lifting techniques and employ a minimum of two people. Exercise the same caution when moving monitors or terminals.

The system arrives at the customer site in a wooden crate. Packed along with the system are the documentation carton and the accessories carton. The documentation carton contains the system manuals as well as warranty and licensing information. The accessories carton contains the system cables and any additional connectors or tools required for a specific configuration. The monitors and/or terminal are shipped in separate cartons. Remove the system from the crate as follows:

Caution: Do not subject the cabinet to any unnecessary shocks or vibration while unpacking and installing the system.

The following steps describe how to unpack a rackmount system, illustrated in Figure 3-1. Note that a minimum of two people are required to safely remove a rackmount system from the packing crate:

1. Release the six latches securing the door to the crate and remove the door.
2. Loosen the four latches securing the top of the crate.
3. Remove the two wing nuts securing the front rail and remove the rail from the crate.
4. Position the lip (located at the top of the door) in the slot immediately in front of the system platform.

Note: When positioning the door, ensure that the foam padding does not swing down and prevent the bottom edge of the door from evenly contacting the floor.

5. Using two people, roll the system out of the crate and down the front door.

Warning: Use extreme caution when rolling the system chassis down the door. The weight and dimensions of the system make it difficult to control. Personal injury and system damage could result if the chassis becomes unbalanced or builds too much momentum coming down the ramp.

At least two people are required to roll the system out of the crate.

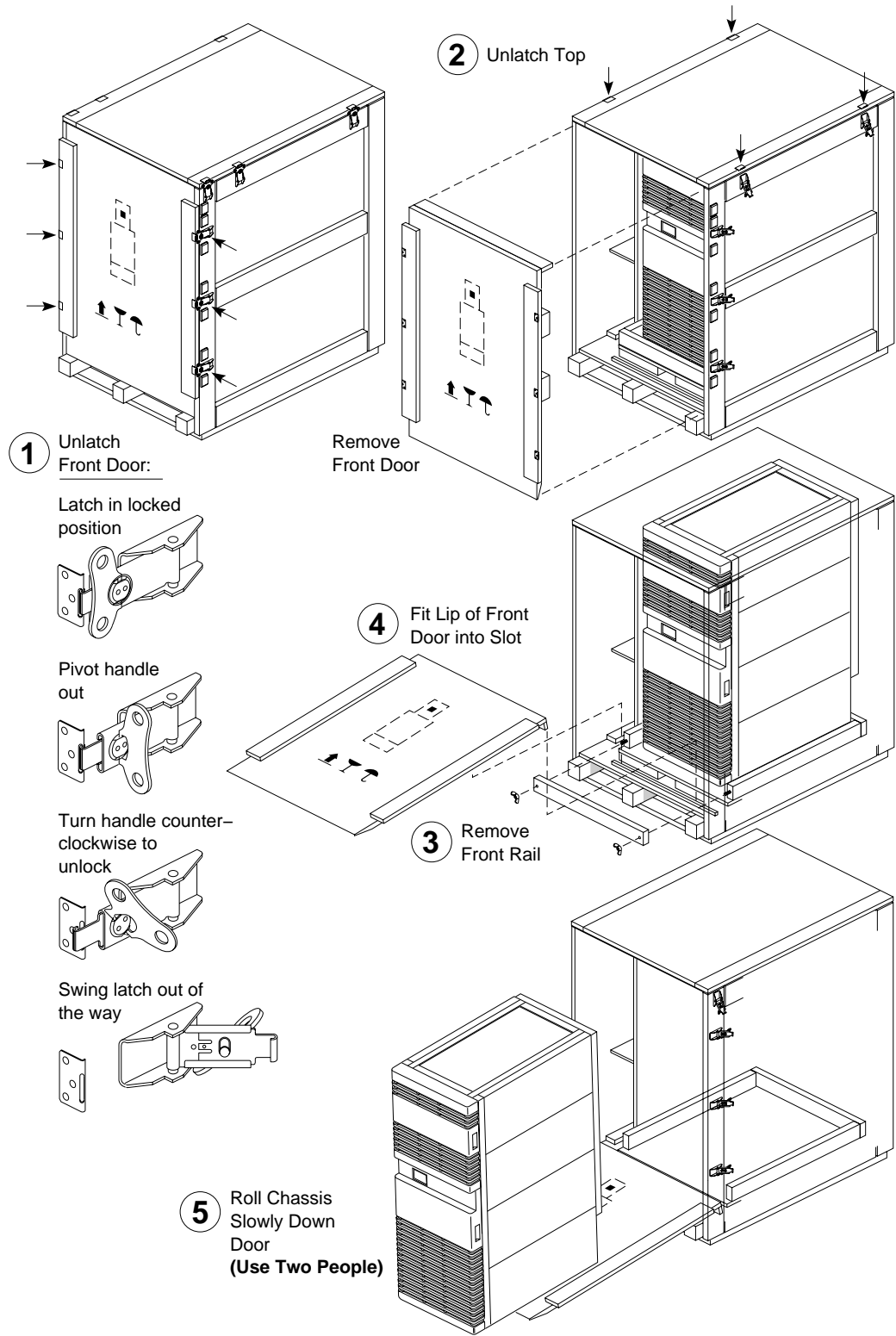


Figure 3-1 Unpacking the Rackmount System Shipping Container

6. Remove the documentation and accessories cartons.
7. Check the items received against the packing list.
8. Inspect each item for defects. Check for scratches, dents, rust, soiling, and loose or missing parts.
9. Open the cabinet and visually verify that the system is configured according to the shipping list.

3.5 System Installation

The Challenge/Onyx rackmount system is configured by the factory to reflect a specific order; however, changes in the order, additional customer-requested options, or upgrades may require some field installation. The following sections describe how to access the cardcages, SCSI drive boxes, and power supply enclosure.

3.5.1 System Board Set Installation and Configuration

Note: Dedicated cardcage slots and restrictions on board placement are found in Section 3.5.1.3, “Onyx Slot Assignments” and Section 3.5.1.4, “Challenge Slot Assignments.”

All three of the access covers to the chassis are held shut with magnetic strips; there are no latches.

Gain access to the system cardcages by performing the following steps:

3.5.1.1 Accessing Cardcage 1

1. Open the upper front door of the chassis.
2. Release the quarter-turn captive screw, on the right side of the system status panel, and swing the panel out of the way (see Figure 3-2).
3. Release the two quarter-turn fasteners securing the I/O panel and lower the panel until it is almost horizontal.

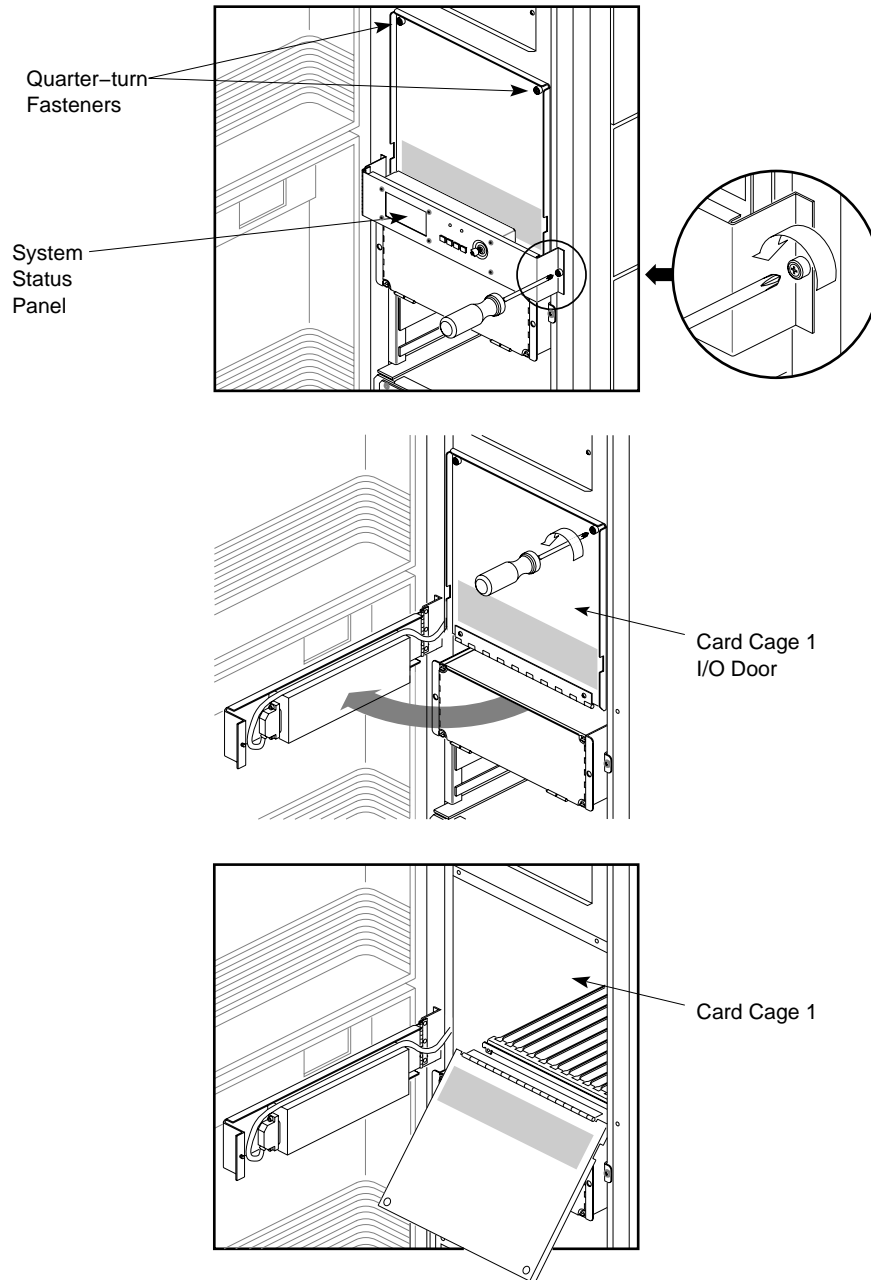


Figure 3-2 Gaining Access to Cardcage 1

4. Unlatch the cable supporting the I/O panel and gently allow the panel to pivot down toward the floor. Circuit boards may now be installed in or removed from the cardcage.

When the circuit board(s) are in place, reverse the preceding steps.

Note: Observe proper ESD procedures when handling the boards. Ensure that the boards are correctly seated in the backplane or midplane connectors and that the ejector tabs have engaged the top and bottom card guides.

3.5.1.2 Accessing Cardcage 2 and Cardcage 3

1. Open the rear door of the system cabinet.
2. Determine if any of the cables attached to the I/O panel will obstruct the panel's movement when opened. Remove cables as required.
3. Release the two quarter-turn fasteners securing the I/O panel (see Figure 3-3) and lower the panel until it is horizontal.

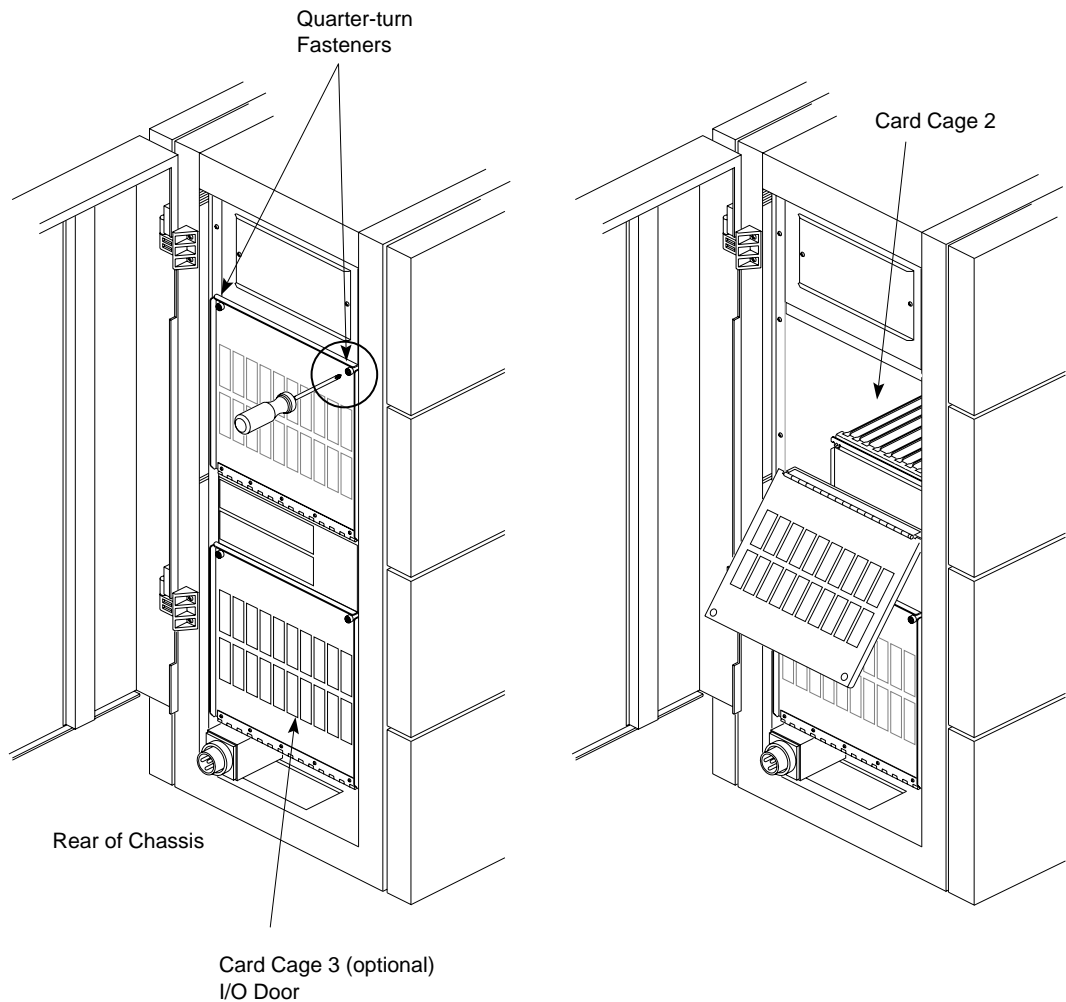


Figure 3-3 Gaining Access to Cardcages 2 and 3

4. Remove any internal I/O cables that will prevent the panel from pivoting down past horizontal.

5. Unlatch the cable supporting the I/O panel and gently allow the panel to pivot down toward the floor. Circuit boards may now be installed in or removed from the cardcage.

When the circuit board(s) are in place, reverse the preceding steps.

Note: Observe proper ESD procedures when handling the boards. Ensure that the boards are correctly seated in the backplane or midplane connectors and that the ejector tabs have engaged the top and bottom card guides.

3.5.1.3 Onyx Slot Assignments

The slot assignments for Onyx systems are shown in Figure 3-4 through Figure 3-6. Be aware that in the field the recommended slot assignments may be different (as indicated by the stick-on labels over the cardcages).

In Cardcage 1, the only board with a dedicated slot is the System Controller board. This restriction is due to the System Controller board's unique backplane connectors. There are no restrictions on any of the Ebus slots; CPUs and memory boards can be installed in any order.

In Cardcage 2, the only Ebus board having a dedicated slot is the master IO4 board. The first (or only) IO4 board must be installed in slot 11, with its mounted VCAM attached to the slot 12 backplane connectors. Additional IO4s (with no VCAMs) can be installed sequentially in slots 9 (second IO4), 7 (third IO4), and 5 (fourth IO4). However, the graphics board set must be installed exactly as shown in the supporting figures.

Note: The Ebus slots on both sides of the midplane are numbered from 1 to 11. Only the even-numbered slots in Cardcage 1 (the upper, front cardcage) have connectors. Cardcage 2 (the upper, rear cardcage) has connectors in only the odd-numbered slots.

See Appendix F for a complete listing of all of the board fault LED error messages.

In Cardcage 3, the boards must be installed exactly as shown in Figure 3-6. For more information on configuring Cardcage 3, including how to create multiple graphics pipes, see Section 3.11.5.2, "Onyx Graphics System Configuration."

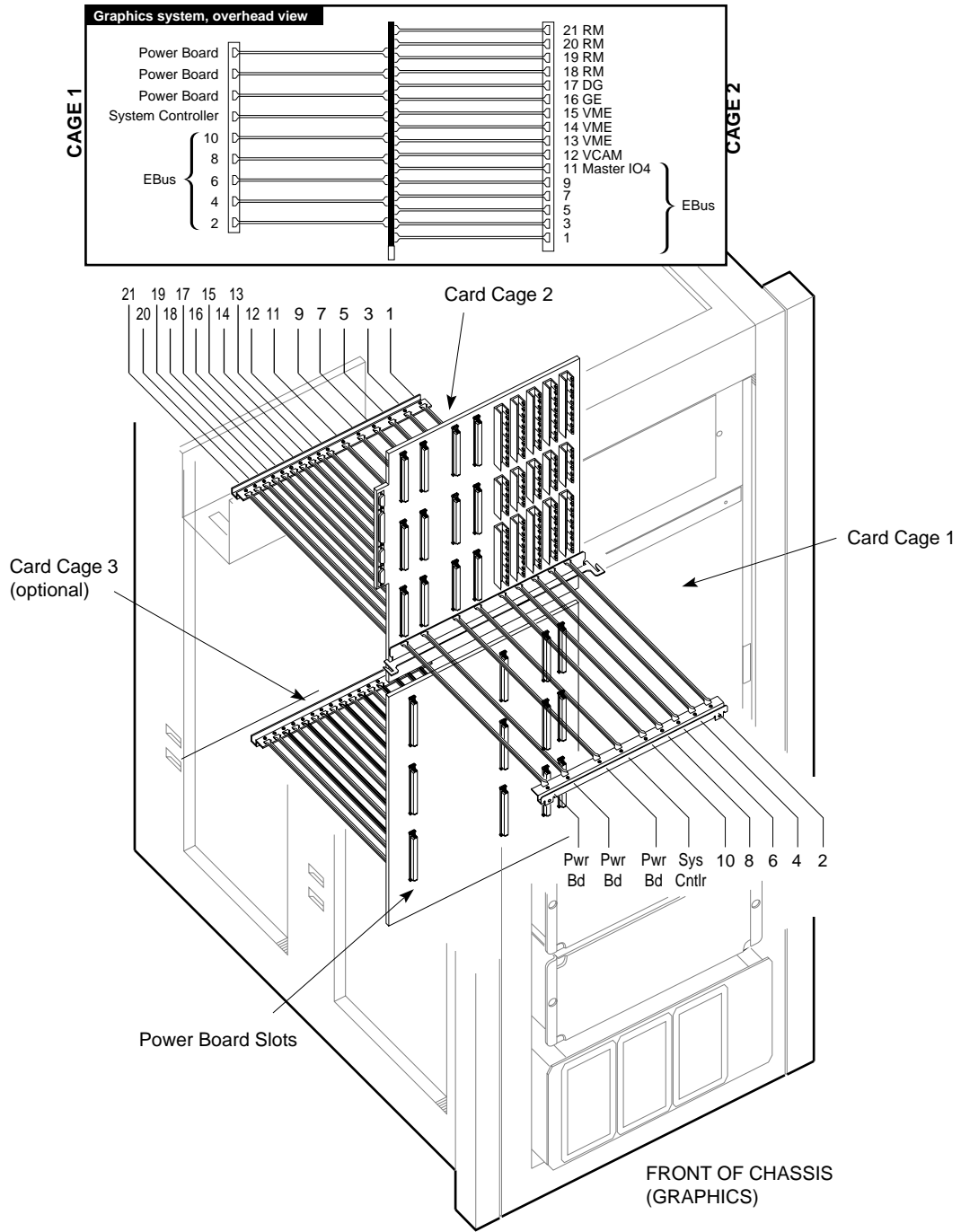


Figure 3-4 Rackmount Graphics Workstation Cardcage 1 Slot Assignments

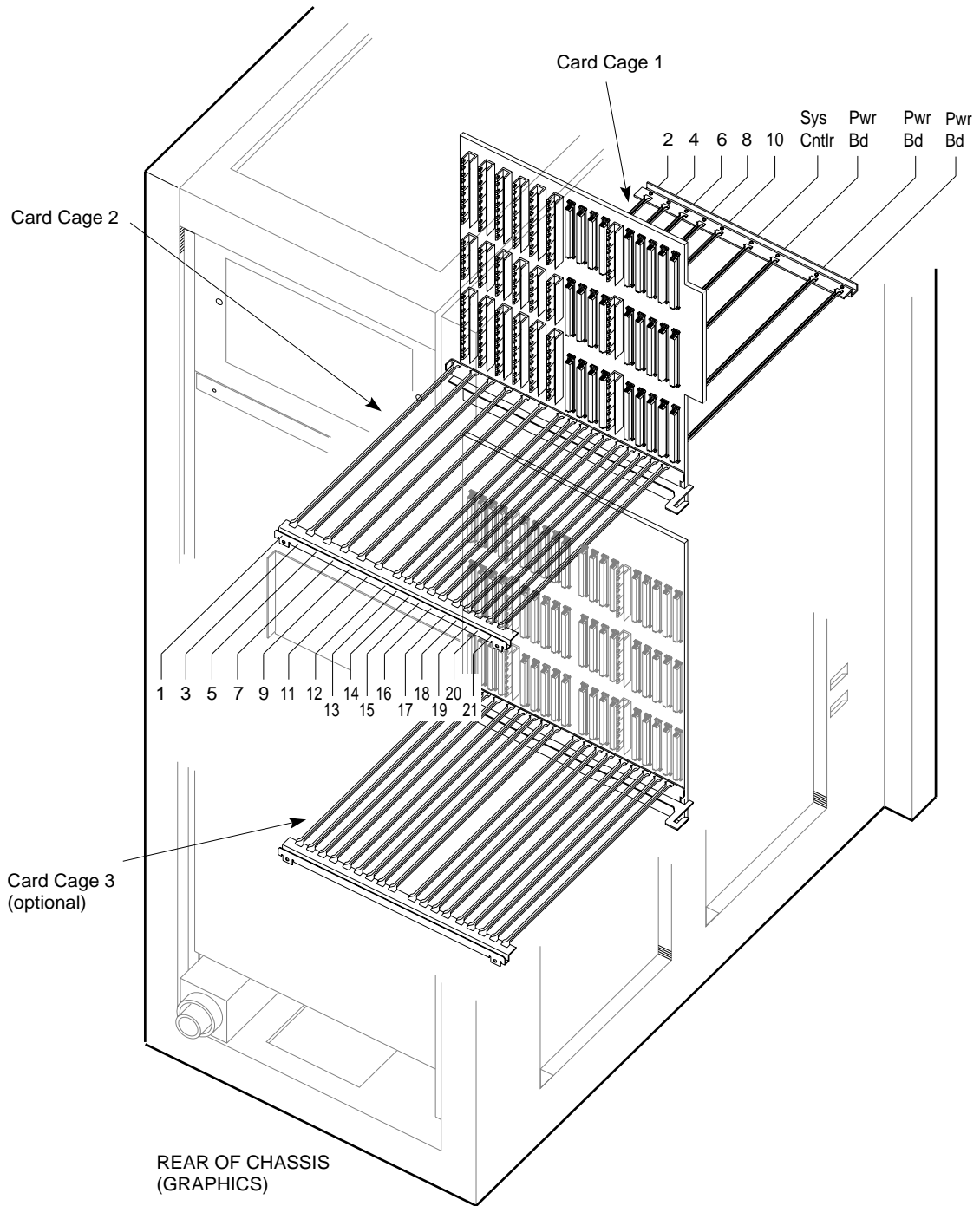


Figure 3-5 Rackmount Graphics Workstation Cardcage 2 Slot Assignments

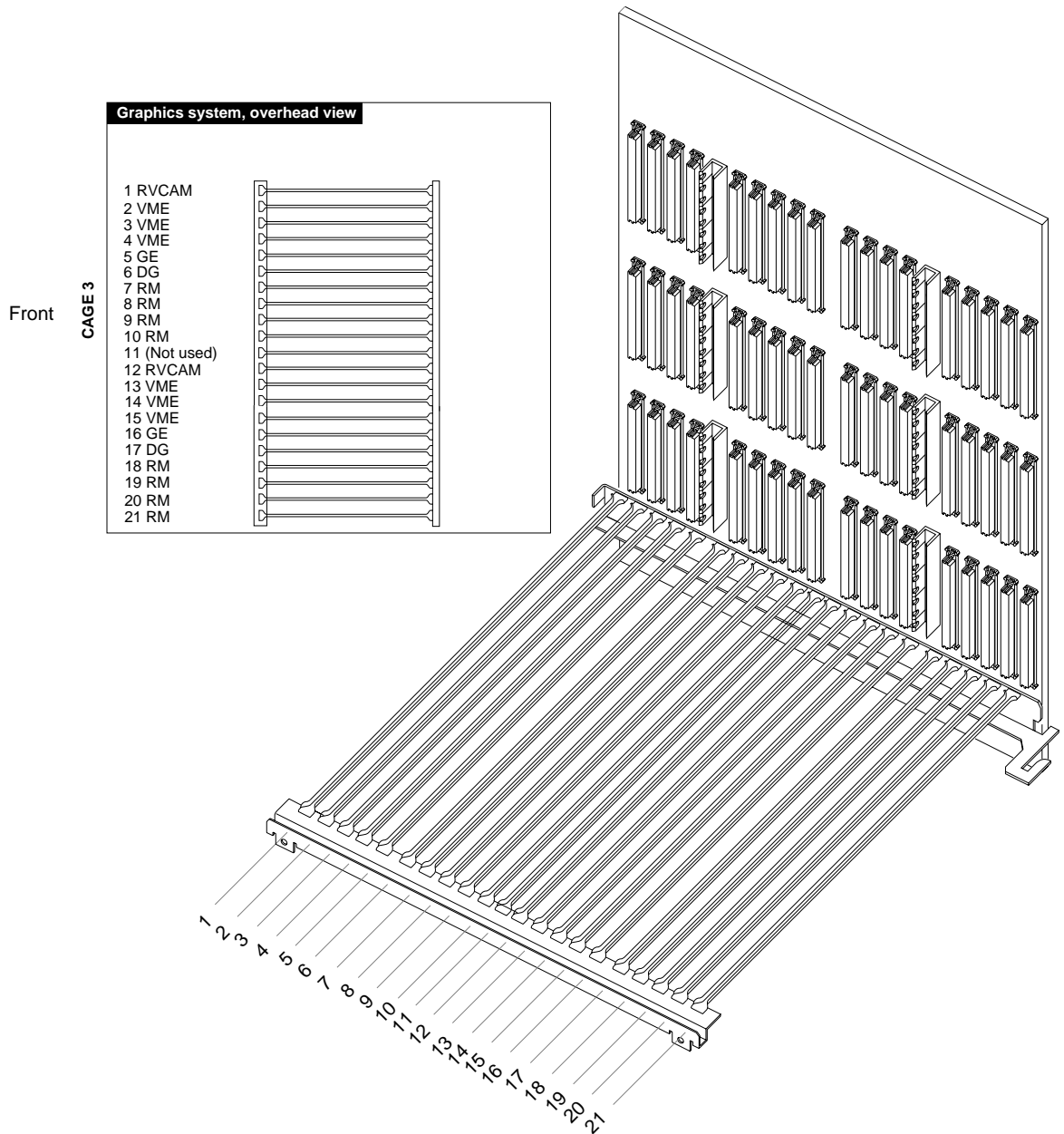


Figure 3-6 Rackmount Graphics Workstation Cardcage 3 Slot Assignments

3.5.1.4 Challenge Slot Assignments

The slot assignments for Challenge systems are shown in Figure 3-7 through Figure 3-9. Be aware that in the field the recommended slot assignments may be different (as indicated by the stick-on labels over the cardcages).

In Cardcage 1, the only board with a dedicated slot is the System Controller power board. This restriction is due to the System Controller's unique backplane connectors. There are

no restrictions on any of the Ebus slots; CPUs and memory boards can be installed in any order. (Note that by convention certain of these boards are typically installed in certain Ebus slots. See Figure 3-7.)

In Cardcage 2, the only Ebus board having a dedicated slot is the master IO4 board. The first (or only) IO4 board must be installed in slot 15, with its mounted VCAM attached to the slot 16 backplane connectors. Additional IO4s (with no VCAMs) must be installed sequentially in slots 13 (second IO4), 11 (third IO4), and 9 (fourth IO4).

In Cardcage 3, the first (or only) Remote VCAM (RVCAM) must be installed in slot 1. Additional Remote VCAMs can be installed in slots 7, 12, and 17. Each RVCAM controls a separate VMEbus. Because of power limitations, you may have to install multiple RVCAM boards in order to drive the desired number of VMEbus boards. There can be one, two, three or four VMEbuses in Cardcage 3. Table 3-1 shows where to place the RVCAM boards for specific VMEbus configurations:

Number of VMEbuses in Cardcage 3	Cardcage 3 Slot in Which to Place RVCAM Board
1	1
2	1 and 12
3	1, 7, and 12
4	1, 7, 12, and 17

Table 3-1 Cardcage 3 Remote VCAM (RVCAM) Slot Assignments

Refer to Section 3.11.5.3, “Challenge Server System Configuration,” for detailed procedures describing the Cardcage 3 configuration, including power limitations and cabling.

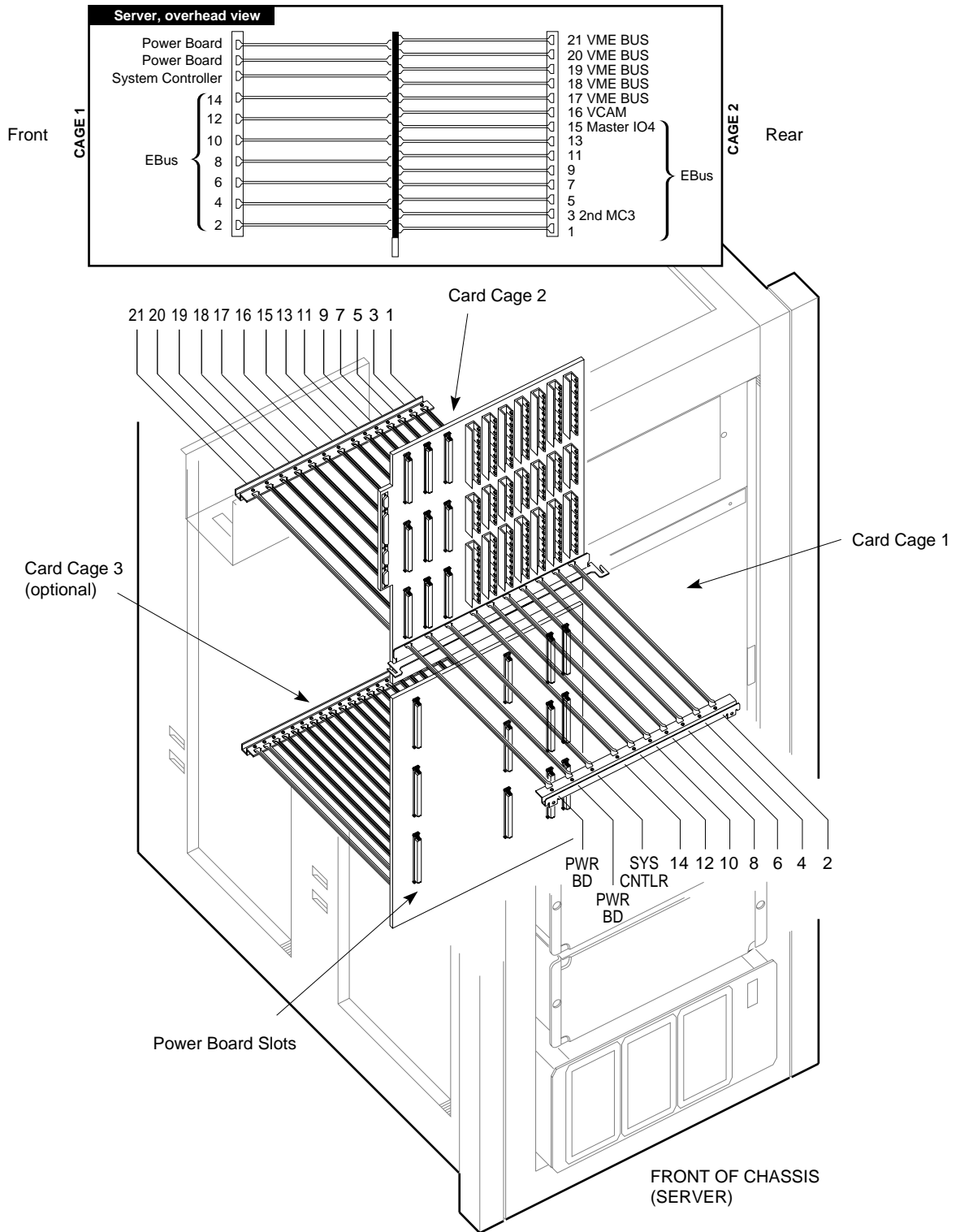


Figure 3-7 Rackmount Server System Cardcage 1 Slot Assignments

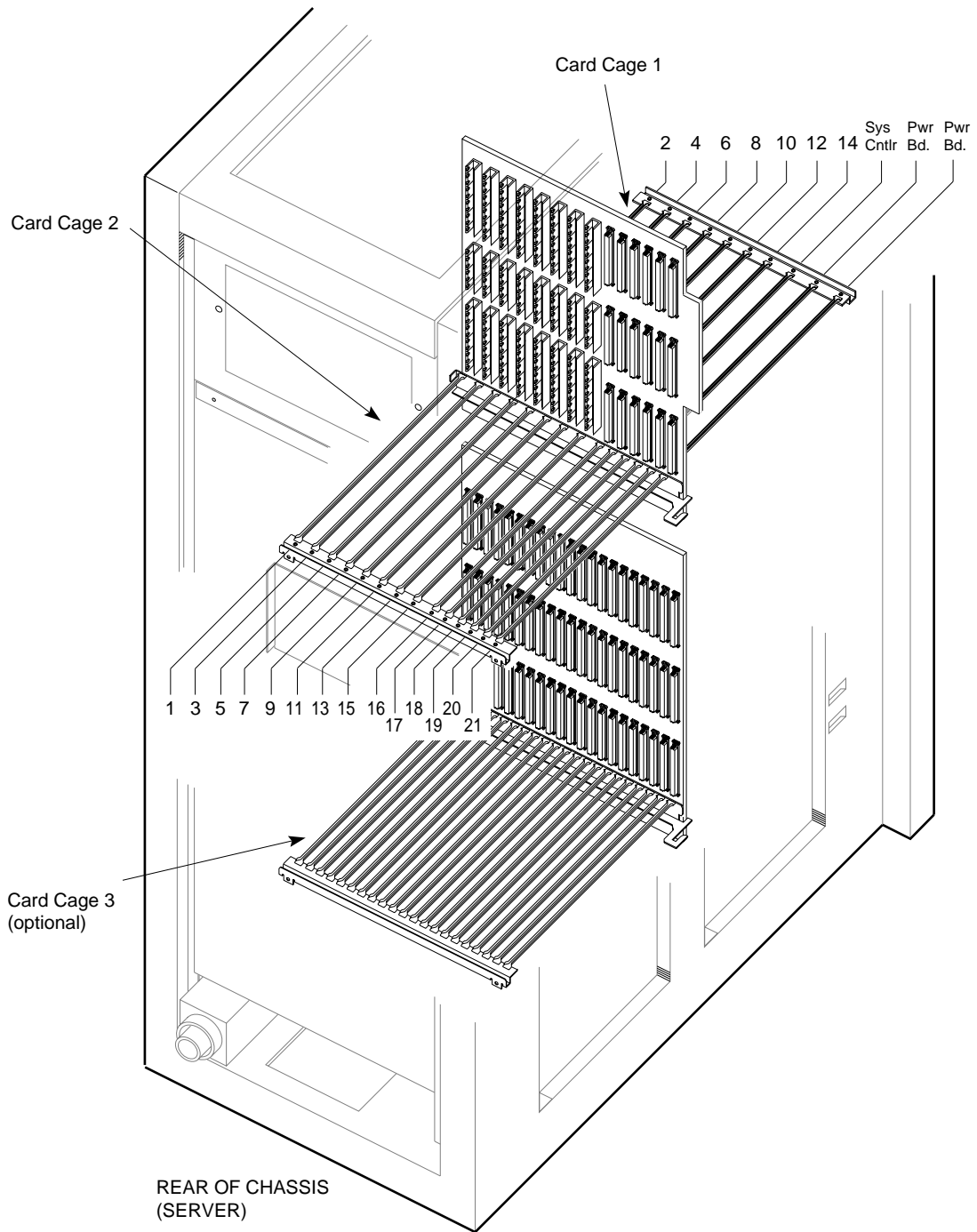


Figure 3-8 Rackmount Server System Cardcage 2 Slot Assignments

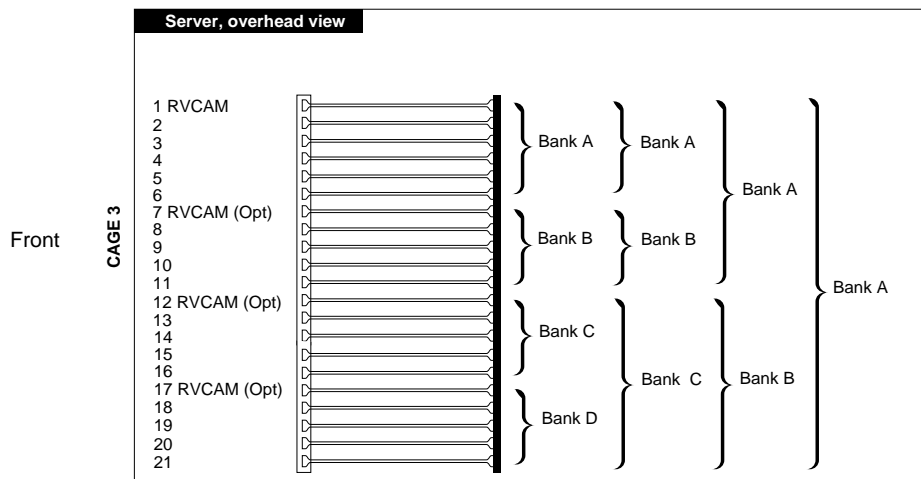
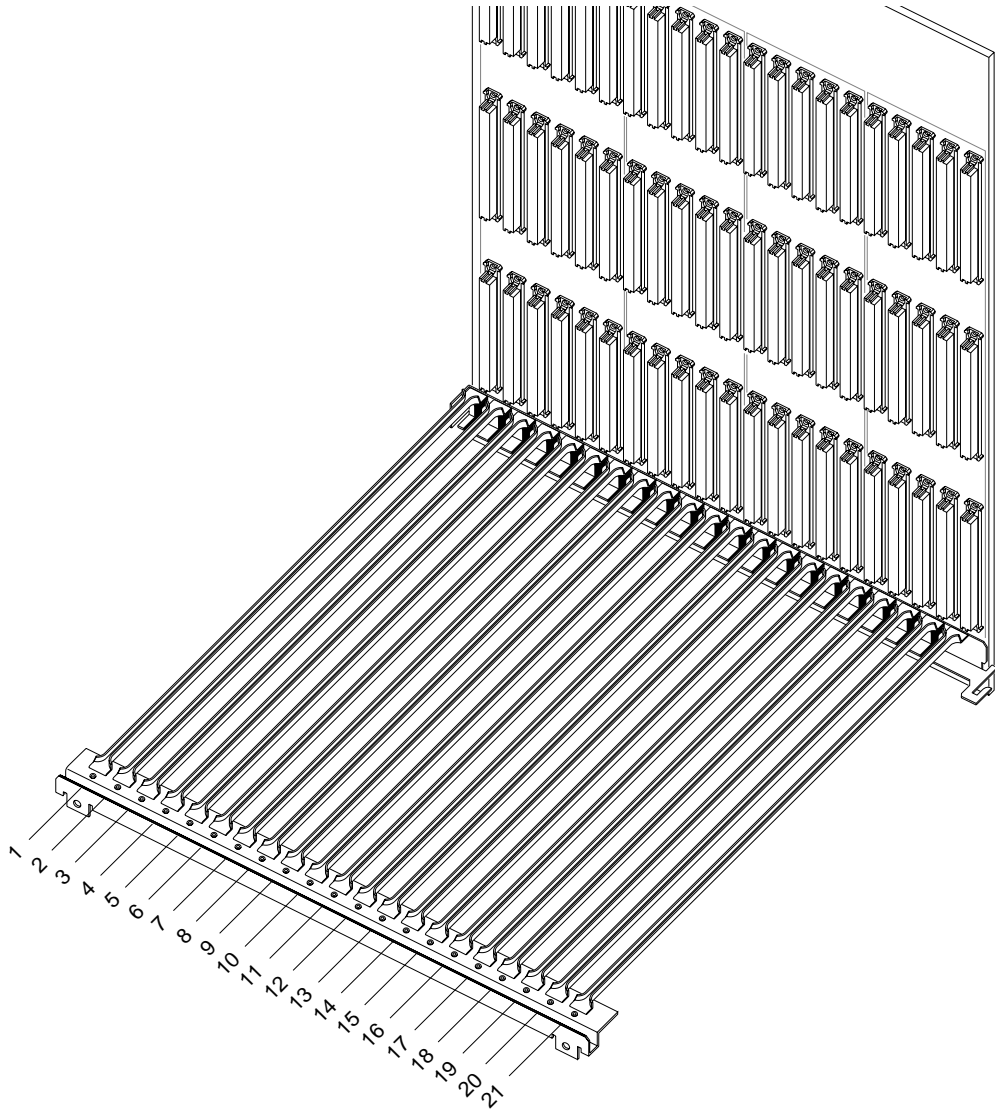


Figure 3-9 Rackmount Server System Cardcage 3 Slot Assignments

3.5.1.5 VMEbus Jumpers

Note: The VMEbus jumpering scheme is now the exact opposite as it was in older Silicon Graphics systems. Please read the following section carefully.

Use jumpers on the VMEbus to skip over empty VME slots in Cardcage 2. If there are any empty slots on the midplane between the installed VMEbus boards, those slots must have jumpers installed to allow signals to pass through to the next occupied slot.

This applies only to the four middle card slots (slots 17 through 20). The first VME slot (16) always contains the VCAM, and the last VME slot (21) has no place to pass the bus signals to.

Each of the four middle slots has a corresponding jumper bank consisting of five jumpers. To jumper a bank, you install five individual jumpers in the bank. These jumpers are located on the Cardcage 1 side of the midplane, between the power bus slots (see Figure 3-10).

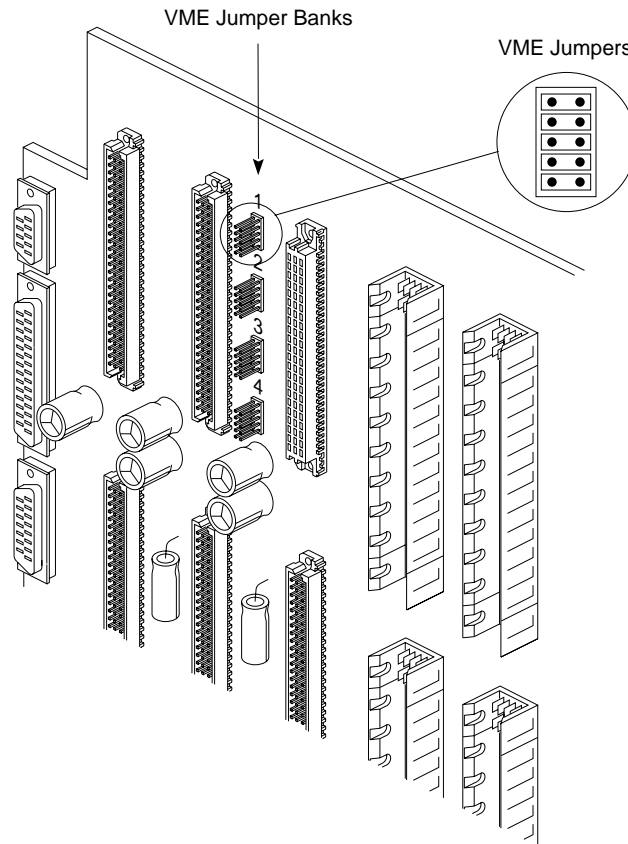


Figure 3-10 VMEbus Midplane Jumpers

Note: The optional Cardcage 3 VMEbus backplane does not have jumper banks as the midplane does. Empty VMEbus slots in Cardcage 3 are jumpered from the cardcage side. See Section 3.11, “Optional Third Cardcage (Cardcage 3) and Power Supply Tray,” for the Cardcage 3 configuration instructions.

The jumper banks correspond to the VME slots as shown in Table 3-2.

Jumper Bank	Cardcage 2 VME Slot
1	17
2	18
3	19
4	20

Table 3-2 Correspondence of VME Jumpers to VME Slots

To jumper a bank, connect all of the five pairs of posts with jumpers.

For example, if you have VME boards in slots 18 and 20, you would place five jumpers in bank 1 (to pass signals through the vacant slot 17) and five jumpers in bank 3 (to pass signals through the vacant slot 19). Figure 3-11 illustrates this example.

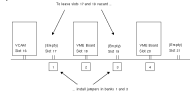


Figure 3-11 Cardcage 2 VMEbus Jumpering Example

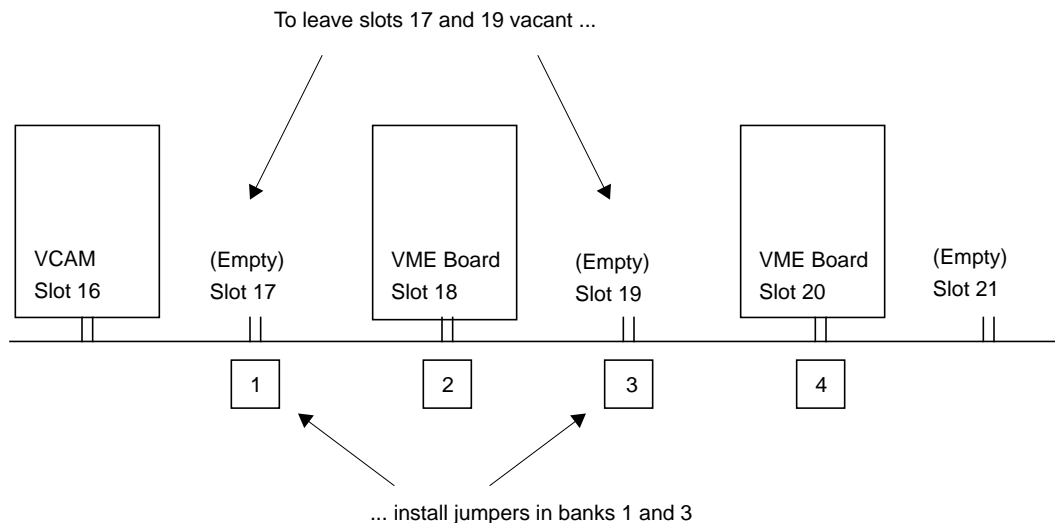


Figure 3-12 Cardcage 2 VMEbus Jumpering Example

You only have to jumper the VME slots if you are leaving gaps between the VCAM in slot 16 and any VME boards, or if you are skipping slots between VME boards. If you have no VME boards installed in Cardcage 2, you do not need to install any jumpers.

3.5.1.6 IP19 Board SIMMs and Power Jumpers

Note: The IP19 SIMMs and power jumpers are not field-replaceable. The information supplied in this section is intended as an aid in identifying the configuration of a specific board.

The IP19 board is shipped with either 3.3V or 5.0V ICs and SIMMs. There are 32 power jumpers soldered to the board that are configured to match the IC power requirements. Each jumper is composed of three through-board mounting pads with “5V” silkscreened near one of the end holes. Jumpering the center hole to the end labeled 5V configures the board for 5-volt ICs. Jumpering the center hole to the unlabeled end hole configures the board for 3.3-volt ICs.

Note: Observe proper ESD procedures when handling the boards and the SIMMs. Ensure that the boards are correctly seated in the midplane connectors and that the ejector tabs have engaged the top and bottom card guides.

3.5.1.7 Memory Board Upgrade

This section describes how memory is arranged and how to install SIMMs on the MC3 board.

The MC3 memory board is composed of two leaves, leaf 0 and leaf 1 (see Figure 3-12). Each leaf contains 16 SIMM sockets.

The 16 SIMMs in leaf 0 are black and the 16 SIMMs in leaf 1 are gray. Note that each leaf consists of an upper and lower group of 8 SIMMs. Note also how the SIMM groups alternate between leaf 0 and leaf 1, up and down the board. This illustrates how memory is physically *interleaved* on the MC3 board.

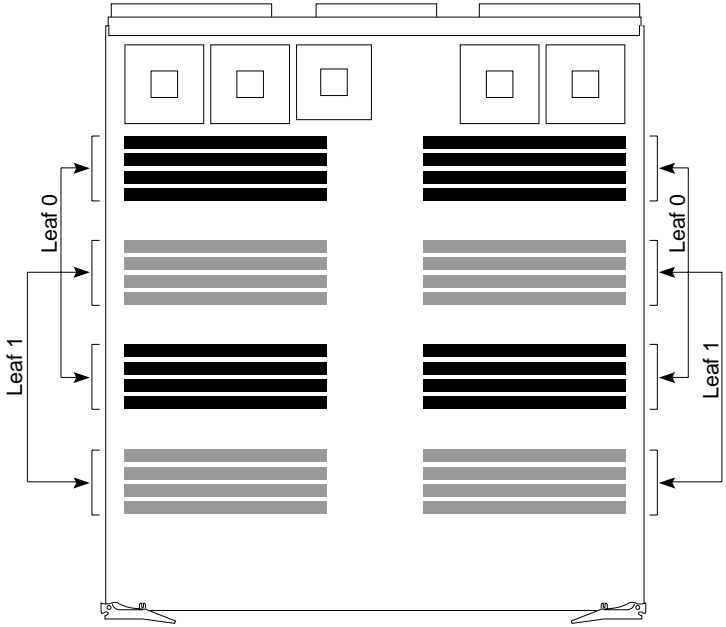


Figure 3-13 Memory Leaf Organization

The SIMMs on each leaf are organized into banks of memory. A bank is the basic memory building block. Each leaf is composed of four banks and there are eight banks per board. Banks A, C, E, and G make up leaf 0 and banks B, D, F, and H make up leaf 1 (see Figure 3-13). A single memory bank contains four SIMMs that are numbered 0 through 3 on the board. For example, the bank A SIMMs are identified as A0, A1, A2, and A3.

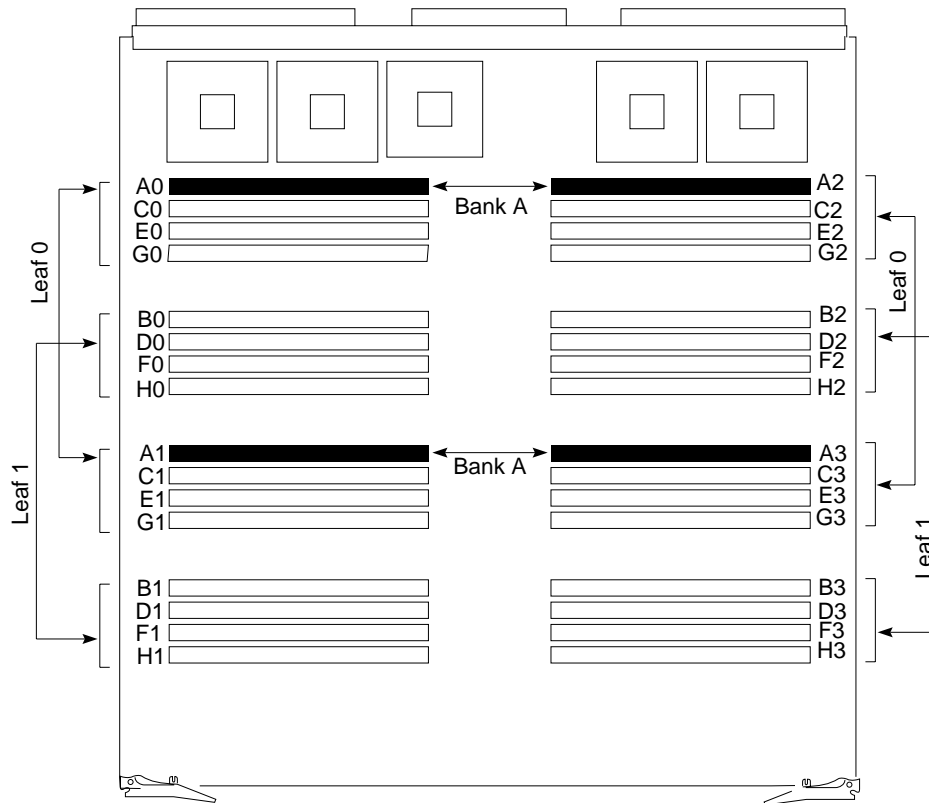


Figure 3-14 Memory Bank Organization

Note: All SIMMs in a bank must be of the same type, that is, 16 or 64 MB. During power-up diagnostics, the memory tests check only one of the four SIMMs in a given location. If you mix SIMM types, memory errors will occur.

On early MC3 boards, only the first two banks of each leaf can be populated. These boards are compatible with later boards that can populate all of their SIMM slots. Both boards can use the same SIMMs; the only difference between the boards is that the maximum configuration of the older boards is exactly half that of the later MC3s.

Caution: Observe proper ESD practices (such as using a ground strap and an antistatic mat) when installing SIMMs.

Installing SIMMs

Install the SIMMs as follows:

1. Slide each SIMM module directly into a single SIMM location with the notch at the ejector tab end (see Figure 3-14).
2. Install the SIMMs, a bank at a time; for example A0, A1, A2, and A3.

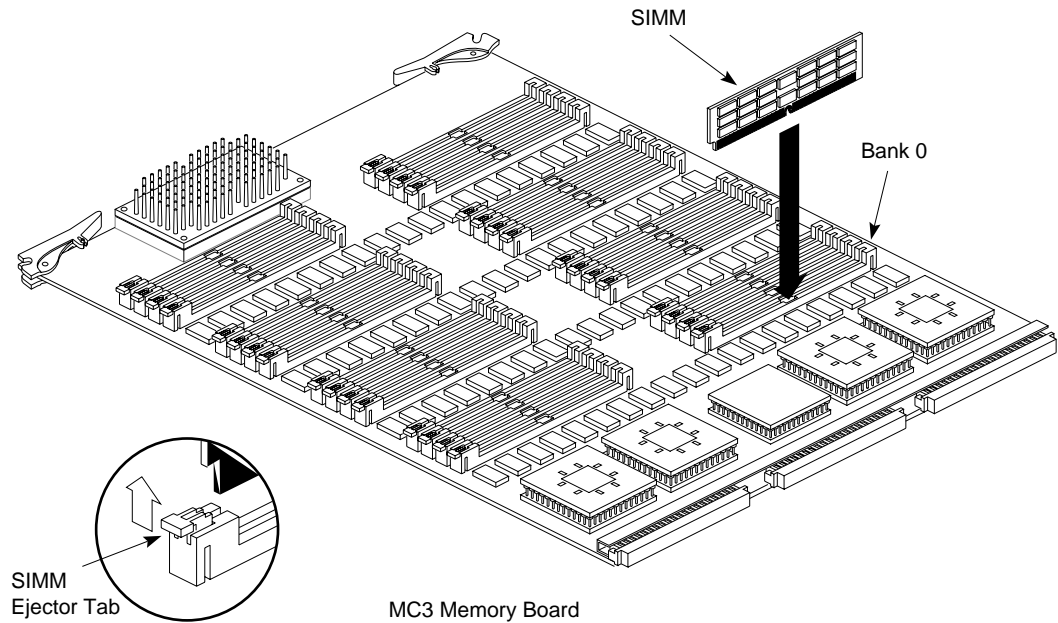


Figure 3-15 SIMM Installation

Removing SIMMs

Use the SIMM extraction tool and the following instructions to remove SIMMs from the MC3 board.

Note: Observe proper ESD procedures when handling the boards and the SIMMs. Ensure that the boards are correctly seated in the backplane connectors and that the ejector tabs have engaged the top and bottom card guides.

1. Place the extraction tool over the SIMM ejector tab as shown in Figure 3-15.
2. Grasp the SIMM extraction tool and lift up the two stirrups on each side of the tool with your fingers.
3. Carefully remove each SIMM and set it aside.

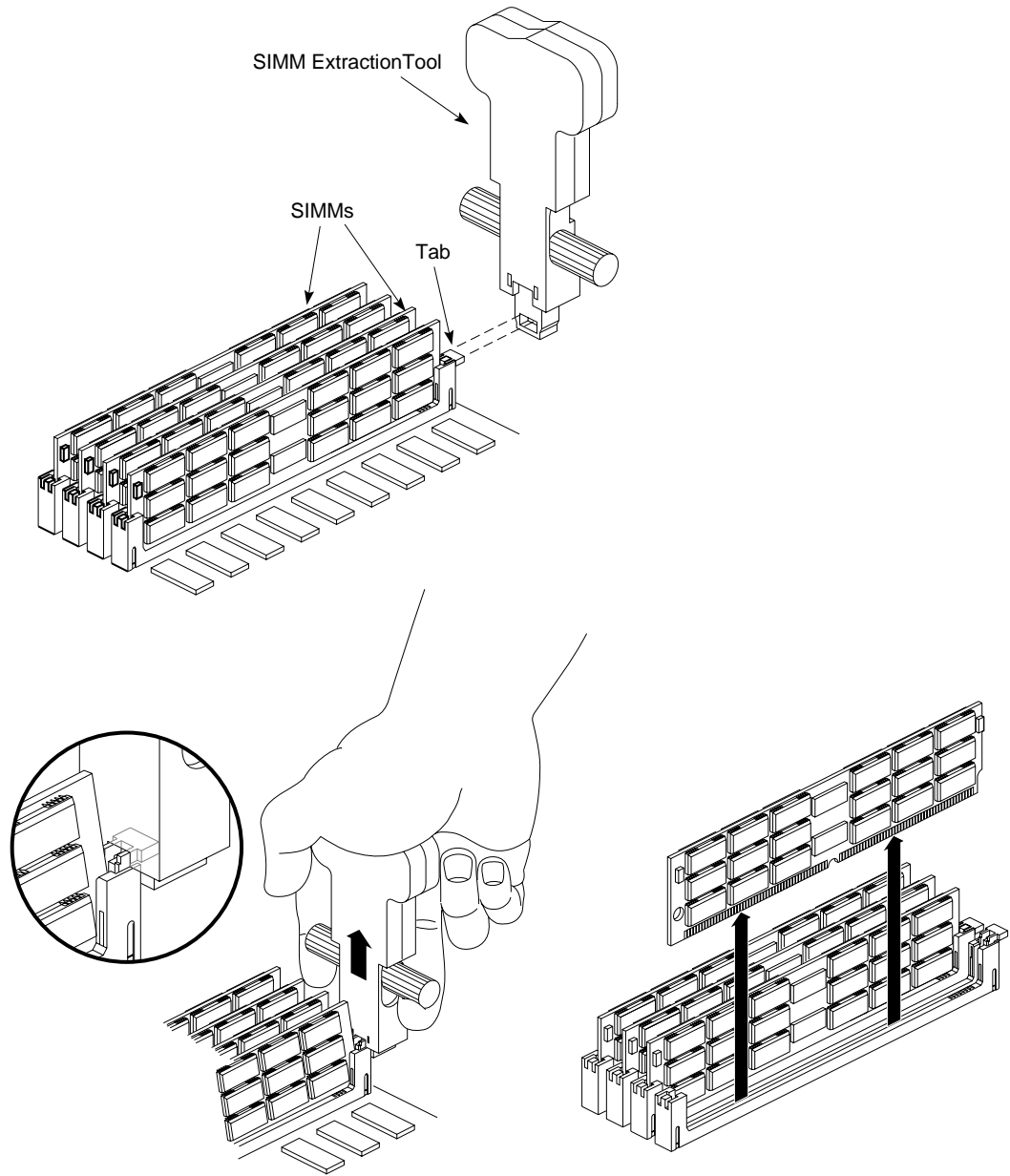


Figure 3-16 Removing SIMMs from an MC3 Board

SIMM Types

Both versions of the MC3 board can use two types of SIMM:

- 16 MB (high density)
- 64 MB (very high density)

Table 3-3 provides additional information for these modules. Figure 3-16 shows an illustration of a SIMM.

SIMM Size	SIMM Type	Color	Part Number
16 MB	High Density	Pink	030-0256-xxx
64 MB	Very High Density	Purple	030-0257-xxx

Table 3-3 Challenge/Onyx System SIMM Information Chart

Note: The SIMMs are color-coded to distinguish type and size. The color bar appears on the top corner and side of the SIMM nearer the notched bottom corner.

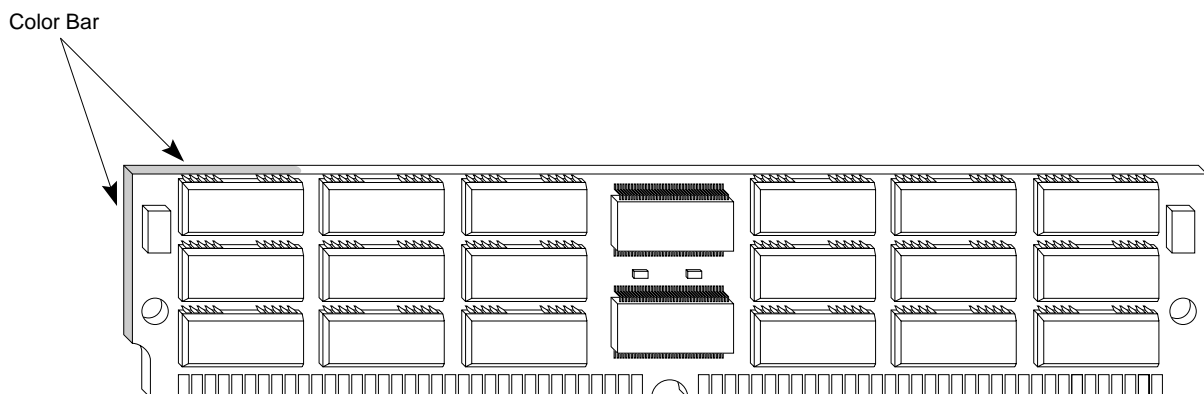


Figure 3-17 MC3 SIMM

Interleaving Memory

Interleaving enables greater utilization of bus bandwidth by evenly distributing requests across the leaves and masking read latency. This results in significant read and write access improvement. The following compares the average bus bandwidth utilization during a read operation for different interleave factors:

- one-way interleaving (50 percent)
- two-way interleaving (66 percent)
- four-way interleaving (80 percent)
- eight-way interleaving (89 percent)

The Challenge/Onyx rackmount system supports one-, two-, four-, and eight-way interleaving. At boot-up, the CPU PROM monitor scans the SIMM configuration on the MC3(s) to determine the system's interleave factor.

One-way Interleaving

One-way interleaving is achieved using four SIMMs across a single bank of memory on a single MC3 board. One-way interleaving provides the lowest interleave factor and the least effective memory performance. See Figure 3-17 for an illustration of this configuration.

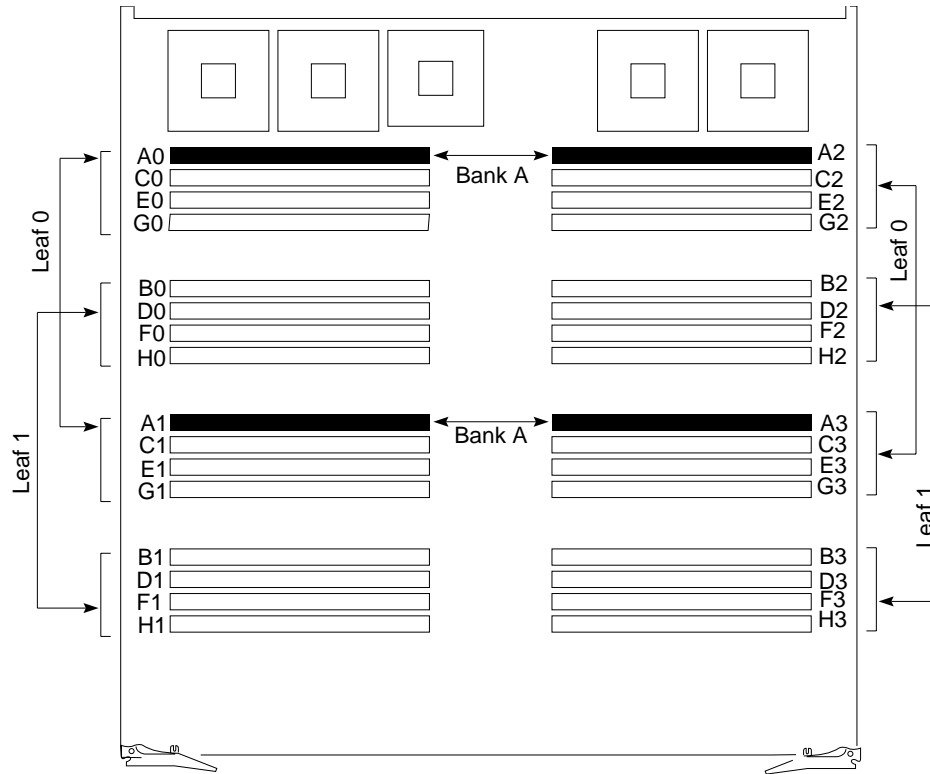


Figure 3-18 One-way Interleaving

Two-way Interleaving

Two-way interleaving occurs across a single MC3 board, as a bank of memory on leaf 0 links with a bank of memory on leaf 1. Two-way interleaving requires a minimum of 8 SIMMs. To enable two-way interleaving, you must install the same SIMM type across corresponding banks in each leaf, for example, banks A and B. See Figure 3-18 for an illustration of this setup. See Table 3-4 for a list of corresponding banks.

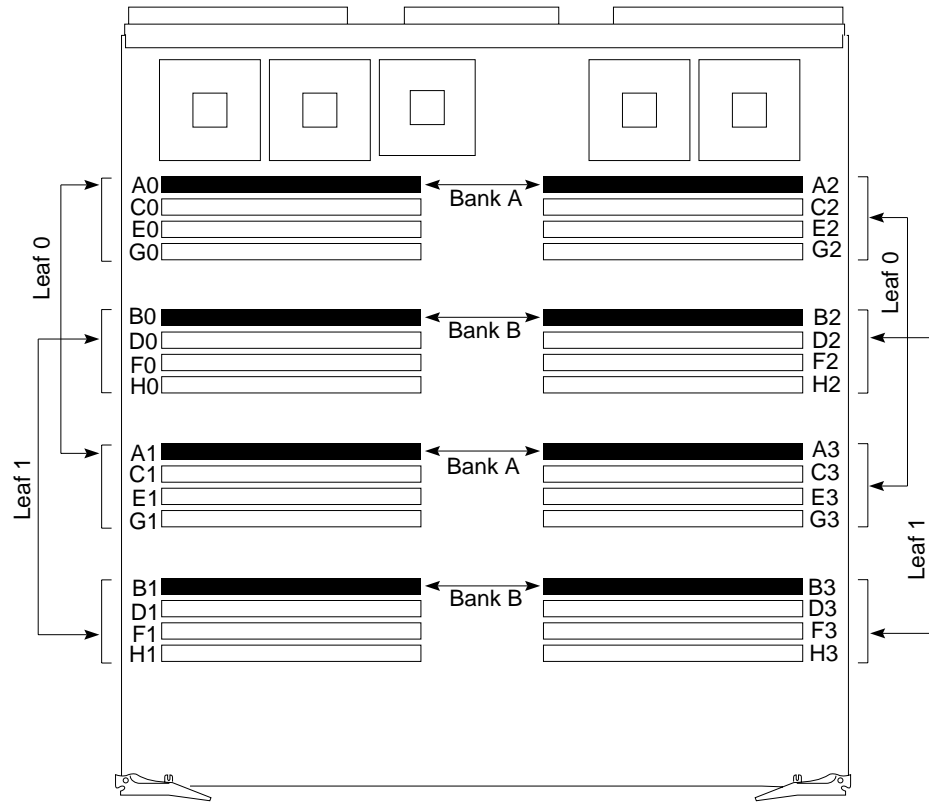


Figure 3-19 Two-way Interleaving, One Board (Bank A on Leaf 0, Bank B on Leaf 1)

Note: To set up two-way interleaving, install the same SIMM type (for example, 16 MB) across corresponding banks in each leaf.

Leaf 0	Leaf 1
A	B
C	D
E	F
G	H

Table 3-4 Corresponding Banks across Leaves 0 and 1

Four-way Interleaving

To enable four-way interleaving, you must first have two MC3 boards. Install the same SIMM type (for example, 16 MB) across corresponding banks (for example, banks A and B) on each MC3 board. Four-way interleaving requires a minimum of 16 SIMMs. See Figure 3-19 for an example of four-way interleaving.

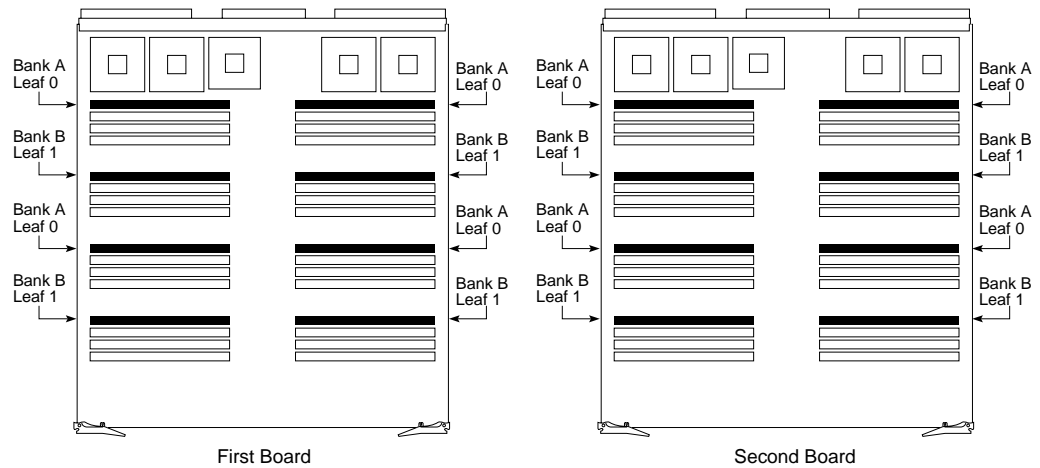


Figure 3-20 Four-way Interleaving (Two Boards Required)

Eight-way Interleaving

The Challenge/Onyx rackmount system can achieve eight-way interleaving using four MC3 boards. To set this up, you must install the same SIMM type across corresponding banks on each leaf on all four boards. Eight-way interleaving requires a minimum of 32 SIMMs.

Avoiding Three MC3 Board Configurations

Do *not* install three MC3 boards into a system, because this is not a very cost-effective configuration. Use only one-, two-, or four-MC3-board configurations, as applicable to the system.

A three-MC3 board setup is not desirable for the following reasons:

- A three-MC3-board setup is available in only two memory configurations.
- The memory upgrade path is severely limited.
- Adding a third MC3 to an existing two-MC3 board (four-way interleaving) configuration can seriously affect the system's memory performance, depending upon how you are able to populate the memory boards. If you can fully populate all 16 banks of the first two boards, then populate either four or eight banks on the third MC3 board, you can remain at four-way interleaving. However, if you cannot configure the MC3 boards in this way, the interleave factor changes from four-way to either one- or two-way (depending on how the third MC3 board is set up). The system defaults to the lowest common interleave factor across the MC3 boards at boot-up time.

Number of CPUs

The more CPUs a system contains, the higher the interleave factor and number of memory boards that a system can properly support.

Table 3-5 provides guidelines for the recommended interleave factor, and the number of MC3s to use, based on the number of CPUs in a system.

Number of Recommended CPUs	Interleave Factor and Number of MC3 Boards to Achieve Standard Memory Performance	interleave Factor and Number of MC3 Boards to Achieve Higher Performance
2 (using 1 CPU board)	1-way (1 MC3 board)	2-way (1 MC3 board)
4 to 6 (using 1 to 2 CPU boards)	2-way (1 MC3 board)	2-way (1 MC3 board)
8 to 10 (using 2 to 3 CPU boards)	2-way (1 MC3 board)	4-way (2 MC3 boards)
12 to 14 (using 3 to 4 CPU boards)	2-way (1 MC3 board)	4-way (2 MC3 boards)
16 to 18 (using 4 to 5 CPU boards)	4-way (2 MC3 boards)	8-way (4 MC3 boards)
20 (using 5 CPU boards)	4-way (2 MC3 boards)	8-way (4 MC3 boards)
22 to 36 (using 6 to 9 CPU boards)	8-way (4 MC3 boards)	8-way (4 MC3 boards)

Table 3-5 Recommended CPU-to-Interleave Factor Guidelines

Note: This table provides recommended (not required) memory guidelines. For example, a server system containing one CPU board can support a two-MC3-board configuration. However, a system containing three CPU boards will support this configuration more effectively.

The higher the number of CPU boards, the more MC3 boards that a system can effectively support, and the better the overall system memory performance.

3.5.1.8 VCAM and Mezzanine Board Installation

Table 3-6 lists the mezzanine boards and the supported configurations. Note that the only restrictions on the available configurations are that the VCAM must be installed on the first (or only) IO4 board, and a standard F Mezz board will not physically fit on an IO4 board that already has a VCAM mounted.

Host Board	VCAM	SMEZZ (SCSI-I)	SMEZZ (SCSI-II)	F Mezz	F Mezz (short)
IO4 (first or only)	YES (required)	YES	YES	NO	YES (2)
IO4 (additional)	NO	YES	YES	YES (2)	YES (2)

Table 3-6 Supported Mezzanine Board Configurations

VCAM

The VCAM mounts on the first IO4 board and is attached to VMEbus connectors on the midplane. In graphics systems, the first IO4 board is installed in slot 11 because it is the last Ebus slot in the cardcage and immediately adjacent to the first VMEbus slot. In server systems, the first IO4 board is installed in slot 15 for the same reason. See Figure 3-4 through Figure 3-6 for graphics cardcage slot assignments, and Figure 3-7 through Figure 3-9 for server cardcage slot assignments.

Attach the VCAM to the IO4 board with the three standoffs and screws provided (see Figure 3-20). Ensure that the FCI connectors from the IO4 board correctly mate with the VCAM connectors.

Install the boards in the cardcage as a single assembly, ensuring that both the Ebus connectors on the IO4 board and the VMEbus connectors on the VCAM are securely mated with the corresponding connectors on the midplane.

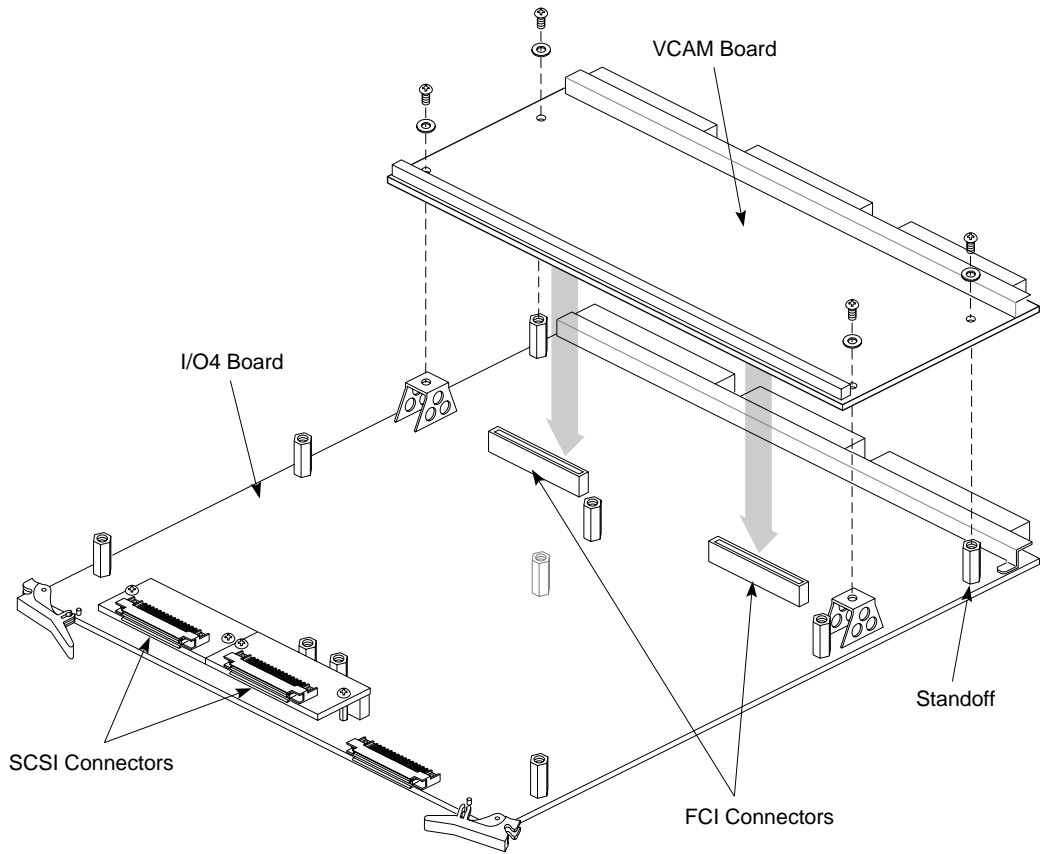


Figure 3-21 VCAM Mounting

Mezzanine Boards

With the exception of the standard-length F Mezz, any combination of mezzanine boards may be installed on the IO4 board(s). Because of its greater length, the F Mezz board may only be mounted on IO4 boards that do not have a VCAM installed. Note that all of the interface modules mount to the IO4 board with four screws and standoffs (see Figure 3-21).

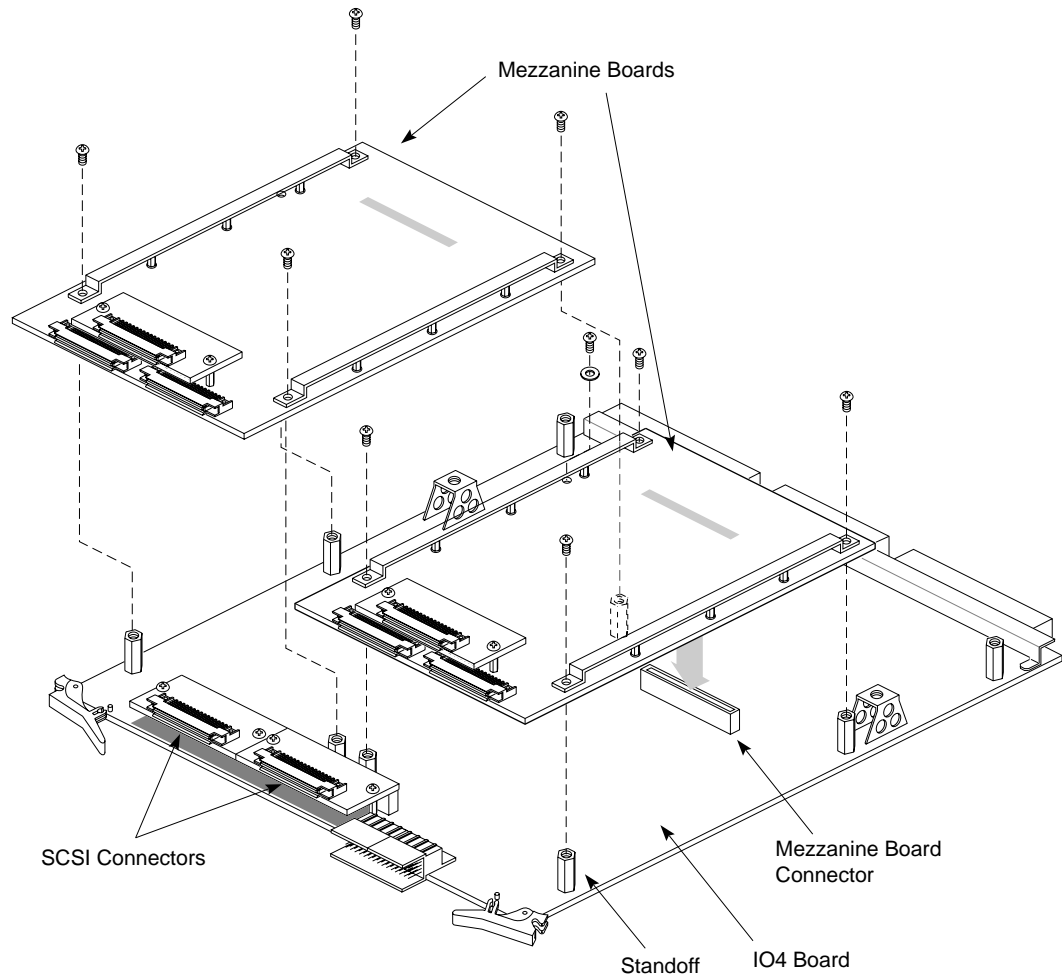


Figure 3-22 Mezzanine Board Mounting

Figure 3-22 uses the SCSI mezzanine board to illustrate how the various mezzanine boards are cabled to the I/O panels.

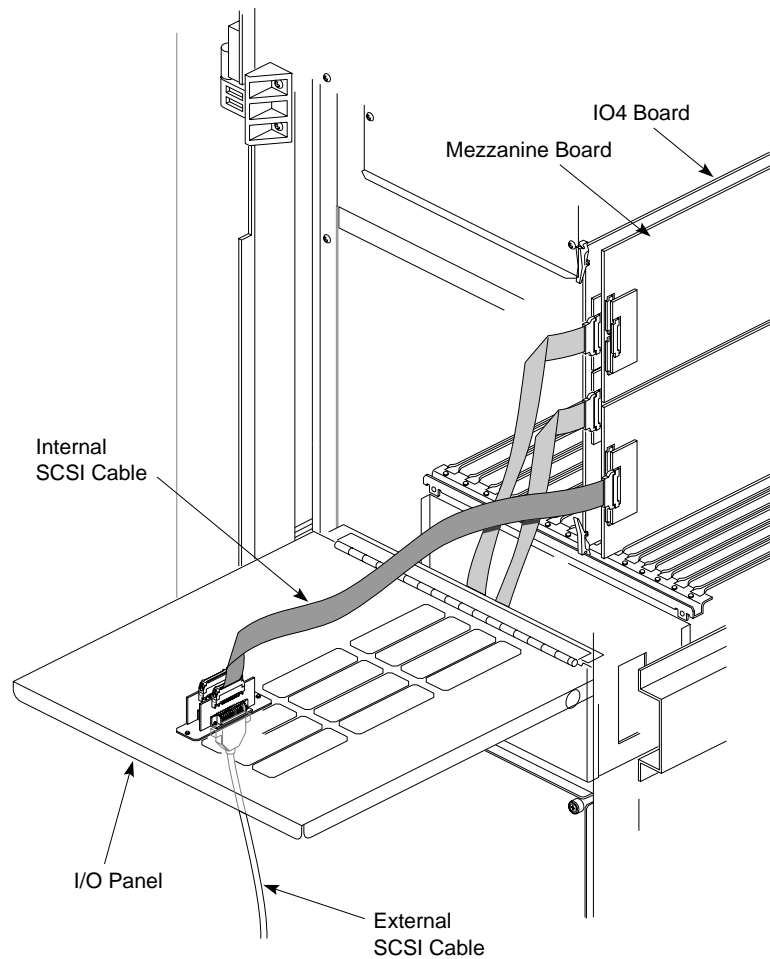


Figure 3-23 SCSI Mezzanine Board Cabling

3.5.1.9 SCSI Channel Adapter Boards

The SCSI channel adapter boards (differential and single-ended) are inserted directly into the SCSI connectors at the forward edge of the IO4 board. These boards convert the SCSI channel in which they are installed to either a differential or single-ended SCSI. The SCSI bus cables are then connected to the adapter boards (see Figure 3-23).

The single-ended adapter board has two transfer rate jumpers. These jumpers are installed or removed depending on whether or not the SCSI bus they are connected to is an internal or external bus. Install the jumpers if the bus supports only internal drives. This sets the SCSI bus data transfer rate at 10 MB per second. Remove the jumpers if the bus is connected to drives located outside the system cabinet. Removing the jumpers slows the bus down to 5 MB per second to allow for the greater distance the data must travel. See Section 2.4.3, “SCSI Channel Adapter Boards” and Appendix D, “Supplementary SCSI Information” for additional SCSI channel and drive configuration information.

Note: The adapter modules are color-coded—the differential adapter is red, the single-ended adapter is green.

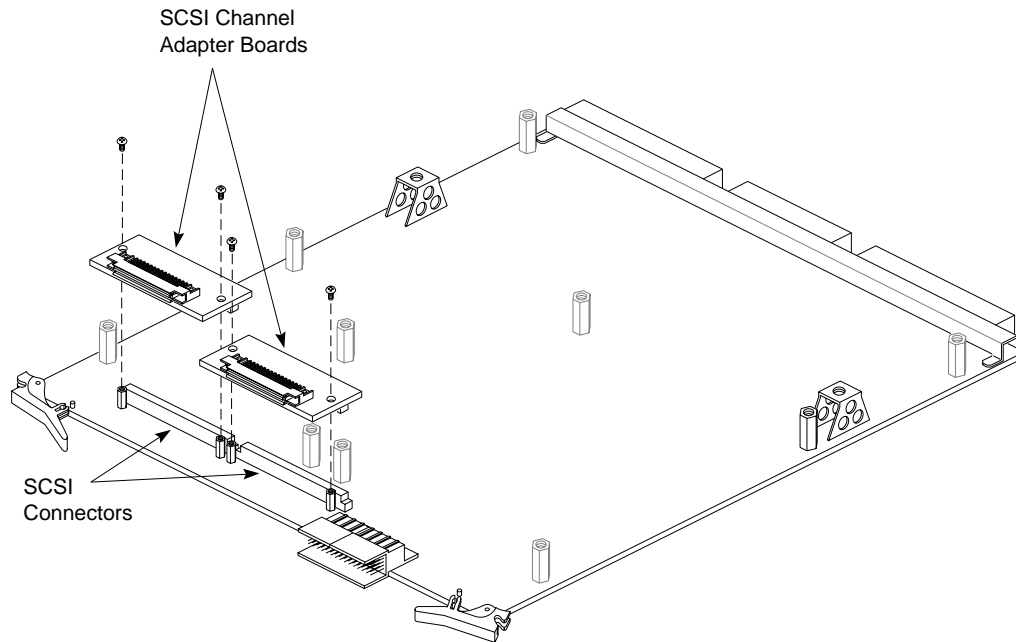


Figure 3-24 SCSI Channel Adapter Boards

3.5.1.10 IO4 Board Fuses

The IO4 board has three replaceable 2A fuses located near the SCSI channel connectors. The two upper fuses provide power to the SCSI bus terminators. The lower fuse protects the Ethernet, RS-232, and keyboard/mouse ports.

Warning: Connecting the Ethernet port to a transceiver box while the system is powered up can generate a voltage spike that will blow the lower fuse. Power down the system before connecting it to the Ethernet.

The fuses are held in their respective sockets by friction. Pull them straight out to check or replace them.

3.5.2 Monitor Cabling and Configuration

The Everest graphics workstation is shipped with one of two color monitors: the 21-inch (1600 x 1200 pixel) monitor is shipped with the RealityEngine² graphics board set, and the 19-inch (1280 x 1024 pixel) monitor is shipped with the VTX graphics board set. Refer to Appendix C, "Connectors and Cables" to select the correct monitor cable for the specific installation.

3.5.2.1 21-inch Monitor Configuration and Controls

The 21-inch Hitachi color monitor has 7 factory-preset viewing modes (screen geometry settings) and memory for an additional 23 customer-configured settings. The monitor

controls are described in Table 3-7 and Table 3-8, and the preset viewing modes are listed in Table 3-9. The monitor cabling and the physical locations of the controls are shown in Figure 3-24.

Control	Description
Power switch	Press on/press off switch. When power is on, the green LED in the switch is lit.
Contrast control (half moon icon)	Turn to adjust foreground brightness.
Brightness control (sun icon)	Turn to adjust background brightness.
Degaussing switch	Press to manually degauss monitor (monitor will automatically degauss following power-on).
Signal Input Selection switch	Selects BNC or 15-pin mini-D connectors.
Manual/Auto Selection switch	Manual position allows display size and position to be changed using the Store, Selection, and Adjustment controls. The Auto position selects one of the 7 factory-preset viewing modes.
Store switch	With the Manual/Auto Selection switch in the Auto position, pressing this switch steps through the preset viewing modes. With the Manual/Auto Selection switch in the Manual position, pressing this switch stores the displayed viewing mode. This mode is indicated when one of the adjustment LEDs lights.
Selection switch	With the Manual/Auto Selection switch in the Manual position, pressing this switch steps through the 4 available adjustments (horizontal size, horizontal position, vertical size, vertical position). When the adjustment is active, the corresponding amber LED is lit.
Adjustment switch (–)	Pressing this switch, with either the horizontal or vertical size adjustment selected, decreases screen size. With the horizontal position adjustment selected, pressing this switch shifts the screen position to the left. With the vertical position adjustment selected, pressing this switch shifts the screen down.
Adjustment switch (+)	Pressing this switch, with either the horizontal or vertical size adjustment selected, increases screen size. With the horizontal position adjustment selected, pressing this switch shifts the screen position to the right. With the vertical position adjustment selected, pressing this switch shifts the screen up.

Table 3-7 21-inch Monitor Controls

Control	Description
Video Signal Termination switches (3) (located on rear panel)	Press in when installing a single monitor (provides 75-ohm termination). Release switches when connecting multiple monitors with loop-through (provides higher impedance).
Sync Adjustment switch (located on rear panel)	Release the switch to manually adjust the incoming sync signal.

Table 3-7 (continued) 21-inch Monitor Controls

Active (Lit) Adjustment Switch	Minus (–)	Plus (+)
Horizontal Size	decrease	increase
Horizontal Position	shift left	shift right
Vertical Size	decrease	increase
Vertical Position	shift down	shift up

Table 3-8 Viewing Mode Adjustments

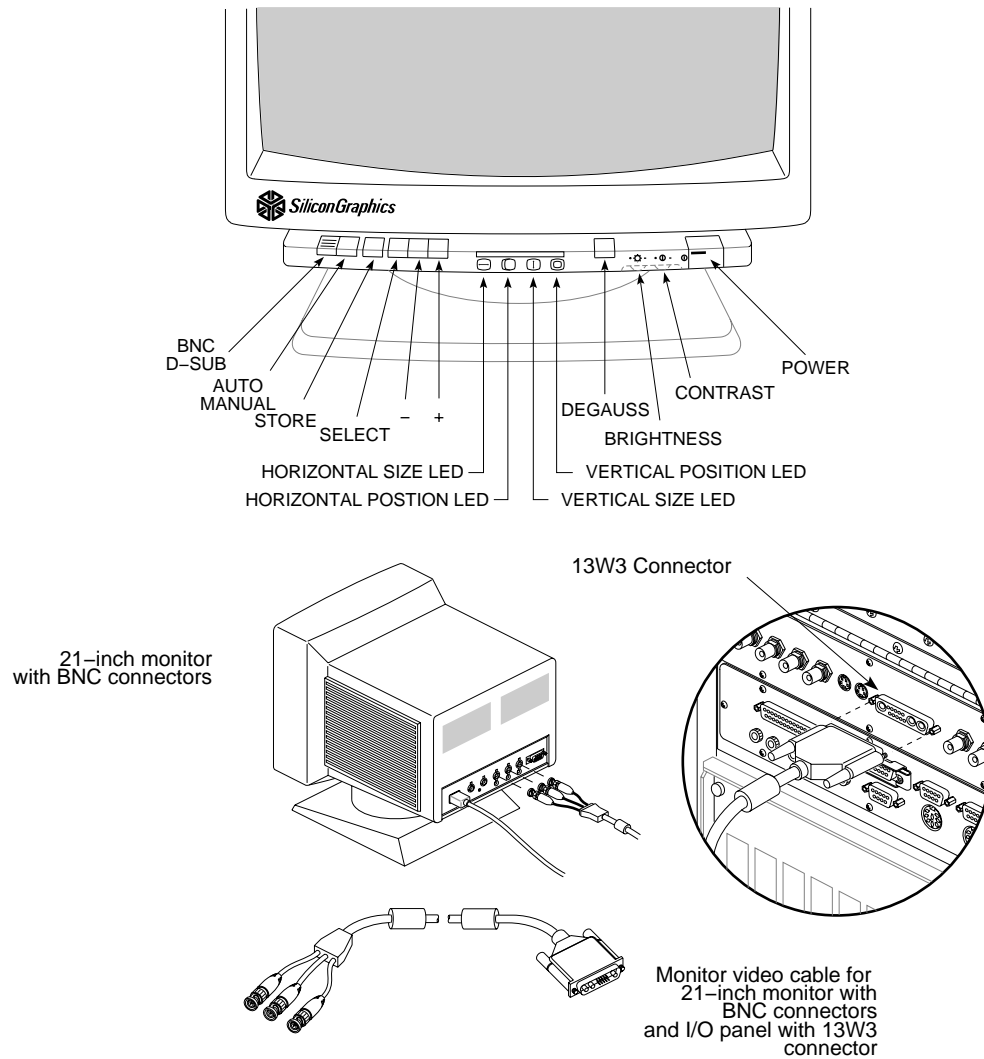


Figure 3-25 21-inch Monitor Controls and Cabling

	Video Mode	Horizontal Frequency	Vertical Frequency	Resolution
1	VGA350	31.5 kHz	70 Hz	640 x 350
2	VGA400	31.5 kHz	70 Hz	640 x 400
3	VGA480	31.5 kHz	60 Hz	640 x 480
4	8514/A	35.5 kHz	87 Hz	1024 x 768 (interlaced)
5	1024 x 768	48.8 kHz	60 Hz	1024 x 768
6	1152 x 870	63.5 kHz	70 Hz	1152 x 870

Table 3-9 Preset Viewing Modes for 21-inch Monitor

	Video Mode	Horizontal Frequency	Vertical Frequency	Resolution
7	1152 x 870	68.7 kHz	75 Hz	1152 x 870

Table 3-9 (continued) Preset Viewing Modes for 21-inch Monitor

Manually Adjusting the Vertical Sync

The following procedure is used to adjust the monitor's screen geometry when the monitor is experiencing problems with the vertical sync.

Note: Do not use this switch unless there is a problem with the incoming sync signal.

1. Select the "Manual" mode by pushing in the Auto/Manual Selection switch.
2. Push out the Sync Adjustment switch (located at the rear of the monitor).
3. If the monitor is out of sync, or there is no display with the correct input signal, press the "+" adjustment switch repeatedly until the displayed image is correct.

Note: Both the adjustment switches change the screen geometry in single increments. Each time a switch is pressed, the screen geometry is changed by one increment. Holding a switch in will not cause a continuous change in the screen geometry.

4. When the screen geometry is correct, press the adjustment switch one more time.
5. If the monitor displays partial skew (the top of the screen appears to tear to the right), press the "-" adjustment switch repeatedly until the displayed image is correct.
6. When the vertical sync is correct, push in the Sync Adjustment switch to the off position.
7. If the size and position of the displayed image is incorrect, use the Selection switch to activate the required adjustment (the corresponding LED will light), and the "+" and "-" adjustment switches to correct the screen geometry.
8. Press the Store switch to save the adjustments in the monitor's memory.
9. Push out the Auto/Manual Selection switch to return to "Auto" mode.

3.5.2.2 19-inch Monitor Configuration and Controls

The 19-inch Mitsubishi color monitor has four factory-preset viewing modes (screen geometry settings) and memory for eight additional customer-configured settings.

The monitor controls are described in Table 3-10, and the preset viewing modes are listed in Table 3-11. The monitor cabling and the physical locations of the controls are shown in Figure 3-25.

Control	Description
Power switch	Press on/press off switch. When power is on, the green LED to the left of the switch is lit.

Table 3-10 19-inch Monitor Controls

Control	Description
Contrast control (half moon icon)	Two switches (+ and –) used to adjust foreground brightness. An LED, located between the Contrast and Brightness controls, lights when the control is active. The LED flashes when the control limit is reached.
Brightness control (sun icon)	Two switches (+ and –) used to adjust background brightness. An LED, located between the Contrast and Brightness controls, lights when the control is active. The LED flashes when the control limit is reached.
Degaussing switch	Press to manually degauss monitor (monitor will automatically degauss following power-on).
The following controls are located behind the panel that is between the Degauss and Contrast controls	
Select switches	These two controls allow you to select any one of the four user-adjustable functions. The LED below each function icon lights to indicate that the function is active. The LED between the Contrast and Brightness controls flashes when the control limit is reached.
Function icons	These icons represent the adjustable screen parameters: horizontal position, horizontal size, vertical position, and vertical size.
Adjust switches (+ and -)	Press these switches to modify the selected function. Your adjustments are automatically saved in memory.
Memory Recall switch	Press this switch to restore all of the factory-preset viewing modes.
Mode Select switch	<p>This switch has three positions: 1–3. Position 1 selects the four preset viewing modes. Positions 2 and 3 each provide four memory locations for user-defined viewing modes.</p> <p>For normal operation with the VTX board set, leave the switch in position 1.</p> <p>If you decide to modify a viewing mode, select position 2 or 3 so that you do not overwrite the preset modes.</p>

Table 3-10 19-inch Monitor Controls

	Resolution	Horizontal Frequency	Vertical Frequency
1	1024 x 768	48.5 kHz	59.6 Hz
2	1280 x 1024	63.9 kHz	60 Hz
3	1280 x 492	63.9 kHz	119.88 Hz
4	1280 x 1024	76.9 kHz	72.3 Hz

Table 3-11 Preset Viewing Modes for 19-inch Monitor

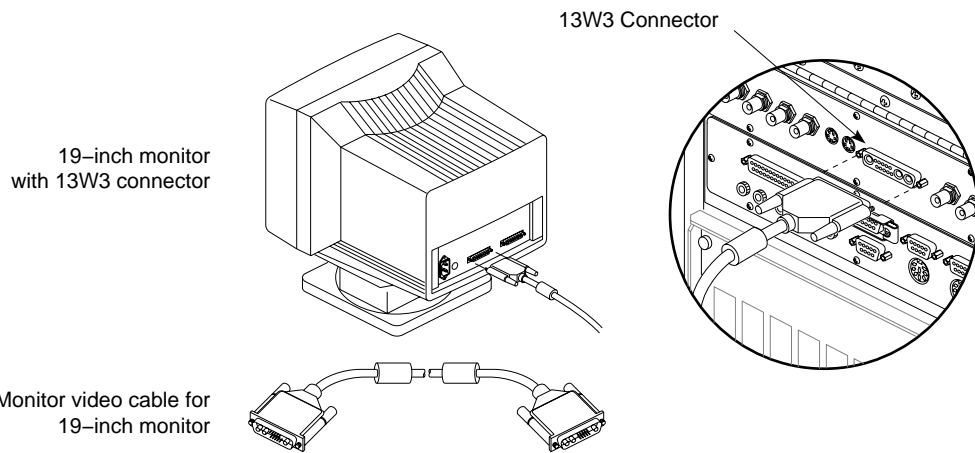
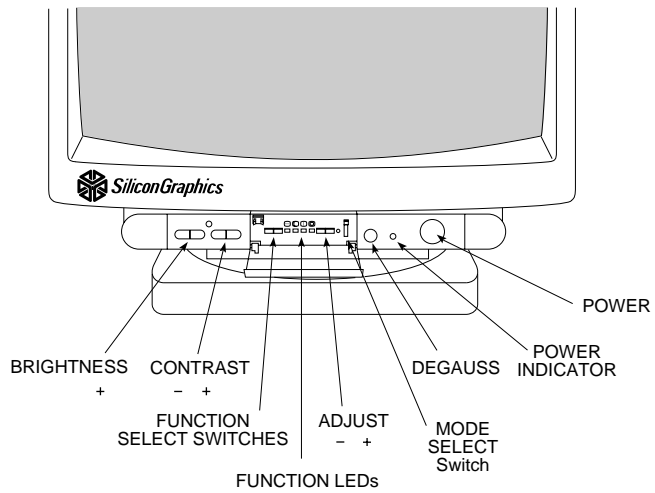


Figure 3-26 19-inch Monitor Controls and Cabling

3.5.3 Terminal Cabling

The Challenge server is shipped with an ASCII terminal. The terminal is connected to the system using a null modem cable with a 9-pin D connector at one end and a 25-pin D connector at the other. Refer to the pin assignments in Table 3-12 if a different cable/connector assembly is being used. Attach the terminal as shown in Figure 3-26.

Note: Configure the terminal for 9600 baud, eight bits, no parity, and one stop bit.

25-pin (DB-25) Connector	9-pin (DB-9) Connector	Signal Description
2	3	Received Data (RXD)
3	2	Transmitted Data (TXD)
7	7	Signal Ground (GND)

Table 3-12 ASCII Terminal Connection Pin Assignments

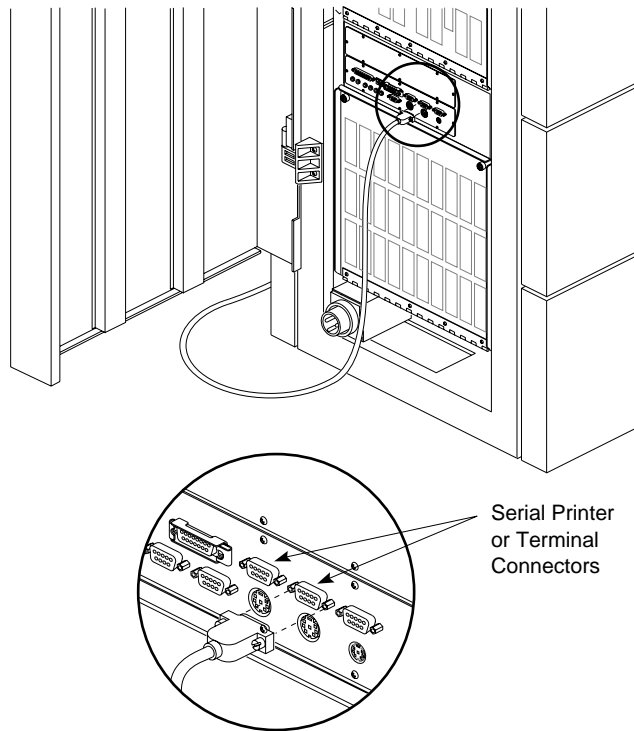


Figure 3-27 Connecting an ASCII Terminal

3.6 Storage Devices

Warning: If you install the EMI shield upside down in a P8 drive sled, there is a high risk of an electrical short in the drive. The EMI shield is copper and is coated on one side with clear plastic insulation. The insulated side of the shield must be placed against the drive.

The SCSIBox accepts any SCSI storage drive that is configured as a Front Loading Device (FLD). A drive configured as an FLD is mounted on a P8 drive sled. The drive sled adapts the drive's signal and power connectors to those on the SCSIBox backplane. Figure 3-27 shows the components of the drive sled. See Section 1.5, "Front-loading Devices" for more information on drive sled components and shielding.

Note: There are two versions of P8 drive sled. The P8-SLED-8 is a 50-pin, 8-bit sled. The P8-SLED-16 is a 68-pin, 16-bit sled.

The interface between the SCSI device and the backplane is provided by an adapter module that snaps into place at the rear of the drive sled (see Figure 3-27). The adapter module is available in two versions: single-ended and differential. Both versions of the adapter provide two bus connectors, allowing either of the two internal buses in the SCSIBox to be selected. Depending on the drive type, the SCSI drive cable can be either 50- or 68-pin. When a 50-pin cable from a drive is connected to the corresponding adapter module, the signals are reassigned and output to the SCSIBox backplane through a 68-pin connector. When a 68-pin cable is connected to a differential adapter module, the signals are simply passed through the 68-pin connector to the SCSIBox backplane.

The sled and attached drive are inserted into corresponding drive trays mounted in the SCSIBox. The trays position the drive sleds so that their connectors are correctly aligned with the backplane connectors. A locking lever on the sled secures the FLD in place.

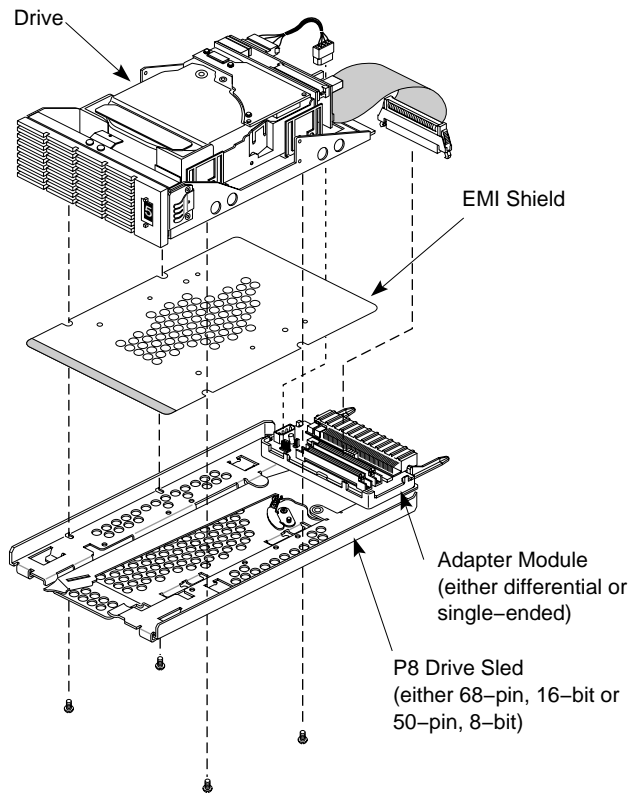


Figure 3-28 Front Loading Device Components

Refer to the *CHALLENGE™/Onyx™ Peripherals Guide* (document number 108-7048-010) for detailed information about the supported drives, including jumper settings for specific drives.

Note: This guide was formerly the *Peripherals Reference Guide and Man Pages*.

3.6.1 SCSI Drive Configuration

The Everest systems support five SCSI channel configurations:

- 8-bit differential
- 16-bit differential
- 8-bit single-ended (slow)
- 8-bit single-ended (fast)
- 16-bit single-ended

Each installed drive must be configured to match the characteristics of the channel to which it is attached. The channel characteristics must be consistent, beginning with the SCSI port and ending with the drive itself. Figure 3-28 is a diagram representing a typical SCSI

channel. The various decision points at which the channel must be configured are called out and explained in the notes that follow.

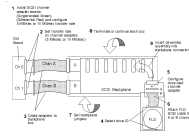


Figure 3-29 SCSI Channel Configuration

- 1** Install SCSI channel adapter boards (Single-ended Green) (Differential Red) and configure 5 MB/sec or 10 MB/sec transfer rate

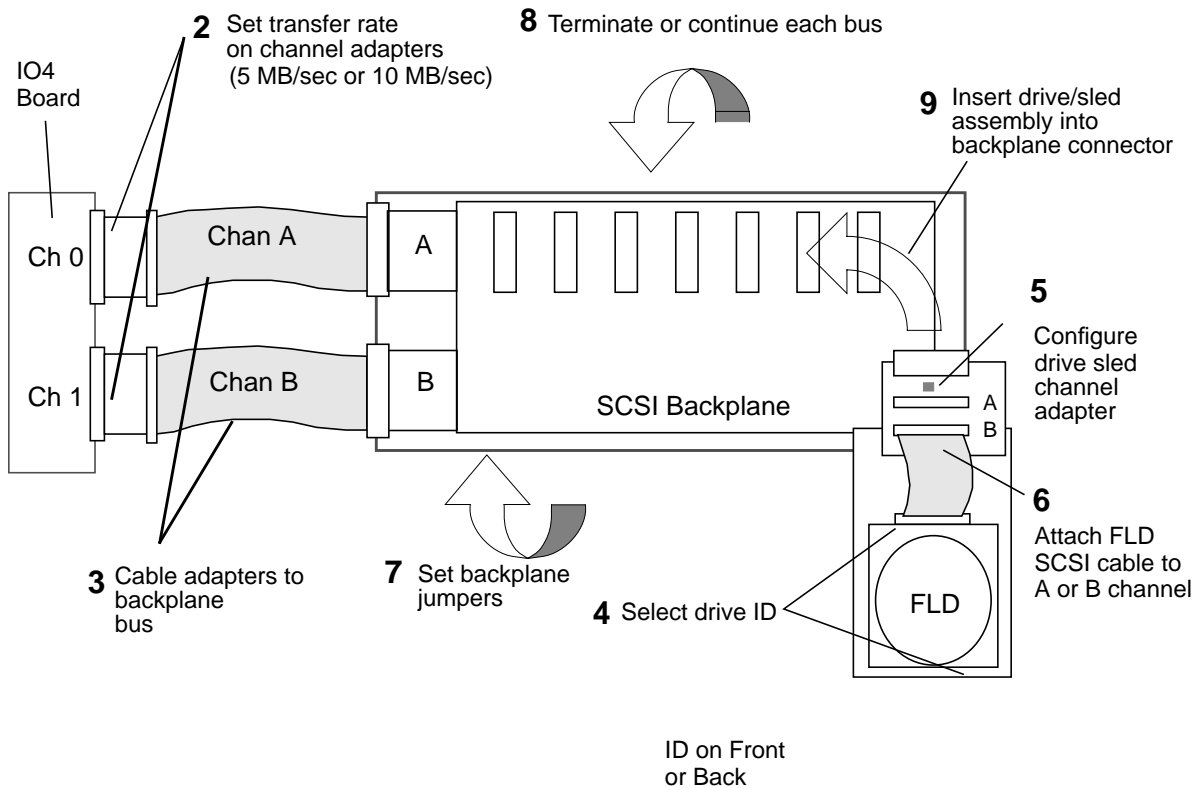


Figure 3-30 SCSI Channel Configuration

To install a SCSI device on a specific channel, perform the following steps while referring to Figure 3-28 (the numerals in bold represent steps in the procedure where the hardware has to be selected and then installed, or configured):

1. Configure the channels at the IO4 board by inserting the appropriate SCSI channel adapter board into each of the two 100-pin connectors on the IO4 board (refer to Figure 3-23). The standard configuration for SCSIBoxes has channel A configured for differential operation and channel B configured for single-ended operation.

Each channel must be configured at both the IO4 board and at the SCSIBox backplane.

Note: The channel adapter boards used on the IO4 are also used on the SCSI mezzanine cards. The adapter boards are color-coded: the single-ended adapter (P/N 034-0355-00x) is green, the differential adapter (P/N 034-0354-00x) is red.

2. Set the transfer rate of the channels on the channel adapter boards. The green, single-ended SCSI channel adapter board has two transfer-rate jumpers. If the channel being configured is an internal channel (for example the SCSIBox), leave the jumpers installed, and the bus transfer rate will remain at 10 MB/second (or fast mode). If an external single-ended channel is being configured, remove both jumpers and the transfer rate drops to 5 MB/second (slow mode). There is no wrong way to install the jumpers; they require no special orientation. See Figure 3-29.

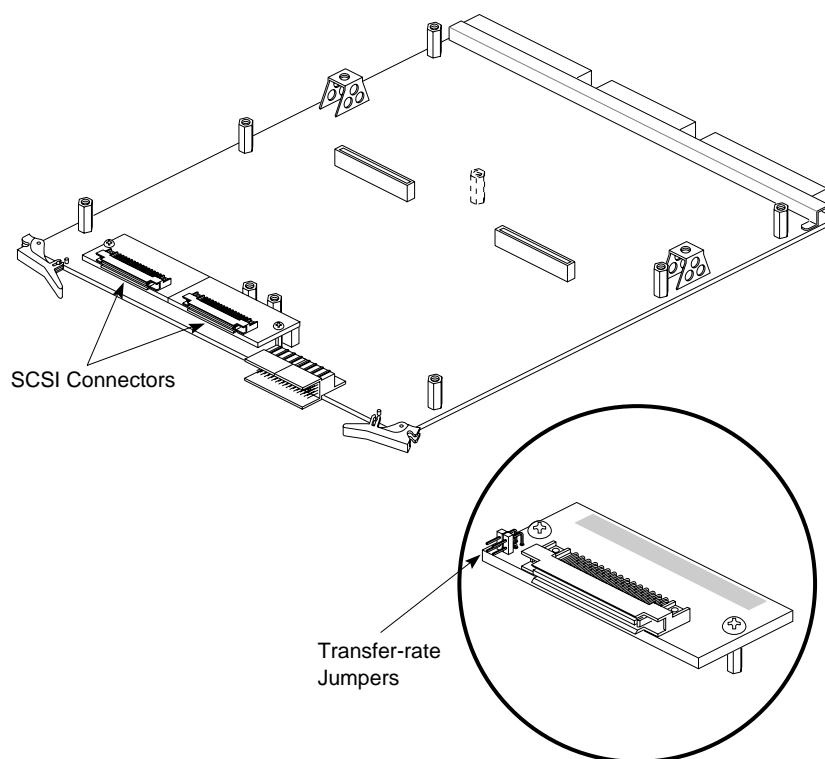


Figure 3-31 Transfer-Rate Jumpers

3. Cable the channel adapters to the backplane. Connect the IO4 SCSI channel 0 to SCSIBox channel A and the IO4 SCSI channel 1 to SCSIBox channel B.
4. Set the drive ID to a number that is not assigned to any other devices on that bus. The ranges are between 1 and 7 for single-ended drives, and between 1 and 15 for differential drives.

Note: The SCSI drive controller's ID is generally set to 0. This is in direct contrast with the Silicon Graphics VME based 4210/4220 SCSI controller boards. The 4210/4220 (Jaguar/Cougar) use 7 for the controller ID number. The cabling applications in this section are not intended for use with Jaguar/Cougar controllers.

Drive IDs cannot be changed while the drives are powered up.

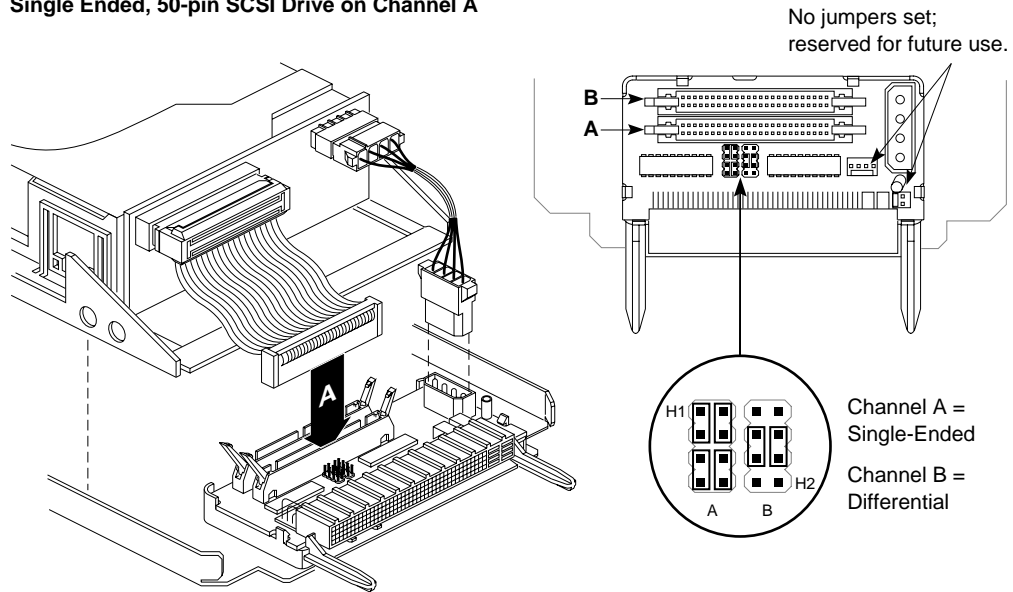
5. Configure the drive sled channel adapter to match the drive (either single-ended or differential) and snap it into place on the drive sled. The 2-GB disk drives supplied with the system are differential, the 1.2-GB drives are single-ended. To mount other devices, consult the manufacturer's documentation. See Figure 3-30 and Figure 3-31 for the channel adapter jumper settings.
6. Choose the SCSI channel that the drive will be attached to by inserting the free end of the drive's SCSI cable into either connector A or B, on the channel adapter. "A" corresponds to SCSIBox channel 0, "B" corresponds to SCSIBox channel 1.
7. Configure the SCSIBox by setting the SCSI backplane jumpers as shown in Figure 3-32.
8. If you are not going to continue the channel to another SCSIBox (differential channels only), you must terminate each channel with the proper termination plug on the rear of the SCSIBox backplane.

Caution: Use the correct channel terminator for each SCSI channel. Attempting to terminate a single-ended channel with a differential terminator, or a differential channel with a single-ended terminator can result in system malfunction and possible equipment damage.

9. Insert the drive in the selected SCSIBox slot.

Note: See Appendix D, "Supplementary SCSI Information," for a more detailed explanation of this process.

Single Ended, 50-pin SCSI Drive on Channel A



Differential, 68-pin SCSI Drive on Channel B

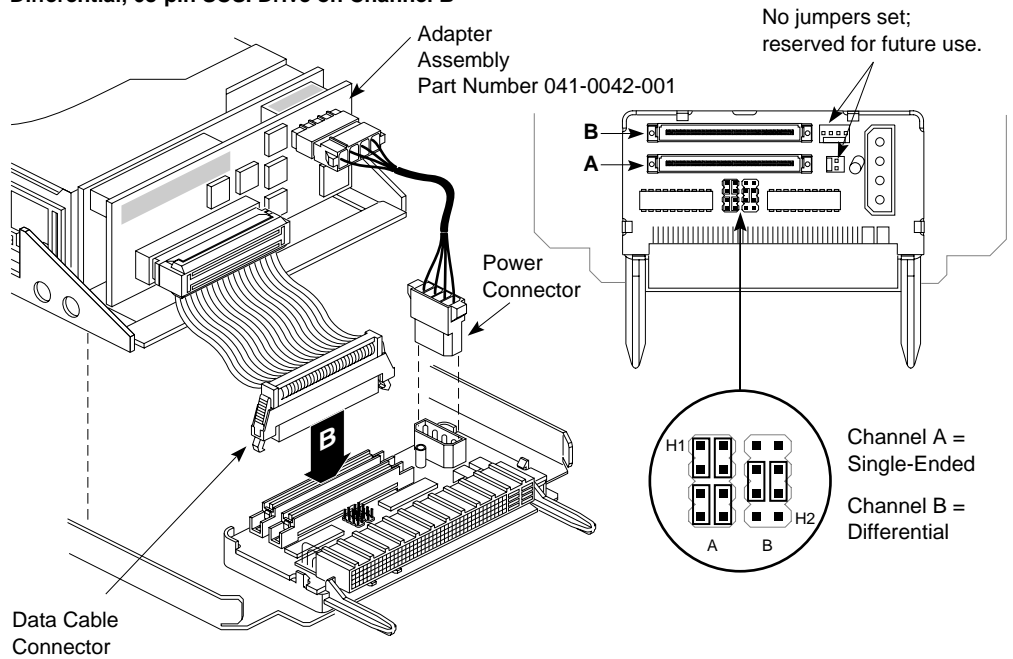
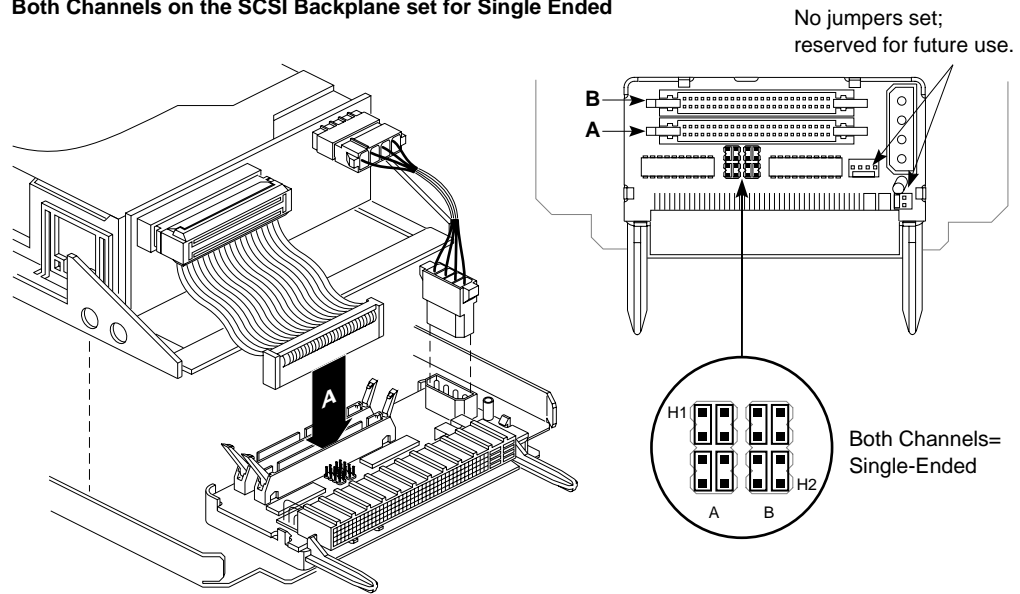


Figure 3-32 Channel Adapter Settings (Different Channel Configurations)

Both Channels on the SCSI Backplane set for Single Ended



Both Channels on the SCSI Backplane set for Differential

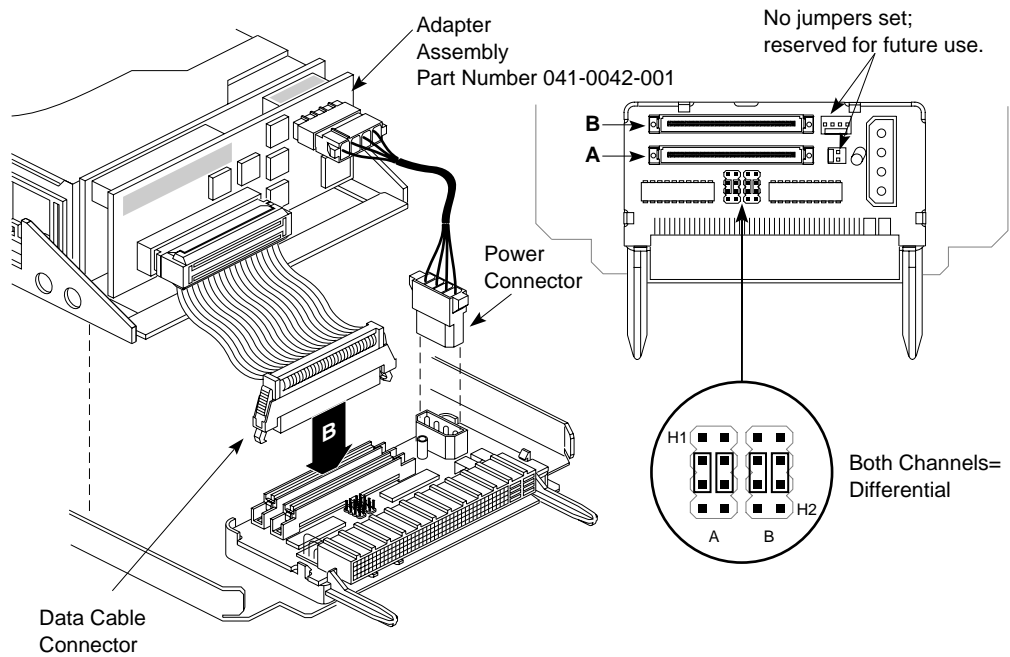


Figure 3-33 Channel Adapter Settings (Same Channel Configuration)

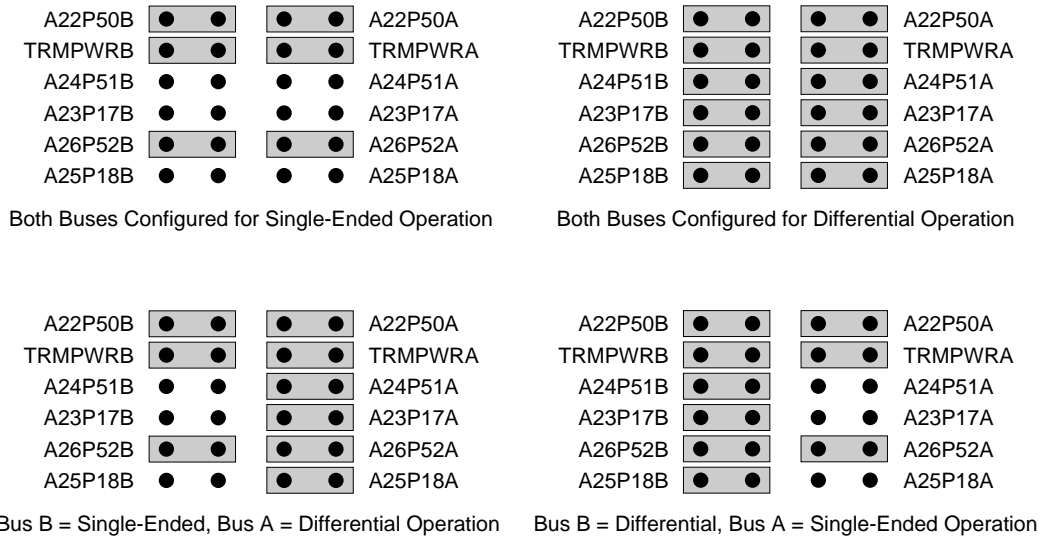


Figure 3-34 SCSI Backplane Jumper Configurations

3.7 Optional Equipment

This section describes how to cable optional peripherals to the Challenge and Onyx rackmount systems. For a complete description of connector pin assignments, see Appendix C, “Connectors and Cables.”

3.7.1 External SCSI Channel Cabling and Termination

The SCSI channels supporting the internal drive boxes are terminated at the SCSIBox backplanes and at the IO4 board. Cable and terminate external SCSI channels as follows:

1. Power down the system as described in Section 3.8, “Bringing the System Up and Down.”
2. Open the Cardcage 2 I/O panel as described in Section 3.5.1.2, “Accessing Cardcage 2 and Cardcage 3.”
3. Locate the SCSI channel to which the drive(s) will be connected.
4. Install a SCSI cable between the connector on either the selected IO4 or mezzanine card, and a SCSI connector on the I/O panel as shown in Figure 3-33.

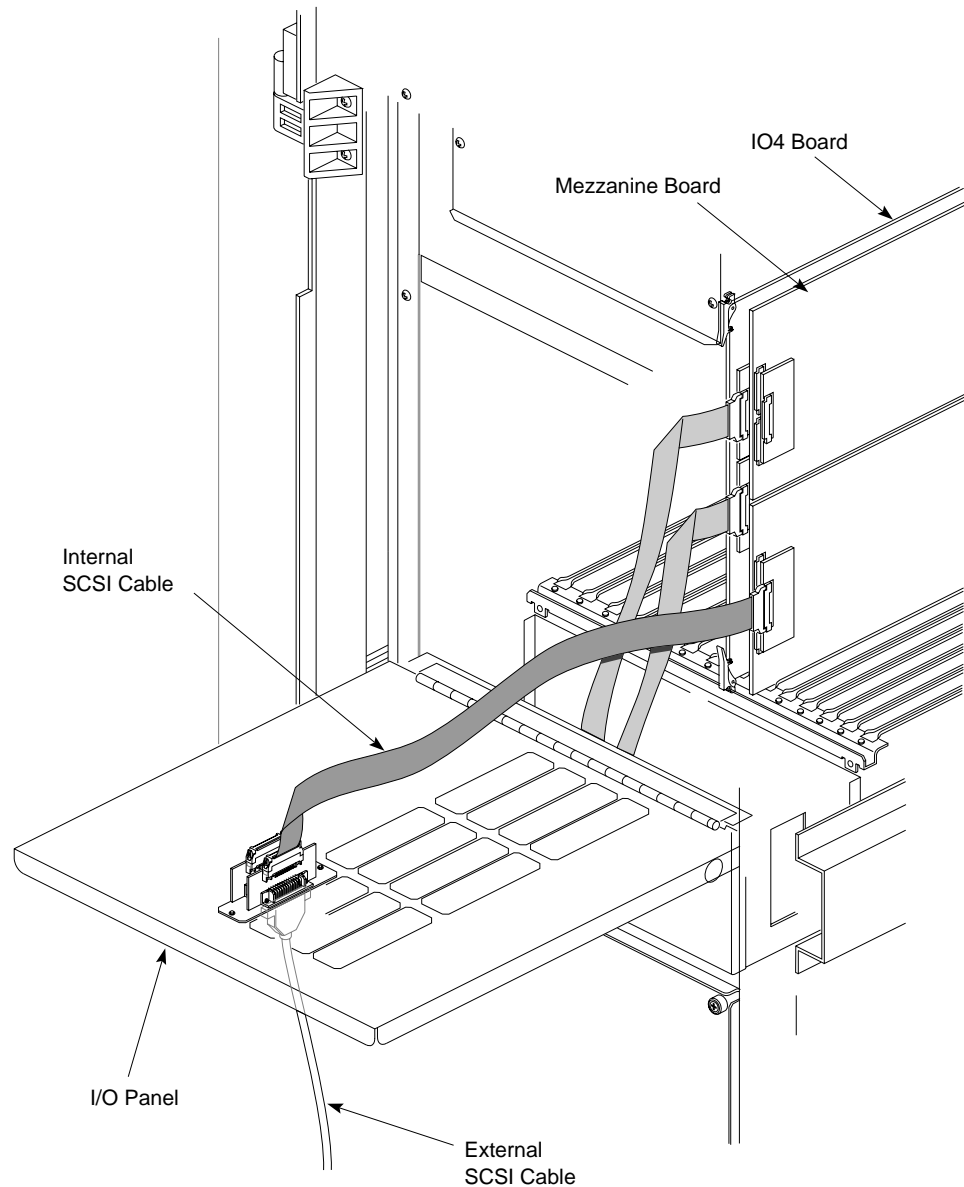


Figure 3-35 External SCSI Cabling

5. Close the I/O panel, ensuring that the internal cables are not pinched, kinked, or dislodged from the connectors.
6. Attach a SCSI cable of the correct length between the remote drive(s) and the I/O panel connector selected in step 4.
7. Ensure that the channel is correctly terminated at the last remote device.

Note: The maximum allowable length for single-ended (standard) SCSI cabling is 19.6 feet (6 meters). This maximum length reflects the combined lengths of both the internal and external cables.

The maximum allowable cable length for differential SCSI is 80.02 feet (25 meters).

If a single-ended SCSI channel is being routed to external drives, ensure that the transfer-rate jumpers are removed from the SCSI Channel Adapter board (refer to Section 3.5.1.9, "SCSI Channel Adapter Boards").

3.7.2 Connecting 50-pin External SCSI Devices

50-pin SCSI devices can be connected to the system's 68-pin SCSI ports using a Centronics adapter cable (SGI P/N 018-0347-001). This adapter cable is available in only one length and is intended to be used to temporarily connect a CD-ROM drive to the system when downloading the operating system. Use the adapter cable together with a standard 50-pin Centronics cable to connect external SCSI devices.

Ensure that the SCSI port(s) that the external devices are being attached to are correctly configured and terminated for the device type (refer to Section 3.6, "Storage Devices"). Also verify that the total combined length of the SCSI cables does not exceed the maximum allowable length for that particular channel type (single-ended or differential).

3.7.3 Serial Printer Cabling

The printer connector can be any of the DB-9 serial ports on the main I/O panel. The pin assignments for the various connectors are shown in Table 3-13. Cable the printer as shown in Figure 3-34.

25-pin (DB-25) Connector	9-pin (DB-9) Connector	Signal Description
2	3	Received Data (RXD)
3	2	Transmitted Data (TXD)
7	7	Signal Ground (GND)

Table 3-13 Serial Printer/Terminal Connector Pin Assignments

For graphics systems, use the Print Manager menu to configure the software to recognize the printer. For servers, refer to the *IRIX Advanced Site and Server Administration Guide* for more information about printer configuration. For a complete description of serial port pin assignments, see Appendix C, "Connectors and Cables."

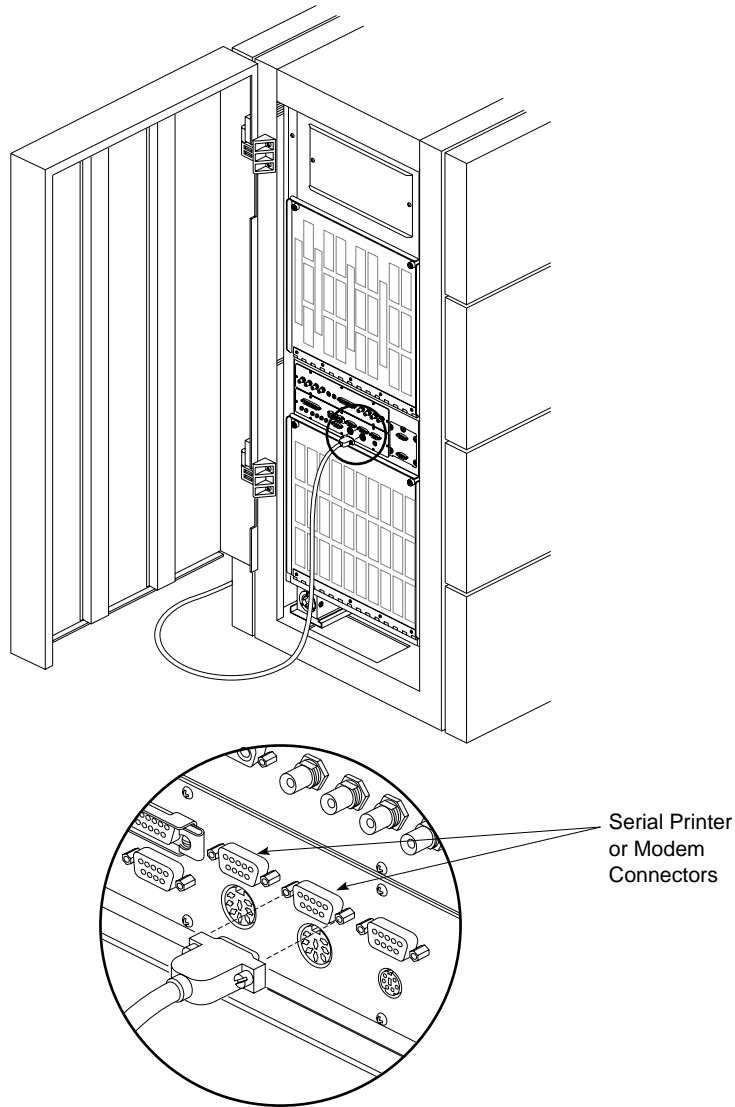


Figure 3-36 Connecting a Serial Printer or Modem

3.7.4 Modem Cabling

The modem connection can be to any of the DB-9 serial ports on the main I/O panel. The pin assignments for the various connectors are shown in Table 3-14. Cable the modem as shown in Figure 3-34.

25-pin (DB-25) Connector	9-pin (DB-9) Connector	Signal Description
2	2	Transmitted Data (TXD)

Table 3-14 RS-232 Modem Connector Pin Assignments

25-pin (DB-25) Connector	9-pin (DB-9) Connector	Signal Description
3	3	Received Data (RXD)
4	4	Request to Send (RTS)
5	5	Clear to Send (CTS)
8	8	Data Carrier Detect (DCD)
7	7	Signal Ground (GND)
20	9	Data Terminal Ready (DTR)

Table 3-14 (continued) RS-232 Modem Connector Pin Assignments

Note: This product requires the use of external shielded cables in order to maintain compliance with Part 15 of the FCC rules. Serial cables from different vendors are not compatible.

Refer to the *IRIX Advanced Site and Server Administration Guide* for more information about modem configuration. For a complete description of serial port pin assignments, see Appendix C, “Connectors and Cables.”

3.7.5 Parallel Printer Cabling

To connect a parallel printer to the system, attach the printer cable to the 25-pin parallel connector on the main I/O panel (see Figure 3-35).

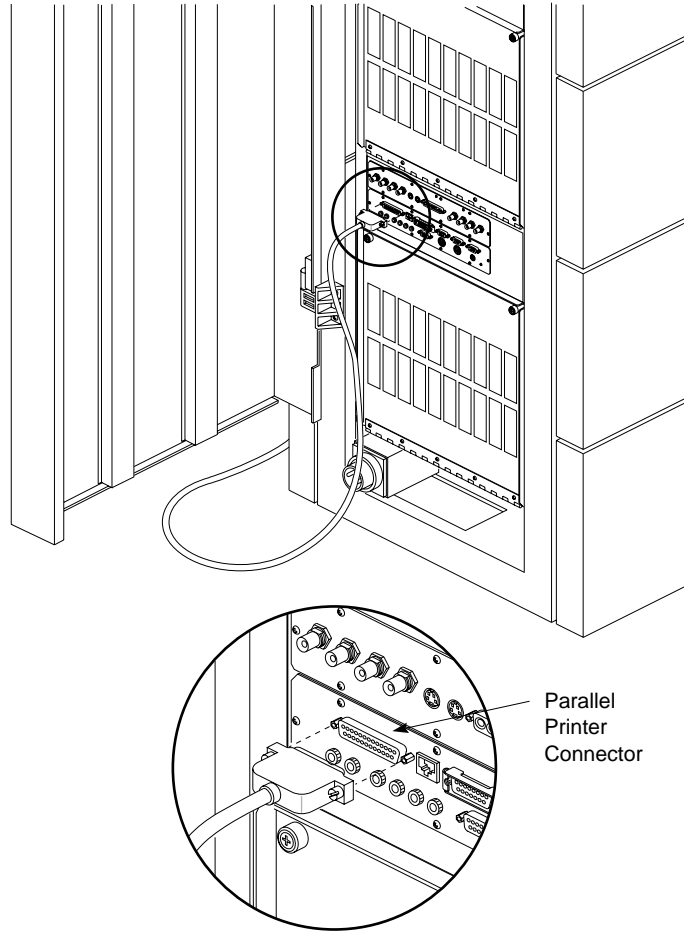


Figure 3-37 Connecting a Parallel Printer

The pin assignments are shown in Table 3-15. Ensure that the pin assignments at the system's parallel port are properly matched to the pin assignments on the printer.

25-pin (DB-25) Connector	Signal Description
1	STB (Data Strobe)
2	DATA 0
3	DATA 1
4	DATA 2
5	DATA 3
6	DATA 4
7	DATA 5

Table 3-15 Parallel Port Connector Pin Assignments

25-pin (DB-25) Connector	Signal Description
8	DATA 6
9	DATA 7
10	DATA ACK
11	BUSY
12	PE (Paper Empty)
13	SLCT (Select)
14	AUTOFD (Autofeed)
15	ERROR

Table 3-15 (continued) Parallel Port Connector Pin Assignments

For graphics systems, use the Print Manager menu to configure the software to recognize the printer. For servers, refer to the *IRIX Advanced Site and Server Administration Guide* for more information about printer configuration.

3.8 Bringing the System Up and Down

This section describes the procedures used to power the system up and down. For more information on the power-up, power-down, and boot processes, refer to the *Challenge/Onyx Diagnostic Roadmap* (P/N 108-7045-010).



Warning: The Challenge/Onyx rackmount operates on 220-400VAC. Use extreme caution when working around this voltage. Never install or remove power cords without first turning off the equipment.

There is 48VDC on the system midplane. This voltage is present even if the system has been reset or halted.

3.8.1 Bringing the System Up



Warning: Refer to the power requirements found in the *CHALLENGE/Onyx Site Preparation Guide* (P/N 108-7040-010) before applying power to the system.

Bring up the system as follows:

1. Power up the system in the following order:
 - System cabinet
 - Open the lower front door of the system cabinet.
 - Turn on the main power switch, located near the lower right front corner of the cabinet.

- Turn the key switch to the **On** position.
- Terminal or monitor
- Printer (if installed)

Note: All internal storage devices are automatically powered up by the System Controller.

2. Monitor the system status panel to follow the progress of the boot arbitration process. Table 3-16 lists the possible boot messages (refer to Appendix E, “System Controller Error and Status Messages” for a complete listing of the System Controller error and status messages):

Bootmaster CPU Selection Message	Context and Meaning of Message
BOOT ARBITRATION NOT STARTED	The system CPU board(s) have not begun the arbitration process.
BOOT ARBITRATION IN PROCESS	The System Controller is searching for the bootmaster CPU.
ARBITRATION COMPLETE BOARD O _x ZZ PROC O _x ZZ	The chosen boot master CPU has identified itself to the System Controller and communication is fully established.
BOOT ARBITRATION INCOMPLETE NO MASTER	An error has occurred in the boot process and no boot master CPU is communicating with the System Controller.

Table 3-16 Boot Status (Arbitration) Messages

3. When the system start up menu appears, press <Esc> to enter the System Maintenance menu. Enter 5 to select “Enter Command Monitor.”
4. Type `hinv`, then press <Enter> to display the system’s hardware inventory.
5. Confirm that the displayed inventory matches the shipping list.
6. Quit the Command Monitor by typing `Exit`.
7. When the System Maintenance menu reappears, type 1 to select the “Start System” command. The system will come up and display the desktop.

3.8.2 Bringing the System Down



Warning: Allow power to drain five (5) minutes before starting any work on the backplane or midplane. Because of the number of capacitors throughout the power system, a significant voltage remains in the system immediately after you shut off the main power switch.

Bring the system down as follows:

1. If the system is currently running normally, verify there are no users working on the system:
 - Log in as *root*.
 - At a shell prompt, use the IRIX *who(1)* command to see who is logged on to the system. If any other users are logged on, notify them that the system will be coming down and that they should log off. Refer to the *IRIX Advanced Site and Server Administration Guide* for a description of methods of notifying users of a system shutdown.
 - While still logged in as *root*, enter */etc/halt* at a shell prompt. This command will gracefully shut down the system software and leave the system at the PROM monitor level.
2. Once you are at the PROM monitor, power down the system in the following order:
 - Terminal or monitor
 - Printer (if installed)
 - System cabinet
 - Turn the key switch to the **Off** position.
 - Open the lower front door of the system cabinet.
 - Turn off the main power switch, located near the lower right front corner of the cabinet.
 - If you are going to disassemble the system, for example to install an optional Cardcage 3, allow the power to drain for five (5) minutes before starting work.

Note: All internal storage devices are automatically powered down by the System Controller.

Refer to the *Challenge/Onyx Diagnostic Roadmap* for detailed explanations of the power-up sequence and the various system startup messages.

3.9 Software Installation

The basic operating system is installed on the system disk. Additional features and third-party software must be loaded using a tape drive or CD player. Refer to the *IRIS Software Installation Guide* for detailed information about installing Silicon Graphics software.

3.10 Remove and Replace Procedures

This section provides step-by-step instructions for the removal and replacement of all of the field-replaceable units (FRUs) in the Challenge and Onyx rackmount systems.

3.10.1 Field Replaceable Unit (FRU) List

Table 3-17 lists all of the FRUs and their part numbers. Unless otherwise indicated, all components are common to both the Challenge and the Onyx rackmount systems.

Component Description	Part Number
Boards	
IP19 CPU Board (2 CPU)	030-0249-003
IP19 CPU Board (4 CPU)	030-0250-003
MC3 Memory Board	030-0245-006
IO4 Interface Board	030-0240-009
SIMM (16MB)	030-0256-001
SIMM (64MB)	030-0257-001
505 Power Board	030-0263-003
S Mezz Board (WD93)	030-0312-001
System Controller Board	030-0265-004
VMEbus Power Board	030-0264-003
Cardcage 3 Power Board	013-0620-001
Power Board Extender	040-0520-001
505X2 Power Board	013-0617-001
VCAM	030-0243-005
SCSI Channel Adapter Module (single-ended)	030-0305-002
SCSI Channel Adapter Module (differential)	030-0304-002
First IO4 Assy (w/VCAM)	013-0646-001
GE10V Geometry Engine Board (VTX graphics system)	030-0363-002
GE10 Geometry Engine Board (RealityEngine ² graphics system)	030-0325-002
DG2 Display Generator Board (Graphics system)	030-0223-009
RM4 Raster Memory Board (Graphics system)	030-0337-001
Chassis Components	
1900-Watt Off-Line Switcher (OLS)	013-0513-002

Table 3-17 Rackmount System Field-Replaceable Units

Component Description	Part Number
OLS Power Shelf (1-2 OLSs)	013-0549-002
System Controller Status Panel	013-0539-001
SCSIBox Drive Box (w/o drives)	013-0526-002
2-GB SCSI Drive	041-0042-001
Rotary Fan Assy	013-0538-002
Midplane (Graphics system)	030-0254-002
Midplane (Server system)	030-0253-006
Analog Video Cable	018-0291-002
SCSI Cable Assy (IO4 to SCSIBox)	018-0302-002
Status Panel Cable Assy	018-0306-002
Blower Power Cable (External)	018-0314-001
SCSI Cable Assy (External Control)	018-0315-001
ChallengeVault Remote Control Cable	018-0319-002
General I/O Cable Assy	018-0333-001
Secondary I/O Cable Assy	018-0331-001

Table 3-17 (continued) Rackmount System Field-Replaceable Units

3.10.2 Chassis Doors and Side Panels (Skins)

Remove the doors on a rackmount system as follows:

1. Open the door part-way.
2. Lift the door off the hinge pins

Replace the doors in the opposite manner.

Remove the chassis side panels (skins) as follows:

1. Stand at the rear of the chassis on either the right or left side.
2. Brace the chassis with your foot so that it does not roll backwards when you pull on the chassis side panels.
3. There are a total of eight individual panels, four per side of the chassis. Starting with the top panel, grasp the panel with both hands through the access hole at the rear off the panel.
4. While keeping your foot braced against the bottom of the chassis, tug backwards sharply on the side panel. It should pull free. If it does not, tug slightly harder. Be careful not to tip the chassis.
5. Repeat this procedure for each of the eight panels (four per side of the chassis).

Note: Be careful when handling the panels. Place them aside, out of your immediate work area. Be careful not to scratch or mar the panels.

SGIVIDEO: [cc3removingskins.mv](#)

[Removing a Side Panel From a Rackmount System](#)

The video clip above illustrates how to remove a side panel. Note hand position when grasping the panel and the placement of the foot to brace the chassis.

3.10.3 Off-line Switchers

Remove an OLS as follows:

1. Power down the system as described in Section 3.8, “Bringing the System Up and Down.”
2. Allow power to drain from the system for five (5) minutes.
3. Open the lower front access door.
4. Remove the three screws securing the OLS to be removed (see Figure 3-36).

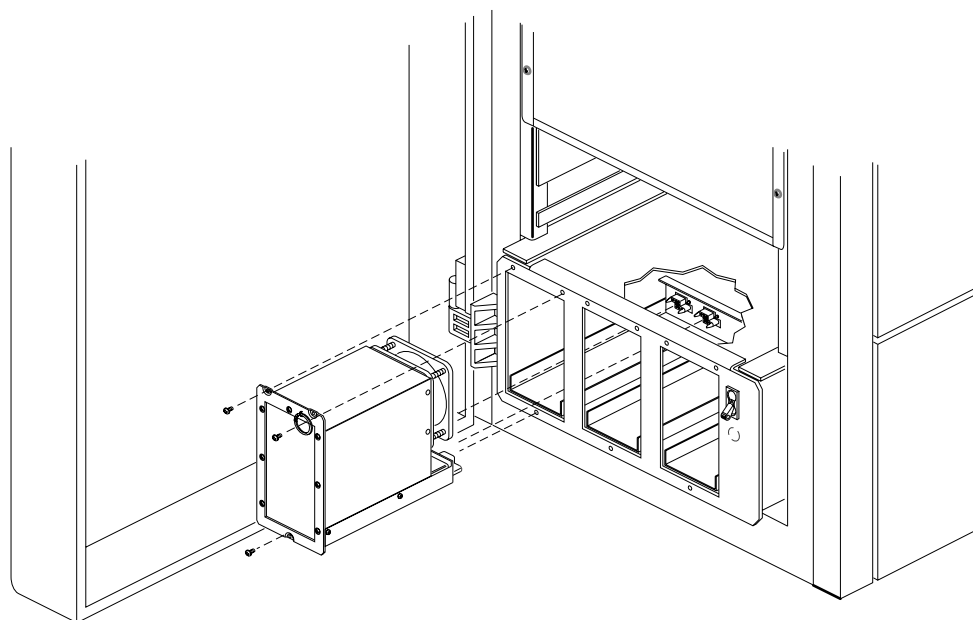


Figure 3-38 OLS Installation or Removal

5. Grasp the OLS by the ring in the upper right corner, and remove it from the power supply enclosure.
6. Install an OLS by reversing the steps in this procedure. Ensure that the connector at the rear of the OLS mates correctly with the corresponding connector in the power supply enclosure.

3.10.4 Blower (Fan) Assembly

The following instructions describe how to remove the blower assembly:

1. Power down the system as described in Section 3.8, “Bringing the System Up and Down.”
2. Wait a few moments for the blower fan to spin down before opening the blower access cover.

Warning: Do not work on or around the blower assembly if the fan is spinning and exposed. Always wait for the fan to stop spinning before opening the access cover.

3. Loosen the two Phillips screws on the front of the blower access cover, then slide the access cover up and off of the screws. See Figure 3-37.

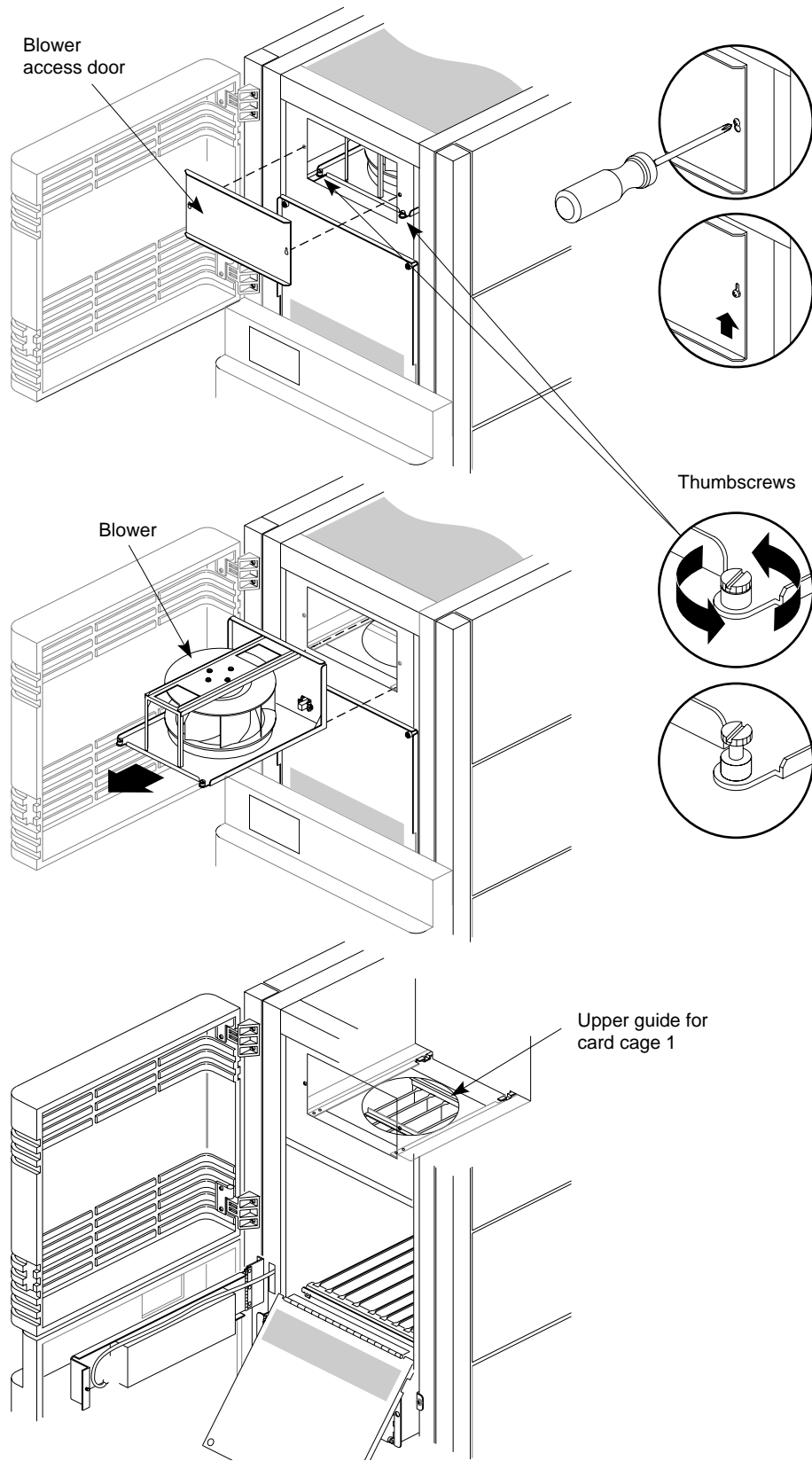


Figure 3-39 Removing the Blower Assembly

4. Unscrew the two captive thumbscrews that hold the blower assembly in place. You may have to use a flat-blade screwdriver to loosen them.
5. Slide the blower out of the system. There are no cables to disconnect; power to the blower is provided by a mating receptacle.

To install the blower assembly, reverse this procedure. When installing, tighten the captive thumbscrews with a flat-blade screwdriver.

3.10.5 SCSIBox

Use the following instructions to install or remove the SCSIBox drive enclosures:

Note: The optional SCSIBox is identical to the standard-equipment drive enclosure that is shipped with all rackmount systems, and is installed and removed in the same way. This optional box mounts in the enclosure directly below the existing SCSI drive box.

1. Power down the system as described in Section 3.8, “Bringing the System Up and Down.”
2. Allow power to drain from the system for five (5) minutes.
3. Unpack the SCSIBox and remove any drives (if installed).
4. Remove the side panels from the left side of the system chassis. See Section 3.10.2, “Chassis Doors and Side Panels (Skins).”

Note: Use care when handling the side panels. Store them in a safe place during this procedure to avoid scratching or marring them.

5. Working from the left side of the system chassis, unfasten the nuts and screws securing the SCSI cable access port cover. Note that the lower right screw is also used to mount the lower inside blanking plate. Remove the blanking plate to provide a cable port for the second SCSIBox (see Figure 3-38).

Note: The blanking plate will fall to the bottom of the chassis when the right bottom screw is removed. Be prepared to catch it as you remove the screws that hold it in place.

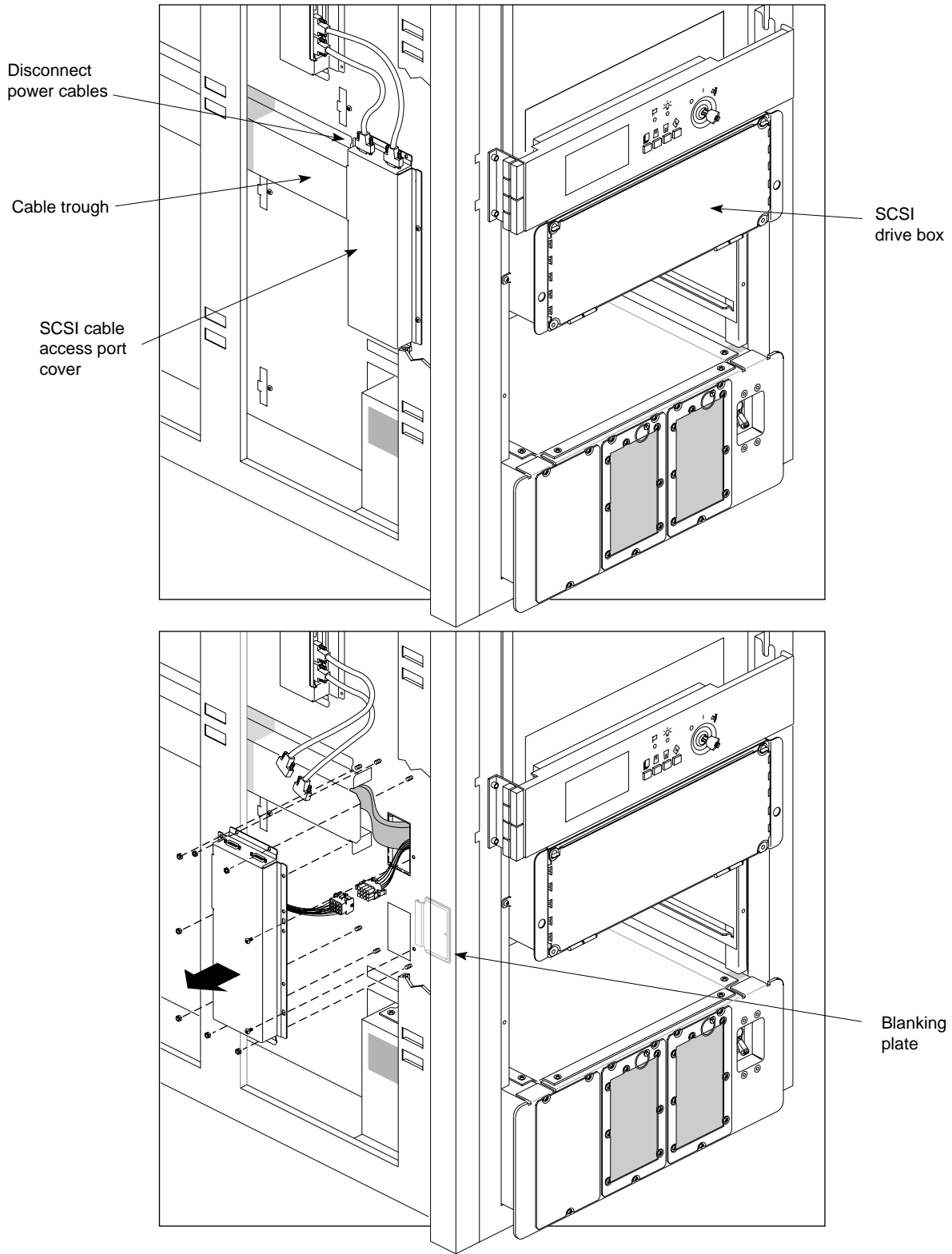


Figure 3-40 Removing the SCSI Cable Access Port Cover and Blanking Plate



Warning: When installing or removing a SCSIBox, be careful not to catch or cut any of the cables on the edges of the access port.

6. Refer to Section 3.6, "Storage Devices," to verify that the SCSIBox backplane is correctly configured.
7. Slide the SCSIBox into the enclosure until the flange on either side of the box contacts the system chassis. Fasten the box in place with the spring-loaded quarter-turn screws mounted on the flanges (see Figure 3-39).

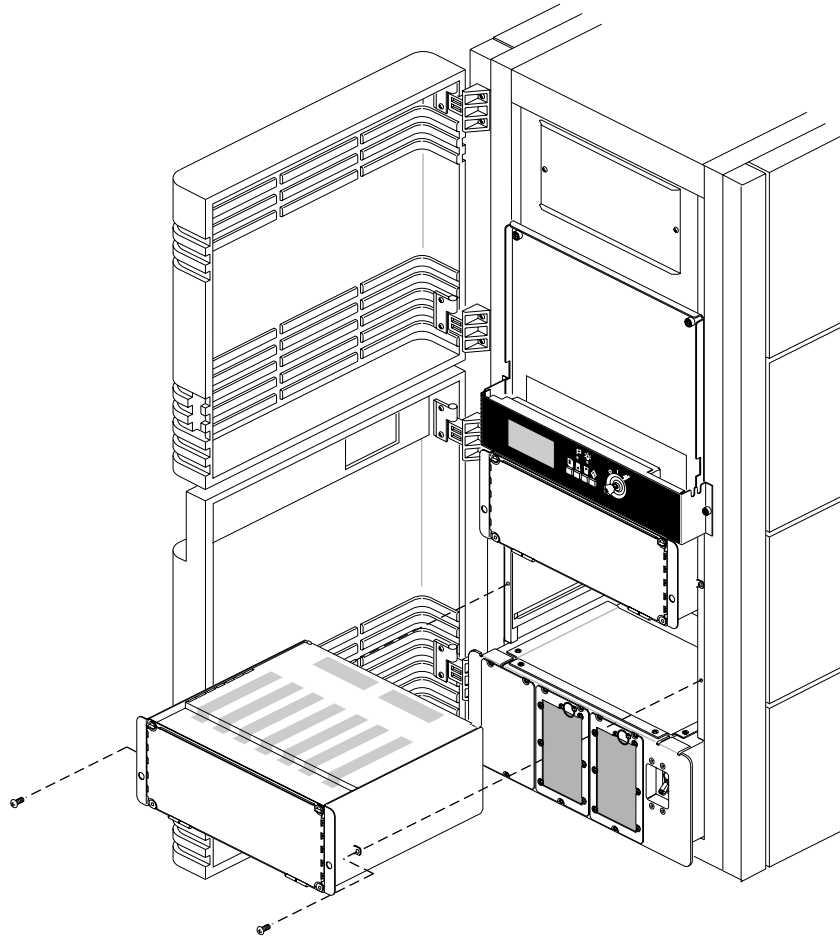


Figure 3-41 Installing or Removing the Optional SCSI Drive Box

8. Locate the 2 SCSI cables and the power cable for the optional SCSIBox. These cables run down the left side of the system cabinet and exit from the cable routing box immediately to the rear of the SCSI cable access ports (see Figure 3-40).

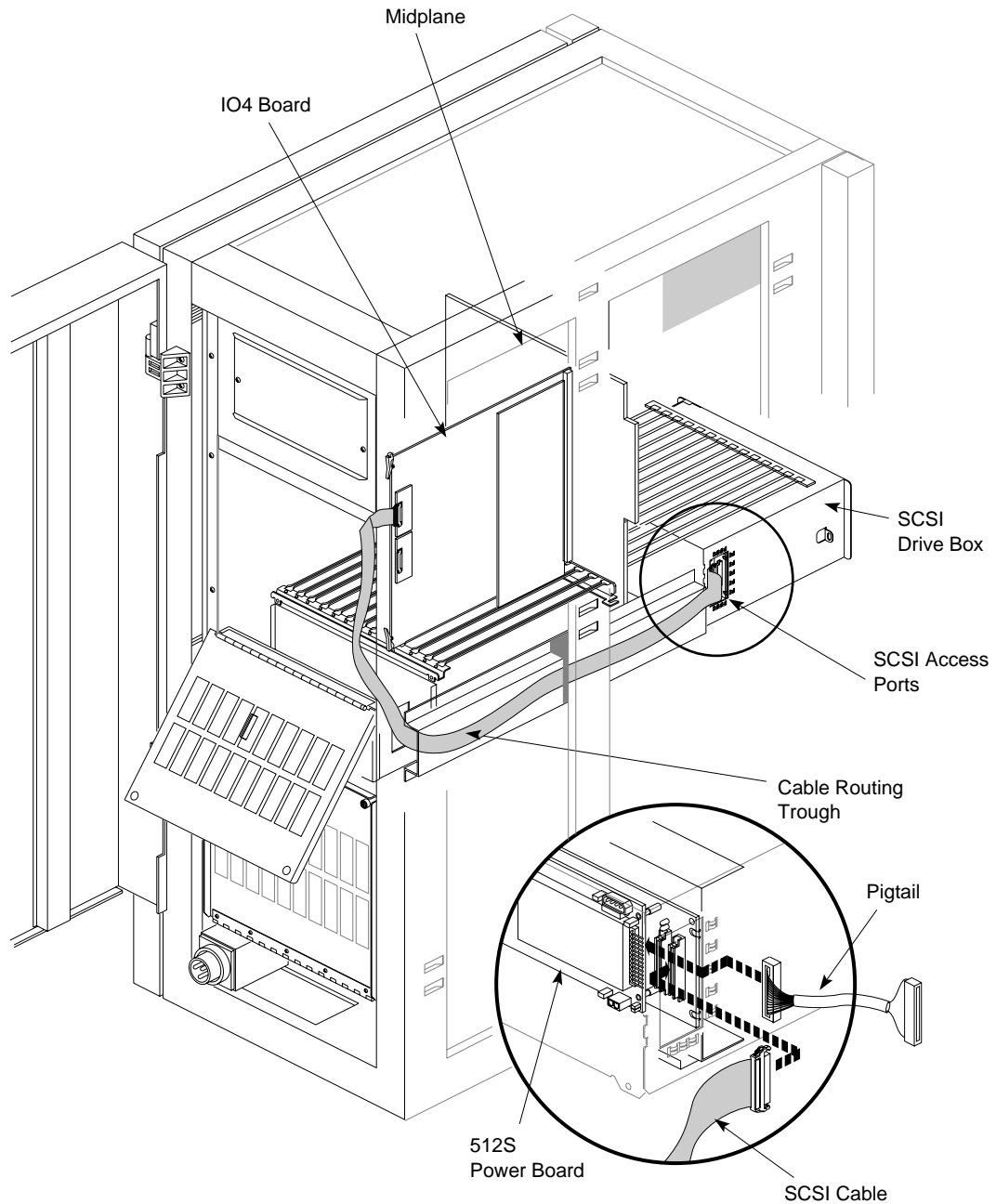


Figure 3-42 SCsIBox Cable Routing

9. Connect the power cable to the pigtail attached to the 512S power board.
10. Route the two unattached SCSI cables into the lower access port and connect them to the SCsIBox backplane.

Note: Verify that the bus designations on the cables match the designations on the corresponding SCsIBox connectors.

11. Reinstall the SCSI cable access port cover (note that the lower screw that secured the inside blanking plate now threads directly into the side of the SCSIBox).
12. Reinstall the side panels.
13. Refer to Section 3.5.1.8, "VCAM and Mezzanine Board Installation," to install and cable a SCSI Interface Module.
14. Refer to Section 3.6, "Storage Devices," and verify that the system disk (boot disk) and any other drives to be installed are correctly configured. Install the drives in the SCSIBox.
15. Power up the system (refer to Section 3.8, "Bringing the System Up and Down").

3.10.6 512S (SCSIBox) Power Board

The 512S power board mounts to the rear of the backplane in the SCSIBox (see Figure 3-41). Remove or replace the 512S board as follows:

1. Remove the SCSIBox as described in Section 3.10.5, "SCSIBox."
2. Unfasten the four crosshead screws securing the rear cover to the SCSIBox.
3. Remove the 6 securing screws and lift the old power board off of the six standoffs and screw the new board onto the standoffs in its place. When installing the new 512S board, ensure that the connector on the back of the board mates with the connector on the backplane.

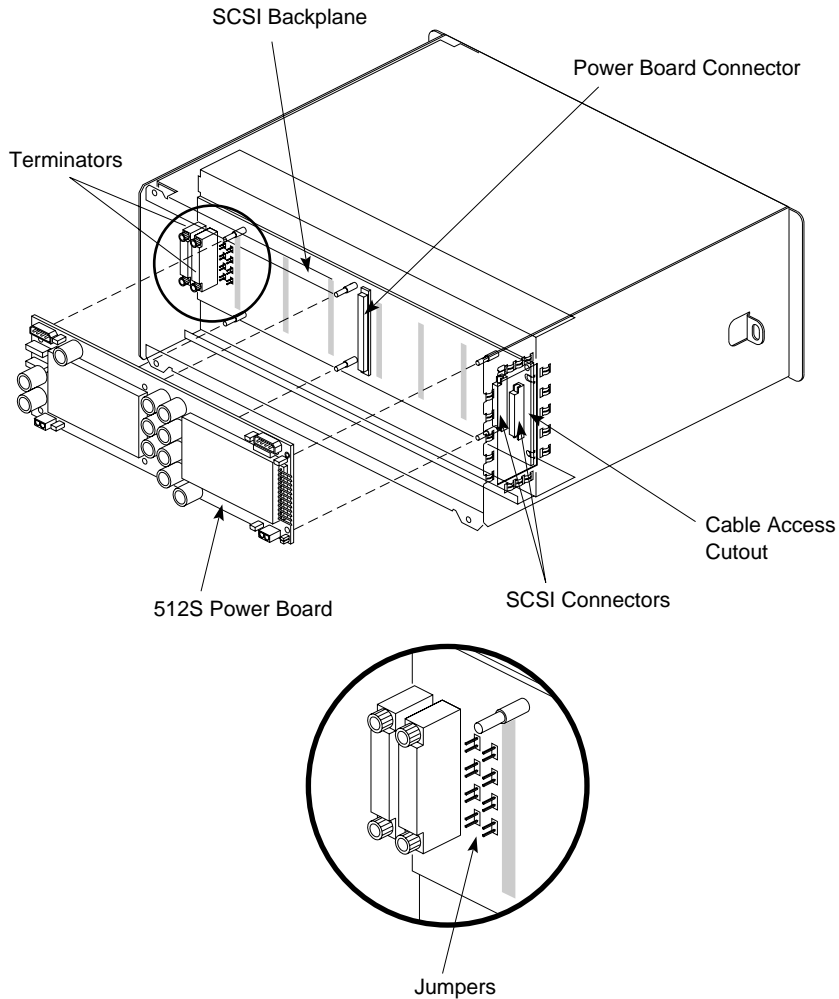


Figure 3-43 SCSIBox Backplane and 512S Power Board

3.10.7 505 and 512 Power Boards

This procedure describes how to install power boards in Cardcage 1. Section 3.10.3, “Off-line Switchers” provides instructions for installing off-line switchers.

Power boards designed for use in Cardcage 1 are mounted on extenders and are installed exactly like any other board (see Figure 3-42). The slots designated for the power boards are shown in more detail in Figure 3-4 (graphics system) and Figure 3-7 (server). Note that the System Controller board has a combination of male and female connectors and must be installed in the slot to the immediate left of the left-most Ebus slot in Cardcage 1.

For information about installing power boards on the Cardcage 3 backplane in a graphics system, see Figure 3-58. For information about installing power boards on the Cardcage 3 backplane in a server system, see Figure 3-62.

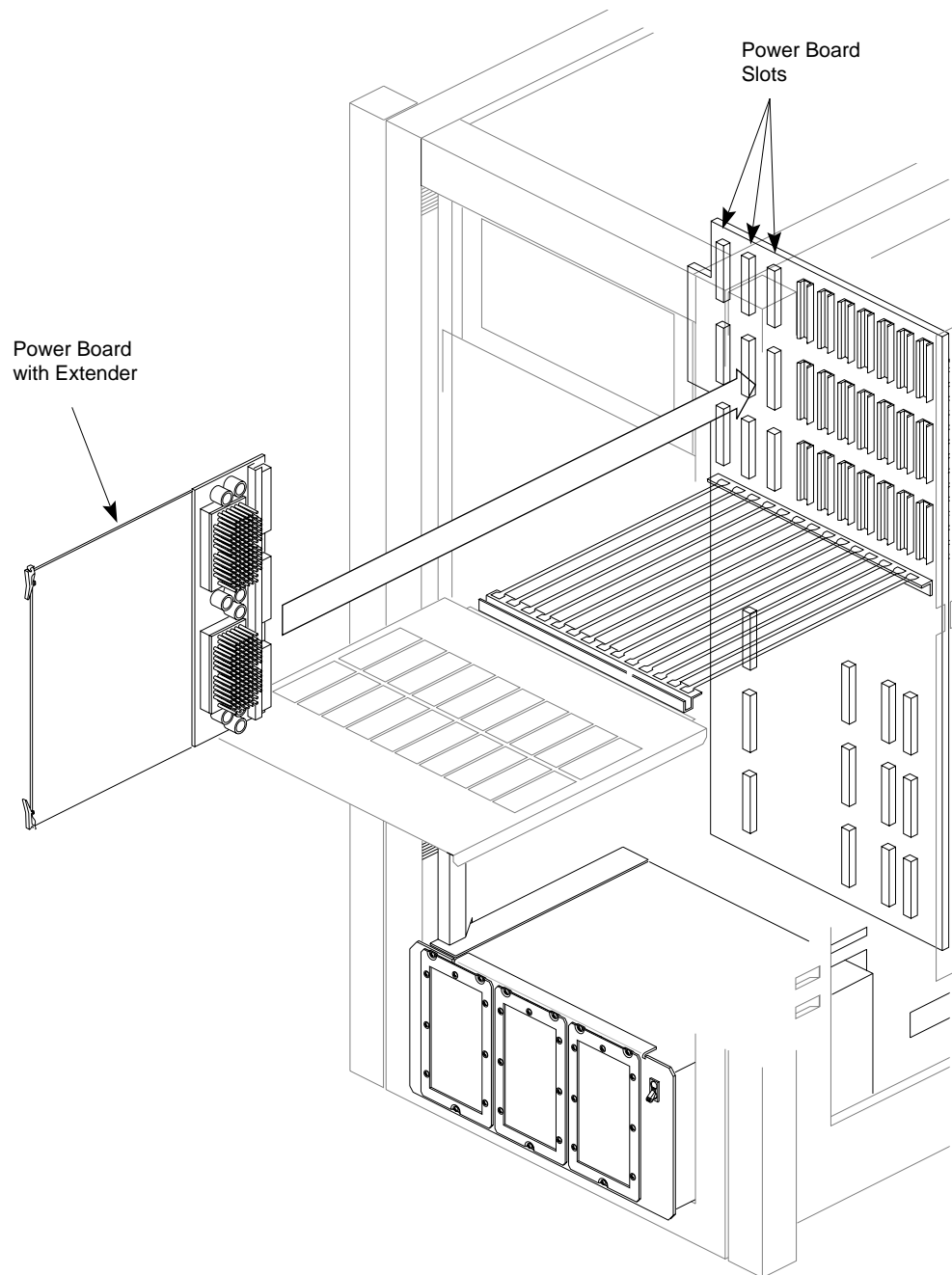


Figure 3-44 Cardcage 1 Power Board Installation (Server System Shown)

3.10.8 Midplane

This procedure describes how to remove or replace the system midplane.

1. Power down the system as described in Section 3.8, “Bringing the System Up and Down.”
2. Allow power to drain from the system for five (5) minutes.
3. Remove the side panels from both sides of the cabinet. See Section 3.10.2, “Chassis Doors and Side Panels (Skins).”
4. Working at the left side of the cabinet (as seen from the front of the system), unfasten the 3-4 cables attached to the midplane connectors (see Figure 3-43).

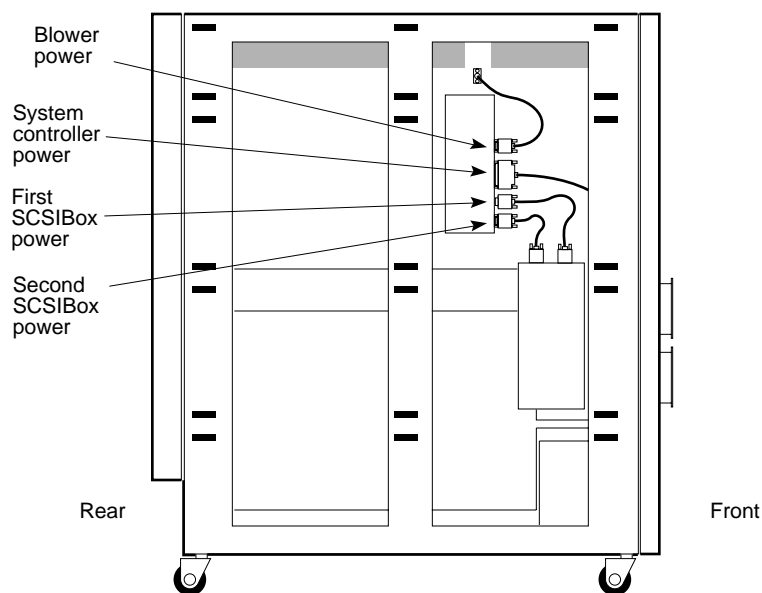


Figure 3-45 Removing Midplane Connectors

5. Gain access to both Cardcage 1 and 2 (see Section 3.5.1.1, “Accessing Cardcage 1” and Section 3.5.1.2, “Accessing Cardcage 2 and Cardcage 3”), and remove all the boards from both cardcages.
6. You may wish to remove the blower assembly to allow easier access to the upper card guide. Although this step is not required, removing the blower allows greater access to the upper card guide and can make removal and installation easier. For information about removing the blower assembly, see Section 3.10.4, “Blower (Fan) Assembly.”
7. Working from the front of the cabinet, unfasten the 2 screws securing the upper card guides. Note that the guide assembly is positioned in the cardcage by four tabs that fit into four corresponding slots in the sides of the cardcage. Gently pull the guide assembly toward the front of the cabinet and away from the midplane. You may find it easier to manipulate the card guide if you remove the blower assembly. Removing the blower assembly allows access to the upper card guide.

Caution: Do not allow the rear of the guide assembly to drop out of the 2 rear locating slots. If the rear of the guide assembly drops, it will contact the midplane and possibly damage it.
8. Repeat Step 6 for the bottom card guide assembly, and for the top and bottom card guides in the rear cardcage.

9. Remove the SCSIBox(es) from the cabinet (refer to Section 3.10.5, “SCSIBox”).
10. Remove the access panel that isolates the SCSIBox enclosure from the midplane jumper board. The access panel is positioned by two alignment pins at its top edge and secured by four quarter-turn screws.
Note: The quarter-turn screws used with the access panel are not spring-loaded like the ones used with the I/O panels and do not release positively when turned. You must turn each one back and forth slightly while pulling gently on the corner it secures in order to release it.
11. Working from inside the SCSIBox enclosure, unfasten the five power connectors at the lower edge of the midplane.
12. Verify that all of the connections to the midplane have been removed.
13. Loosen the six screws securing the midplane access port cover on the right side of the cabinet. Lift the cover slightly and remove it from the cabinet.
14. Use a 3/32-inch hex wrench to loosen the upper and lower wedgelocks (located at the top and bottom edges of the midplane).
15. Carefully slide the midplane out of the cabinet.
Caution: If resistance is felt, stop immediately and determine its cause. Verify that the card guides have been withdrawn from the midplane enough to give sufficient clearance.

Installation is the reverse of this procedure.

3.11 Optional Third Cardcage (Cardcage 3) and Power Supply Tray

These instructions describe how to install the optional third cardcage and three-phase power supply tray in a Challenge or Onyx rackmount system. Multiple-IO4 board installation, cabling, and configuration are supported for both graphics machines and servers.

Note: The installed power supply tray must be exchanged for a three-phase power supply tray whenever the third cardcage is installed.

3.11.1 Parts List and Part Numbers

The basic parts and part numbers for the server and graphics versions of the third cardcage upgrade to the Challenge/Onyx rack products are listed in the following sections. Some parts such as mezzanine cards, graphics boards, or IO4 boards may not come with the Cardcage 3 upgrade kit. International Cardcage 3 upgrades will vary slightly from North American kits.

If you do not find a part number you believe needs to go with the upgrade, see Section 3.11.1.3, “Optional Parts Used with Cardcage 3 Upgrades,” that follows the two main parts lists.

3.11.1.1 Challenge VME Cardcage 3 Upgrade Parts List

Parts included in the VME Cardcage 3 upgrade are:

- 3-Phase Off-Line Switcher tray (P/N 013-0513-00x)
- 3-Phase Off-Line Switchers (208V North American P/N 013-0688-00x, 400V International P/N 013-0687-00x)
- Cardcage 3 top card guide for server (P/N 013-0536-00x)
- Cardcage 3 bottom card guide for server (P/N 013-0537-00x)
- Cardcage 3 server I/O door assembly (P/N 013-0541-00x)
- Cardcage 3 board locking assembly (P/N 013-0677-00x)
- Cardcage 3 VME server backplane (P/N 030-0296-00x)
- 505 power board (P/N 030-0263-00x)
- 512 power board (P/N 030-0264-00x)
- Remote VCAM (P/N 030-0502-00x)
- Short F Mezz board (option) (P/N 030-0501-00x)
- Long F Mezz board (option) (P/N 030-0244-00x)
- 60-pin micro-strip cable (P/N 9290049)
- Server air deflector (P/N 013-0854-00x)
- Cardcage 3 backplane VME terminator (P/N 030-0302-00x)
- J1 jumper boards for VME backplane Cardcage 3 (P/N 030-0303-00x)
- J2 jumper boards for VME backplane Cardcage 3 (P/N 030-0316-00x)
- J3 jumper boards for VME backplane Cardcage 3 (P/N 030-0514-00x)
- North American 220V 3-phase label (P/N 024-0635-00x)
- International 400V 3-phase label (P/N 024-0636-00x)
- Cardcage 3 server slot label (P/N 024-0656-00x)
- OLS air cover (P/N 040-0750-00x)
- Cardcage 3 interrupt board (P/N 030-0516-00x)
- Upgraded PROM (2.03) for Challenge Cardcage 3 (P/N 070-1117-005)

3.11.1.2 Onyx Graphics Cardcage 3 Upgrade Parts List

Parts included in the graphics Cardcage 3 upgrade are:

- 3-Phase Off-Line Switcher tray (P/N 013-0513-00x)
- 3-Phase Off-Line Switchers (208V North American P/N 013-0688-00x, 400V International P/N 013-0687-00x)
- Cardcage 3 top card guide for graphics (P/N 013-0536-00x)
- Cardcage 3 bottom card guide for graphics (P/N 013-0537-00x)

- Cardcage 3 graphics I/O door panel (P/N 013-0832-00x)
- Cardcage 3 board locking assembly (P/N 013-0677-00x)
- Cardcage 3 graphics backplane (P/N 030-0297-00x)
- 505 power board (P/N 030-0263-00x)
- 512 power board (P/N 030-0264-00x)
- Remote VCAM (P/N 030-0502-00x)
- Graphics system air deflector (P/N 013-0853-00x)
- Jumper wire assembly (P/N 015-0133-00x)
- OLS air cover (P/N 040-0750-00x)
- Cardcage 3 graphics slot labels (P/N 024-0657-00x)
- Long F Mezz board (option) (P/N 030-0244-00x)
- 60-pin micro-strip cable (P/N 9290049)
- North American 220V 3-phase label (P/N 024-0635-00x)
- International 400V 3-phase label (P/N 024-0636-00x)
- Cardcage 3 interrupt board (P/N 030-0516-00x)
- IO4 Board (P/N 030-0240-0xx)

3.11.1.3 Optional Parts Used with Cardcage 3 Upgrades

The following list includes parts often used with the Cardcage 3 upgrade:

- Single-ended SCSI module board for IO4 (P/N 030-0305-00x)
- Differential SCSI module board for IO4 (P/N 030-0304-00x)
- Dual SCSI connector plate (P/N 013-0610-00x)
- I/O option door for Onyx CC2 (P/N 013-0661-00x)
- I/O cable (P/N 018-0333-00x)
- Fixed I/O adapter plate (P/N 040-0530-00x)
- GE10 graphics board (P/N 030-0325-00x)
- DG2 graphics board (P/N 030-0513-00x)
- RM4 graphics board (P/N 030-0359-00x)
- Video filter bracket (P/N 013-0831-00x)
- Analog video cable (P/N 018-0428-00x)

3.11.2 Installing the Hardware

This section describes the installation of the Cardcage 3 card guides and backplane, as well as the three-phase power supply tray.

1. Refer to Section 3.8, "Bringing the System Up and Down" for instructions on powering down the system.
2. Allow power to drain five (5) minutes before continuing with the upgrade.
3. Remove the side panels from both sides of the system cabinet (four panels per side) by sliding them toward the rear of the cabinet and then lifting them off.
Note: Be careful when removing and storing the panels to avoid marring them.
4. Open the lower access door covering the rear of the Cardcage 3 enclosure by releasing the two quarter-turn screws located at the door's upper right and left corners.
5. Unfasten the screws securing the door hinge to the system chassis and remove the door.
6. Remove the SCSIBox(es) as described earlier in this chapter.
7. Remove the access panel from the top of the installed power supply tray by unfastening the two screws (see Figure 3-44).
8. Remove the access panel that isolates the SCSIBox enclosure from the midplane jumper board. The access panel is positioned by two alignment pins at its top edge and secured by four quarter-turn screws.
Note: The quarter-turn screws used with the access panel are not spring-loaded like the ones used with the I/O panels and do not release positively when turned. You must turn each one back and forth slightly while pulling gently on the corner it secures in order to release it.
9. Loosen the ten screws securing the midplane/Cardcage 3 backplane access port cover to the right side of the cabinet. Lift the cover slightly and remove it from the cabinet.

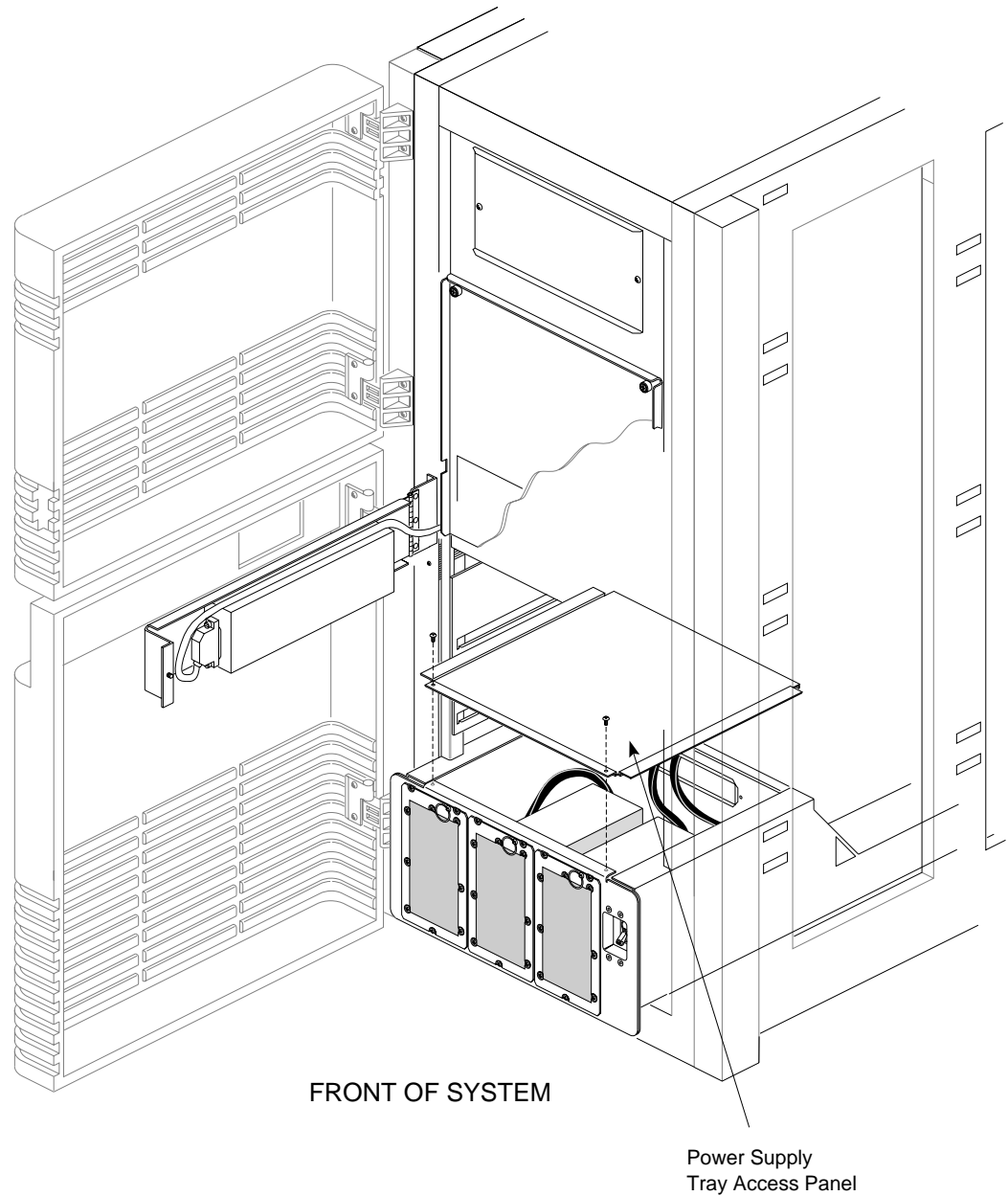


Figure 3-46 Power Supply Tray Access Panel

10. Unfasten the nine connectors from the midplane jumper board (see Figure 3-45). The five connectors at the top of the jumper board come from the midplane. The four lower connectors come from the power supply tray.

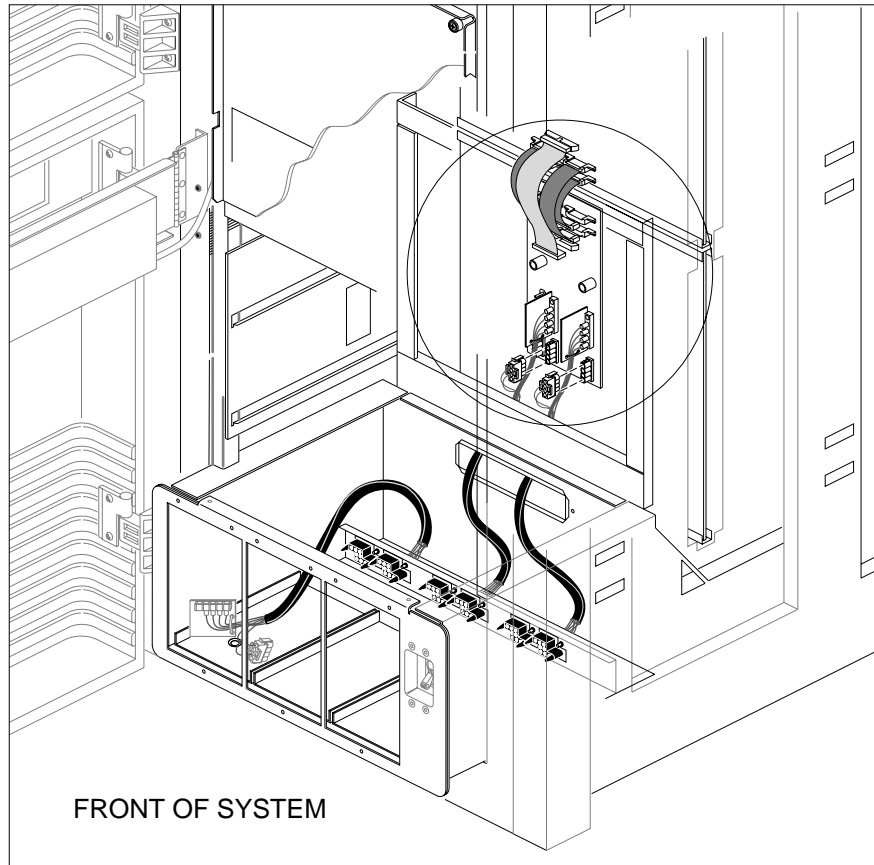


Figure 3-47 Midplane Jumper Board Connections

11. Remove the plate that covers midplane connectors (see the circled area in Figure 3-45). Disconnect the cables and connectors from the midplane and pull the four power supply cables (two bundles), back through the cable port and into the power supply tray.
12. Remove all of the OLSs installed in the power supply tray (three screws per OLS). Locate the four screws securing the power supply tray to the system cabinet and remove them (see Figure 3-46).

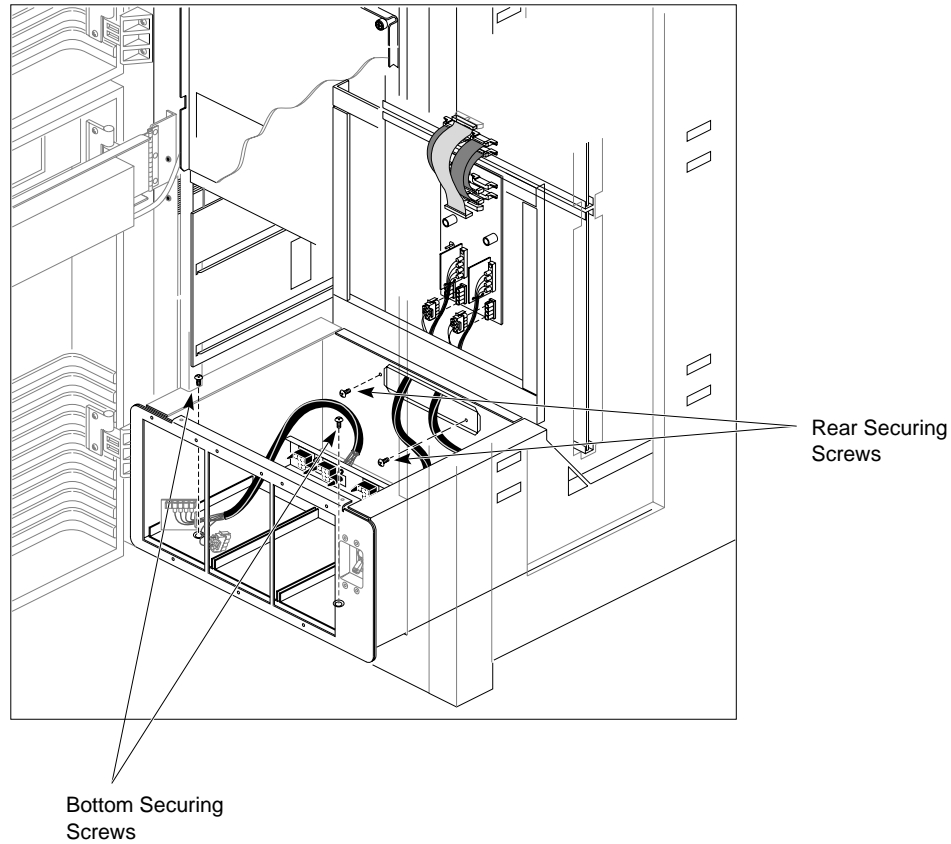


Figure 3-48 Power Supply Tray Securing Screws

13. Withdraw the power supply tray from the front of the system cabinet (see Figure 3-47).
14. Withdraw the midplane jumper board through the access port on the right side of the cabinet (see Figure 3-47).

Note: The jumper board is held in position by friction. There is no mounting hardware.

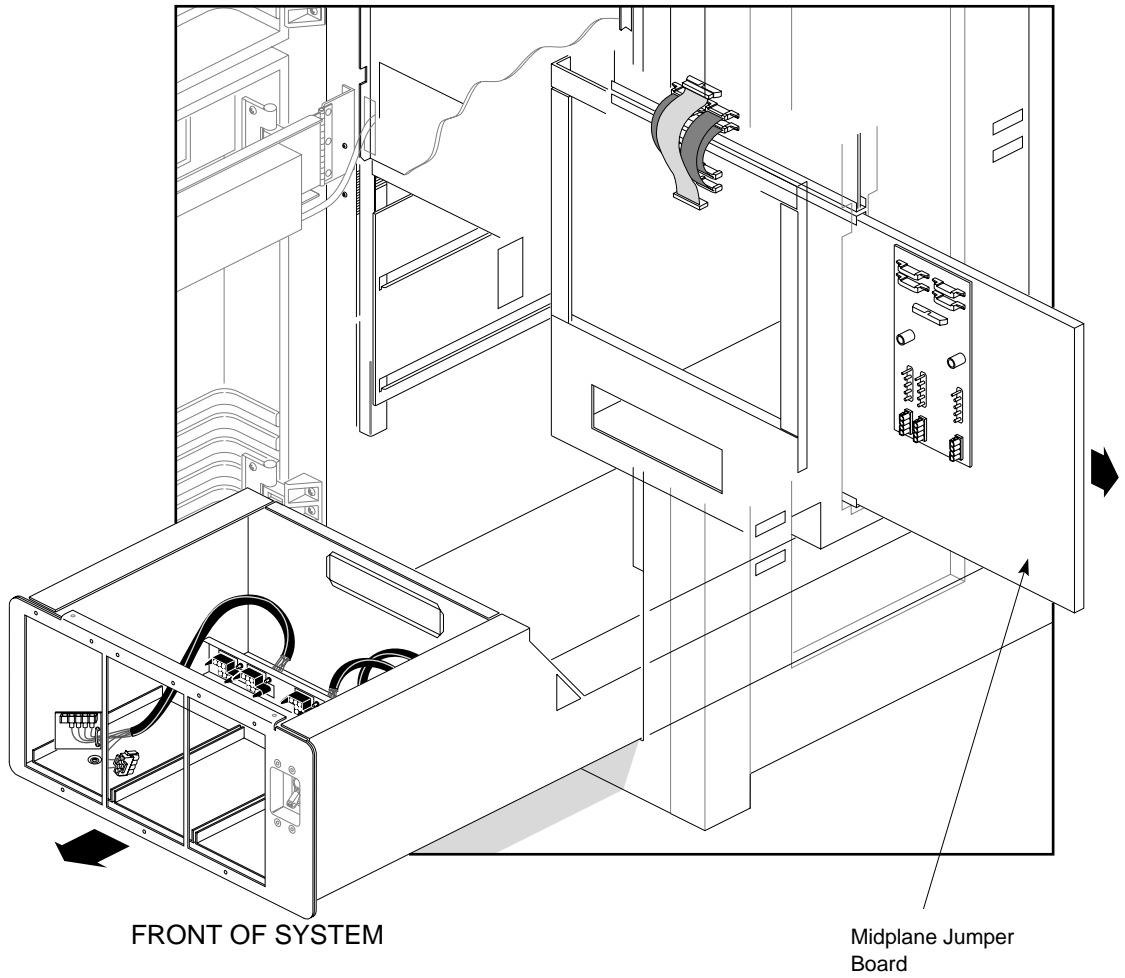


Figure 3-49 Removing the Midplane Jumper Board

15. Remove the four card guide covers from the left side of the cabinet. Each cover is mounted with a single screw (see Figure 3-48).

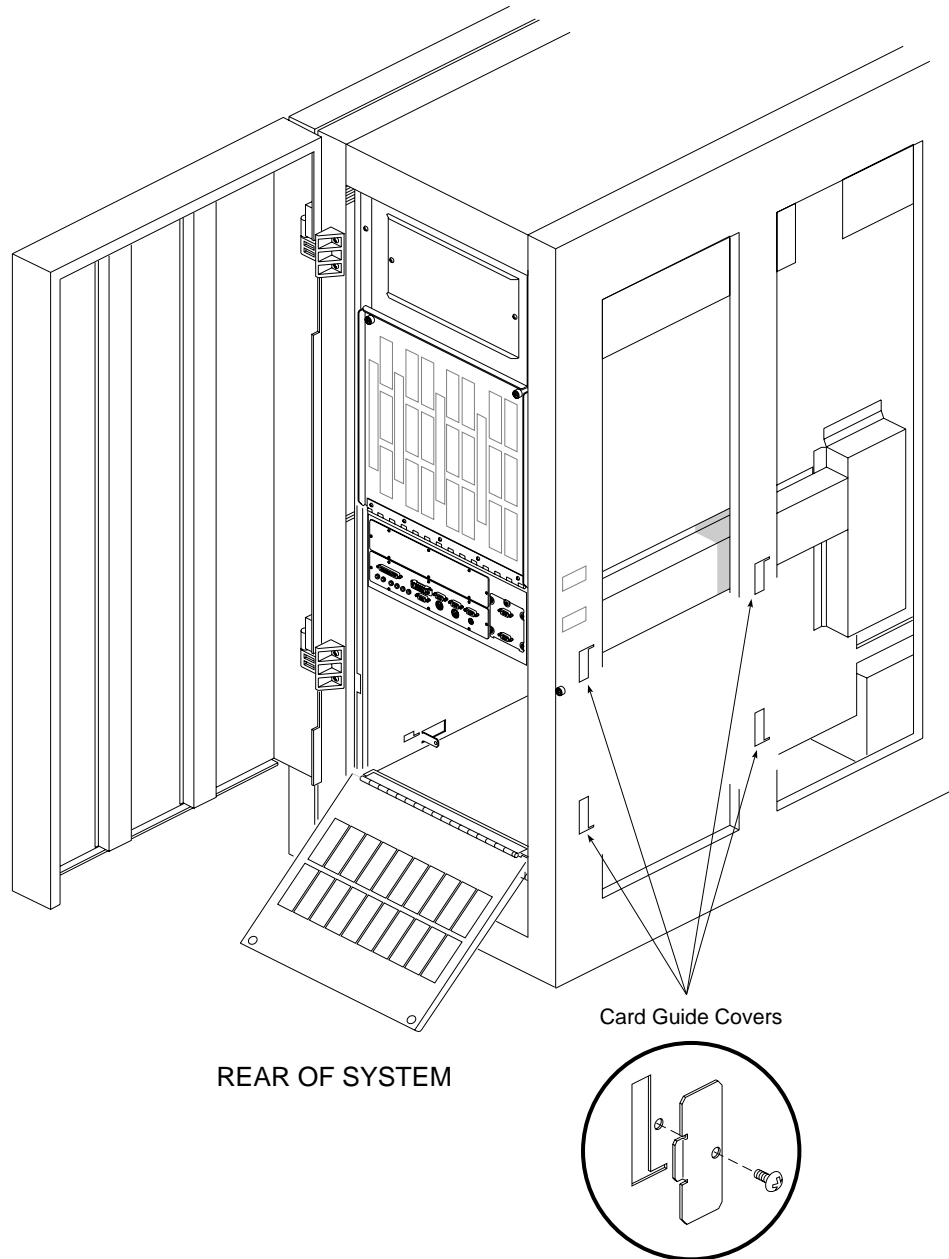


Figure 3-50 Card Guide Covers

16. Install the upper and lower Cardcage 3 card guides. Each card guide has four locating tabs (one in each corner). Make sure the tabs are perpendicular to the flange. The tabs fit into slots in the sides of the system chassis (see Figure 3-49).

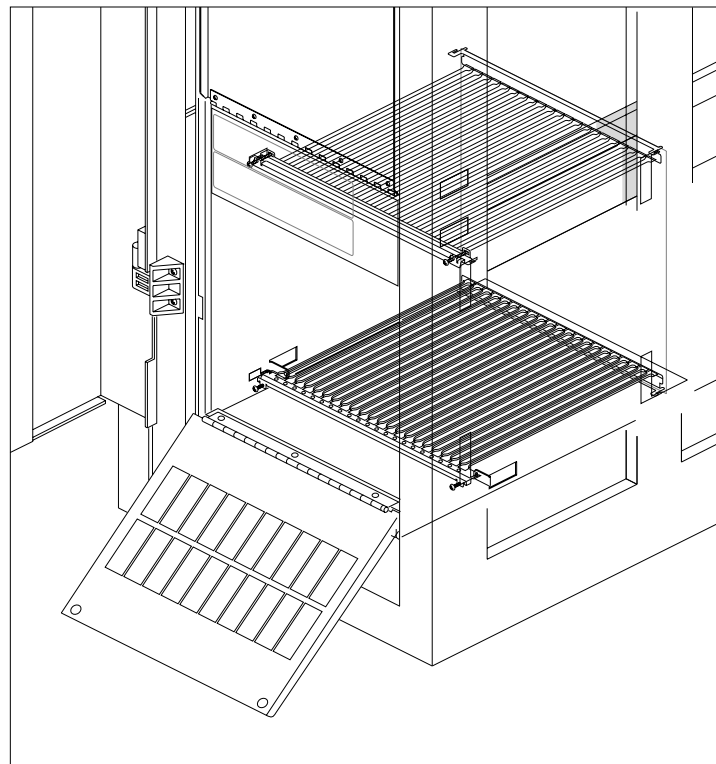
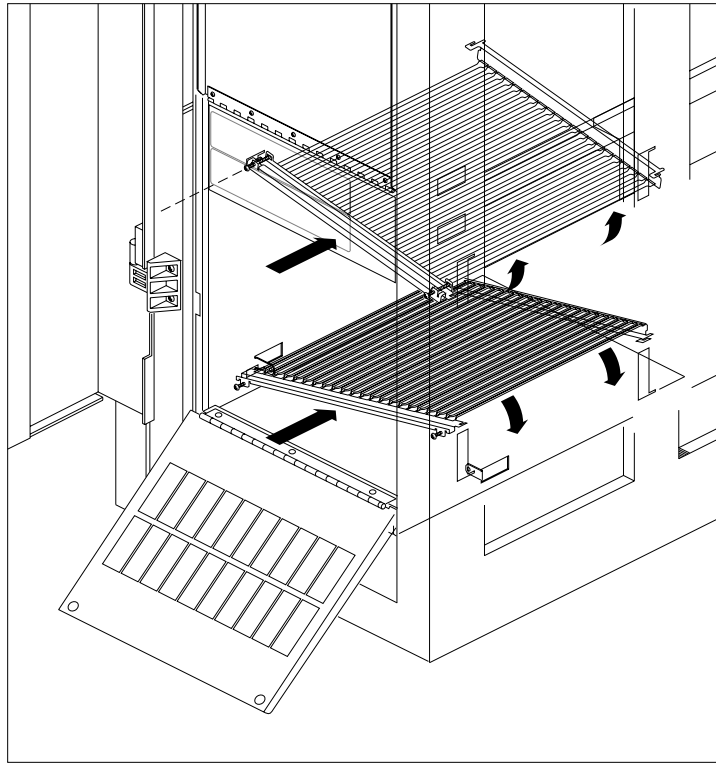


Figure 3-51 Card Guide Installation

17. Tip each guide so that the left-hand locating tabs (as seen from the rear of the system) engage the small slots in the left side of the chassis first. Insert the right-hand tabs into the larger openings on the right side of the chassis. Lower/raise the right side until the card guide is level. Then position each guide back as far as it will go in the locating slots.
18. Reinstall the four card guide covers on the left side of the cabinet.
19. Slide the Cardcage 3 backplane into the system chassis (see Figure 3-50). Feed the top and bottom wedgelocks into the U-shaped mounting tracks a section at a time, until the two locating pins on the backplane's left side engage the corresponding holes in the side of the system cabinet. Verify that the two locating pins on the right side of the Cardcage 3 backplane align with and fit through the slots in the sheet metal access cover.
Note: If the locating pins on the Cardcage 3 backplane do not align with the slots in the sheet metal midplane/Cardcage 3 backplane access cover, refer to the procedure in the following step to work around the problem.

SGIVIDEO: [cc3backplane.mv](#)

[Installing the Cardcage 3 Backplane in the Rackmount Chassis](#)

The video clip above illustrates the guide pins and shows how to install the Cardcage 3 backplane in the rackmount chassis. Notice how the backplane is jiggled slightly to align the wedgelocks in the U-shaped mounting tracks. The view in this video is from the rear of the system looking towards the front.

20. This step provides a solution for the misalignment of the right-side locating pins on the Cardcage 3 backplane and the slots in the sheet metal access cover. Go to the next step if this is not a problem. Remove the backplane and use a small Phillips-head screwdriver to remove the six screws (three on each side) that hold the lower backplane stiffener in place. Replace the backplane and proceed to the next step.

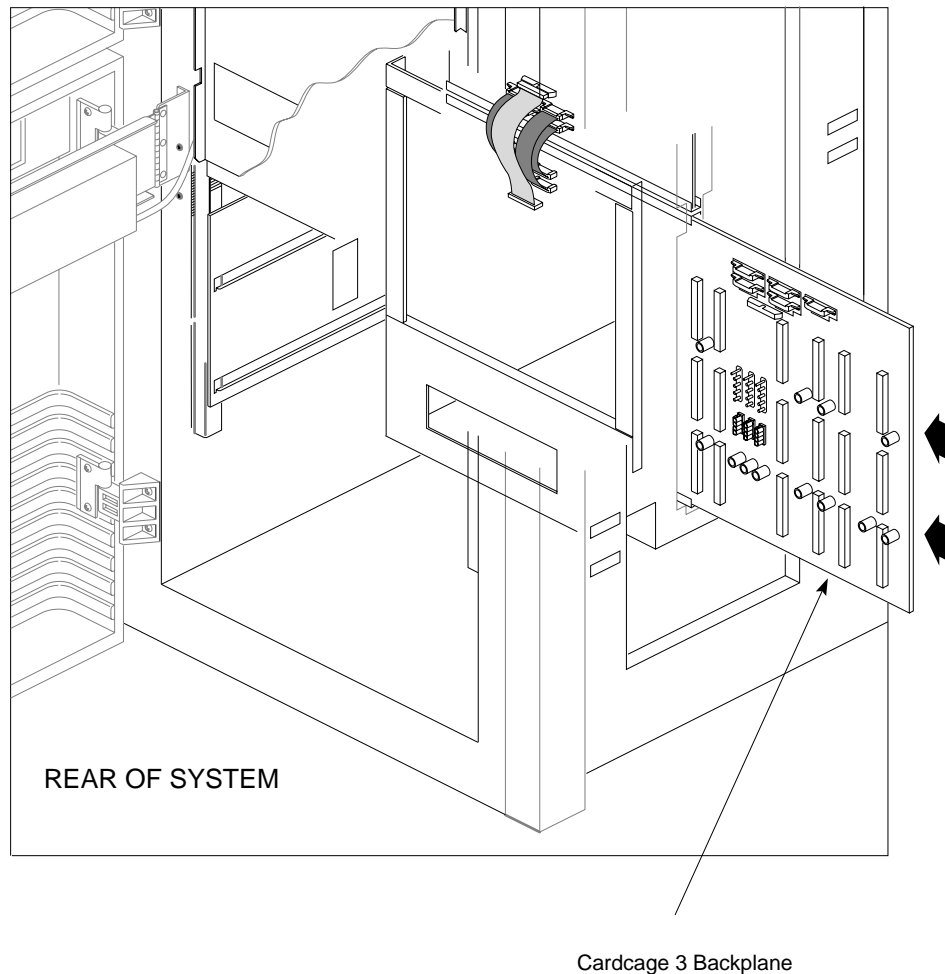


Figure 3-52 Positioning the Cardcage 3 Backplane

21. Slide the top and bottom card guides forward until the guide's locating pins have mated with the corresponding holes in the backplane. Tighten the screws that hold guides in place.
22. Use a 3/32-inch hex wrench to tighten the wedgelocks located at the top and bottom corners of the backplane.
23. Reinstall the midplane/Cardcage 3 backplane access port cover. Verify that the two pins on the right side of the backplane engage the two corresponding slots in the cover. Refer to steps 19 and 20 if they do not. Tighten the six screws that secure the cover.
24. Remove all OLSs and the access cover from the top of the new three-phase power supply tray that is part of the upgrade package.
25. Slide the power supply tray into the front of the cabinet. Ensure that the rear of the tray engages the rails mounted to the floor of the cabinet.
26. Secure the tray to the system cabinet using the four screws removed in Step 12.

27. Attach the five connectors from the midplane, and the six connectors from the new power supply tray, to the Cardcage 3 backplane as shown in Figure 3-51.

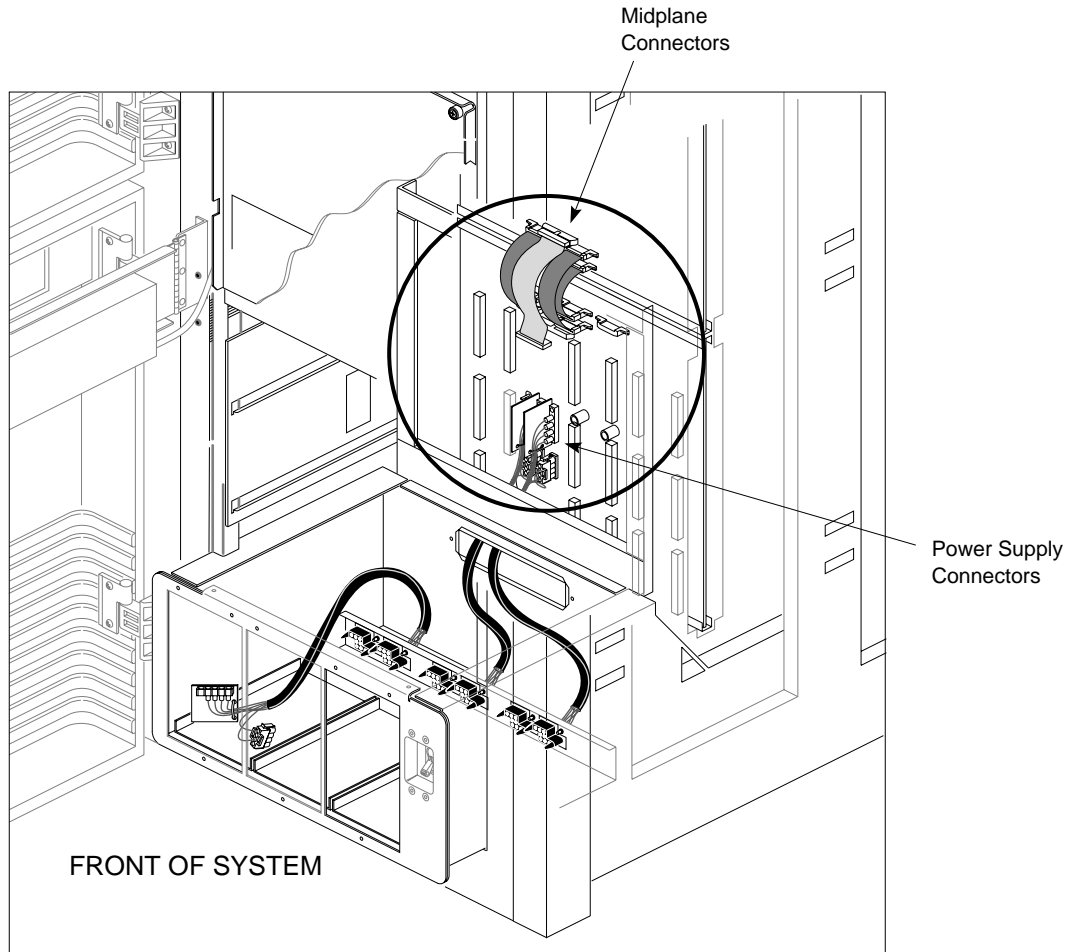


Figure 3-53 Cardcage 3 Power Supply and Midplane Connections

28. Reinstall the OLSs in the new power supply tray.
29. Reinstall the access cover.

Continue to the next section and ensure that all system power and ground requirements are met. Then proceed to Section 3.11.5, “Configuring Cardcage 3,” to install and cable the system boards.

3.11.3 Site Power and Ground Requirements for 3-Phase Rack Systems

The following sections define the power, ground, and electrical outlet connection requirements for both North American and international versions of the Challenge/Onyx rack products.

3.11.3.1 North American Power Requirements

All 3-phase 4-wire versions of the Challenge/Onyx rack products (CMN A010D) must be connected to electrical outlets rated as follows:

- Nema L15-30R
- 250V
- 30 amps
- 50/60 Hz

The socket outlet should be installed near the equipment and should be easily accessible.

3.11.3.2 North American 3-Phase, 4-Wire Grounding Requirements

All North American 3-phase, 4-wire versions of the Challenge/Onyx rack products (CMN A010D) must meet the following specifications:

- An insulating grounding conductor must be installed that is identical in size, insulation material, and thickness to the grounded and ungrounded branch circuit supply conductors.
- It must be green in color and may or may not have yellow stripes.
- The conductor must be installed as part of the branch circuit that supplies the unit or system.
- The grounding conductor must be connected to ground at the service equipment or, if supplied by a separately derived system, at the supply transformer or motor-generator set.
- The attachment-plug receptacles in the vicinity of the system must all be the grounding type and the grounding conductors serving the receptacles must be connected to the ground at the service equipment.

3.11.3.3 Power Requirements for International 3-Phase, 5-Wire Systems

All 3-phase, 5-wire European type “WYE” versions of the Challenge/Onyx rack products (CMN A010Y) must be connected to electrical outlets rated as follows:

- 3/N/PE
- AC 360-480V
- 30 amps minimum
- 50/60 Hz

All 3-phase, 5-wire European type “WYE” versions of the Challenge/Onyx rack products (CMN A010Y) must meet the following specifications:

- The electrical outlet to which the system is connected must be a 3-phase, 5-wire “WYE” connection with both neutral and earth ground terminals as well as terminals for each of the three-phase conductors.
- The integrity of the neutral connection must be verified in order to avoid damage to the off-line switchers (OLSs).

- For connection to “IT” power systems, a 4-pole breaker must be available at the building site.

3.11.4 New Regulatory Label Application

Included in the Cardcage 3 upgrade kit is a label that *must* be applied over the “**MODEL NO:**” section of the original system serial number label. This label was applied to the unit at the factory and is similar to: **P/N 024-0603-001**.

The label is located on the sheet metal base of the chassis, and is directly above the front right caster. It is visible when standing in front of the rack with the door open. Follow these steps to properly apply the regulatory labels:

1. Apply the new model number label so that it completely covers the original model number.
2. Apply the system rating label. It must be positioned on the lower right-hand corner of the system serial number label. This label should overlap the edges of the system label in order to avoid covering up any of the certification symbols.

Note: These labels *must* be applied to all systems that receive the Cardcage 3 upgrade in the field. They are required by regulatory and safety organizations for the installation of Cardcage 3.

3.11.5 Configuring Cardcage 3

Before the third cardcage (Cardcage 3) can be populated with either VMEbus or graphics boards, a combination of system boards must be installed. These boards include:

- a second IO4 board
- Short and/or Long F Mezz boards
- Remote VCAMs
- 505 and 512 power boards
- VMEbus interrupt boards
- VMEbus backplane terminators
- VMEbus backplane jumpers

Also, in order to use some of the additional I/O capabilities (such as additional Ethernet ports, or serial ports), some system configuration is required. See the *system(4)* reference page and Section 3.12, “Software Configuration” for information about editing IRIX system configuration files.

This section covers the labelling, installation, and cabling of these boards in both server and graphics systems.

Caution: Observe proper ESD procedures when handling the boards. Ensure that the boards are correctly seated in the backplane connectors and that the ejector tabs have engaged the top and bottom card guides.

3.11.5.1 IO4 Board Locations and IO4 Filter Board Labelling

This section provides the cardcage slot assignments for multiple-IO4 configurations, as well as the labelling conventions for the IO4 boards and their I/O adapters. The I/O adapters involved in the configuration of Cardcage 3 are the two Flat Cable Interfaces (FCIs) mounted on each IO4 board and the FCIs on any installed F Mezz boards. The physical locations and specific configurations of the IO4 board(s) and F Mezz board(s) have a direct relationship on the labelling of each of the I/O adapters. The adapter labelling is, in turn, crucial in the software configuration phase of this upgrade.

See Table 3-18 for the slot assignments for multiple-IO4 boards.

IO4 Board Number	CC2 Server slot	CC2 Graphics slot
1st	15	11
2nd	13	9
3rd	11	7
4th	9	5

Table 3-18 Server and Graphics System IO4 Board Slot Assignments

Note: Use of all physically available serial, parallel, and Ethernet connectors may be restricted by the IRIX software release the system is running. Be sure to check all system release notes pertaining to the hardware and software before configuring a Challenge/Onyx rack with multiple IO4s.

Figure 3-52 identifies the position of the IO4 boards on the server's Cardcage 2 I/O panel and the cabling from the I/O panel to the Cardcage 2 slots. As shown in Figure 3-52, IO4 boards are installed in a counterclockwise order, starting with the lower horizontal I/O panel cutout.

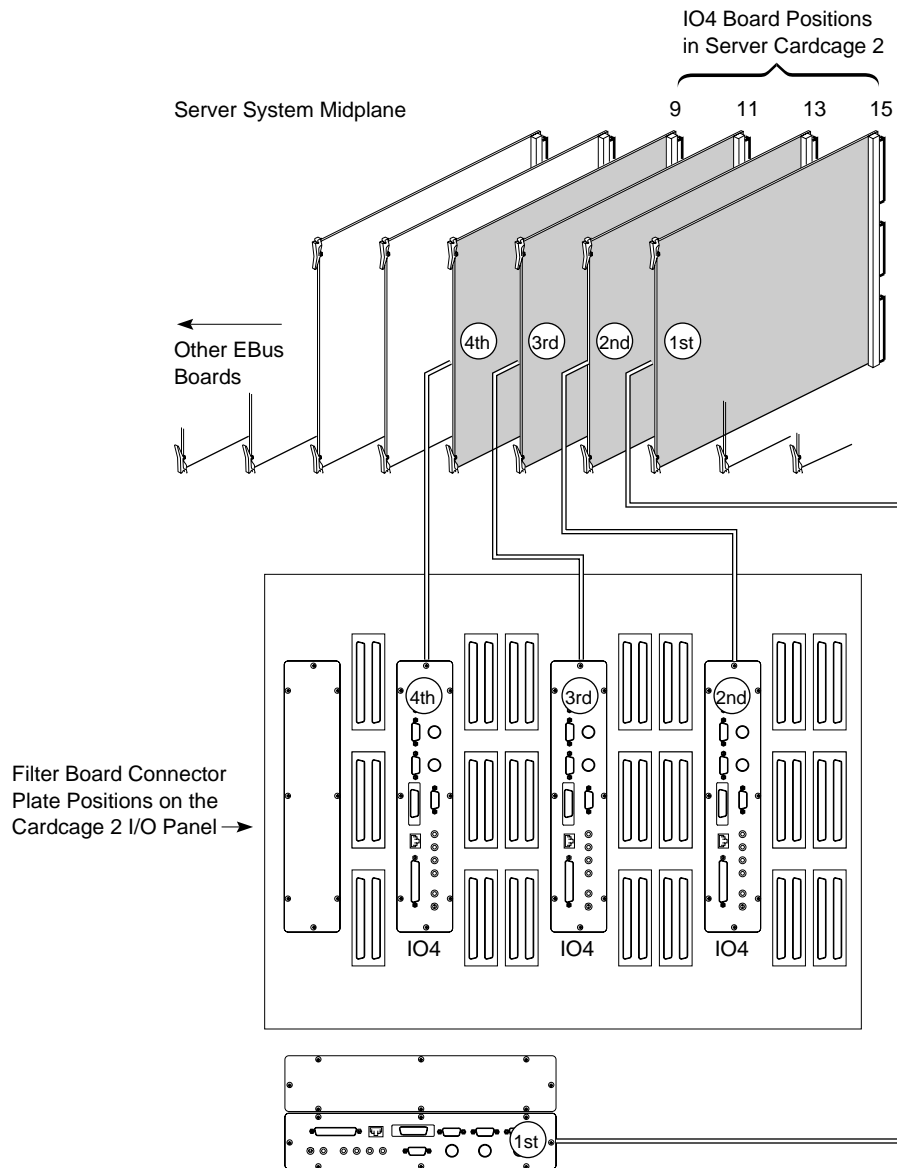


Figure 3-54 Server System IO4 Board Slot Locations and I/O Panel Connection

Figure 3-53 identifies the position of the IO4 boards in the Onyx graphics system Cardcage 2. The I/O panel and the cabling from the I/O panel to the Cardcage 2 slots are also shown.

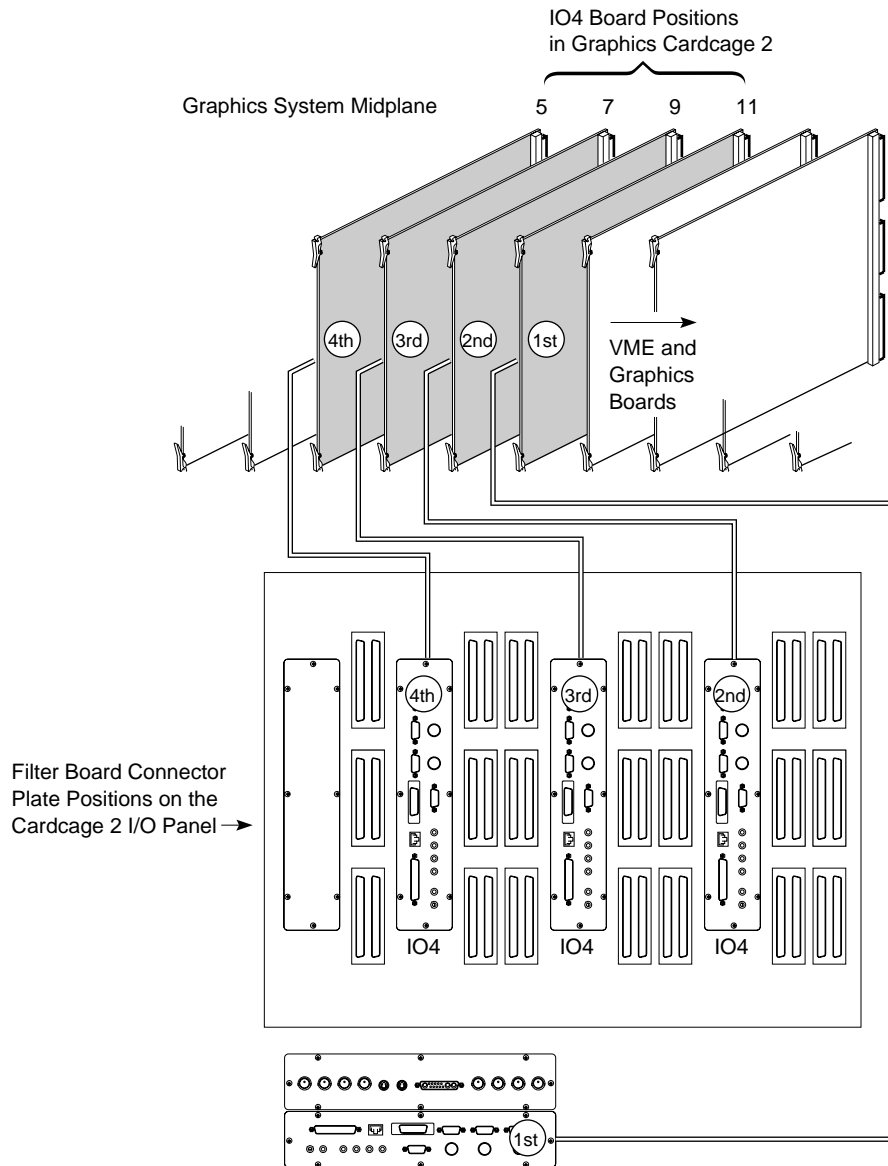


Figure 3-55 Graphics System IO4 Board Slot Locations and I/O Panel Connection

Labelling IO4 Board Connector Plates

The IO4 board labels match the board's bus and slot number. For example, since the first IO4 board in a server system resides in slot 15, the IO4 board number is EBus 15. Since IO4 boards are only installed on one side of the midplane, all slot numbers are odd.

In the Onyx graphics rack system, the first IO4 must go in slot 11, so the slot numbers will differ from those shown for the server system in Figure 3-54. The rules for placement remain the same as in the server system.

Note: The second (top) horizontal I/O panel cutout in Cardcage 2 is only used for graphics connectors.

The labels are placed above the IO4 board's connector plate on the I/O panel. For the horizontal IO4 connector plate, the label is at the upper left corner of the plate. For vertical IO4 connector plates, the labels are placed between the parallel port and the AUI ethernet connector (see Figure 3-54).

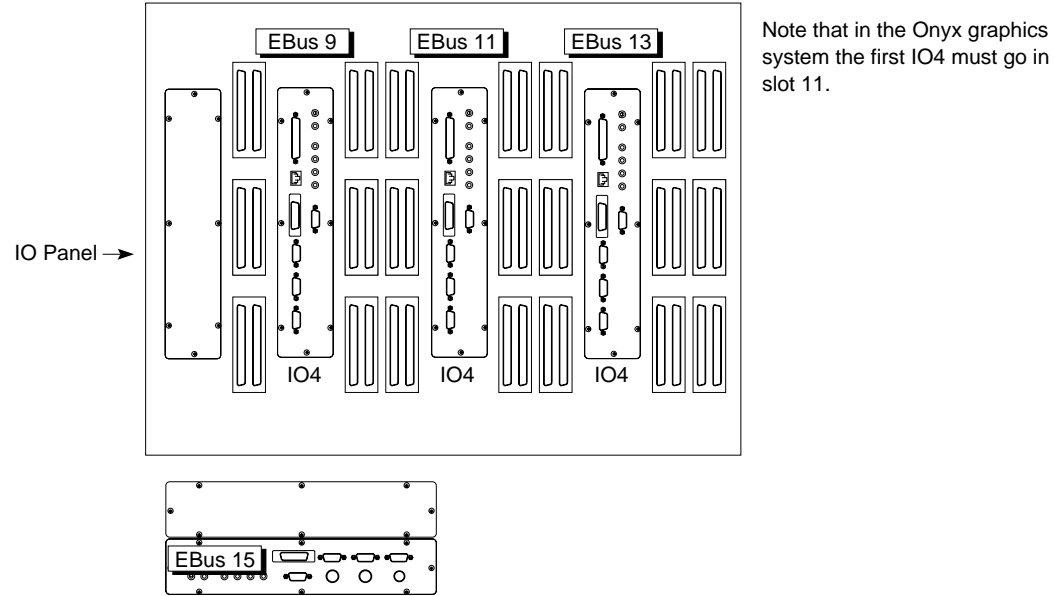


Figure 3-56 Server System IO4 Filter Board Connector Plate Labelling

Labelling Connectors

Connectors are labelled sequentially, starting with the first IO4 board and proceeding through all installed IO4 boards. For example, the first serial connector on the first IO4 board is labelled **tty_1**. See Table 3-19 for information on labelling a server system and Table 3-20 for labelling a graphics system.

IO4 Board Number	IO4 Filter Board Label (Server)	Serial Connectors	Server Parallel Connectors	Network Connectors
1	EBus 15	RS-232: tty_1-3 ^a RS-422: tty_4	plp15	et0
2	EBus 13	tty_45-47 ^b	plp13	et1
3	EBus 11	^b tty_49-51	plp11	et2
4	EBus 9	^b tty_53-55	plp9	et3

Table 3-19 Server System IO4 **Filter** Board Connector Labelling

- a. Connectors are labelled sequentially from right to left.
- b. Connectors are labelled sequentially from top to bottom.

IO4 Board Number	IO4 Filter Board Label (Graphics System)	Serial Connectors	Graphics System Parallel Connectors	Network Connectors
1	EBus 11	RS-232: tty_1-3 ^a RS-422: tty_4	plp11	et0
2	EBus 9	tty_45-47 ^b	plp9	et1
3	EBus 7	^b tty_49-51	plp7	et2
4	EBus 5	^b tty_53-55	plp5	et3

Table 3-20 Graphics System IO4 Filter Board Connector Labelling

- a. Connectors are labelled sequentially from right to left.
- b. Connectors are labelled sequentially from bottom to top.

Serial Connectors

Serial connectors are labelled *tty_#*, where # is a one or two-digit integer. Numbering is sequential, from 1 through 4, 45 through 47, 49 through 51, and 53 through 55. Numbers 5 through 44, 48, and 52 are reserved or used for other optional serial devices.

To alert the system to the presence of a new IO4, you must edit the file */var/sysgen/system/irix.sm*. When adding an IO4 to the Challenge/Onyx, you must edit the “EPC serial” information section to include new information about the placement of the IO4. See the *system(4)* reference page and Section 3.12, “Software Configuration.”

Serial connector *tty_4* is an RS-422 receptacle located on the first IO4 board (EBus 15 on a server, EBus 11 on a graphics system). All other serial connectors are RS-232 receptacles.

Parallel Connectors

Parallel connectors are labelled *plp#*, where # is a one- or two-digit integer. Numbering relates to the IO4 board’s slot number. For example, on the IO4 board, EBus 11, the parallel connector is labelled *plp11*.

Ethernet Network Connectors

Ethernet connectors are labelled *et#*, where # is a single-digit integer. Numbering is sequential from 0 to 3, starting at the first IO4 board, (EBus 15 or EBus 11).

Each IO4 board provides a 15-pin AUI Ethernet connector. Only one connector may be used at a time for each IO4 board, for a total of four IO4-based Ethernet connections on a system with the maximum number of IO4 boards.

To enable the use of an additional Ethernet connector on a new IO4 board, you must edit the file */var/sysgen/system/irix.sm*. When adding an IO4 to the Challenge/Onyx you must edit the “EPC Ethernet” information section to include new information about the additional IO4. See the *system(4)* reference page and Section 3.12, “Software Configuration,” for additional information about editing this file.

I/O Adapter Labelling

Each IO4 board supports six I/O devices. Each of the six devices is assigned a unique I/O Adapter number, as shown in Table 3-21.

I/O Adapter Number	Device Description
1	Everest Peripheral Controller (EPC ASIC)
2	Flat Cable Interface to lower F ASIC
3	Flat Cable Interface to VMEbus (upper F ASIC)
4	SCSI Controller (S1 ASIC)
5	ASIC in Lower Mezz Card Location
6	ASIC in Upper Mezz Card Location

Table 3-21 I/O Adapter Labelling

The I/O Adapters used with Cardcage 3 are the two F ASICs mounted on each IO4 board (I/O Adapters 2 and 3) and the F ASICs on any installed F Mezz cards (I/O Adapters 5 and 6). The relationship of these adapters to the physical board connectors is illustrated in Figure 3-55. The labelling convention for each connector is F-XX-N, where “F” specifies an F ASIC, “XX” represents the Cardcage 2 slot number, and “N” is the I/O Adapter number.

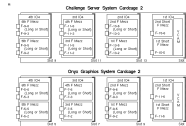
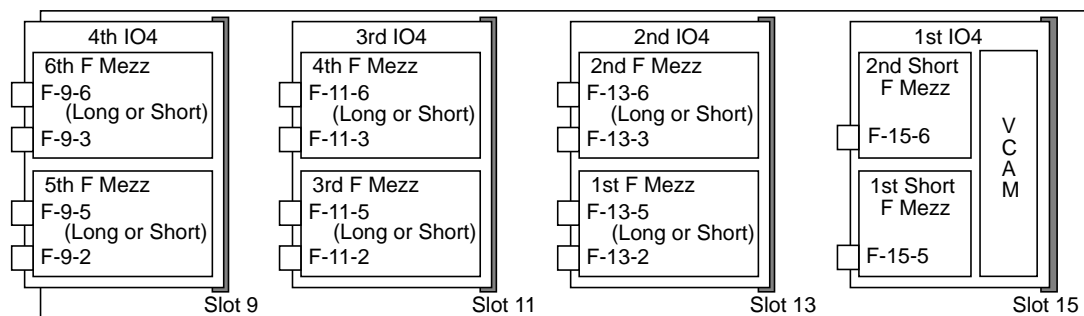


Figure 3-57 I/O Adapter Labelling

Challenge Server System Cardcage 2



Onyx Graphics System Cardcage 2

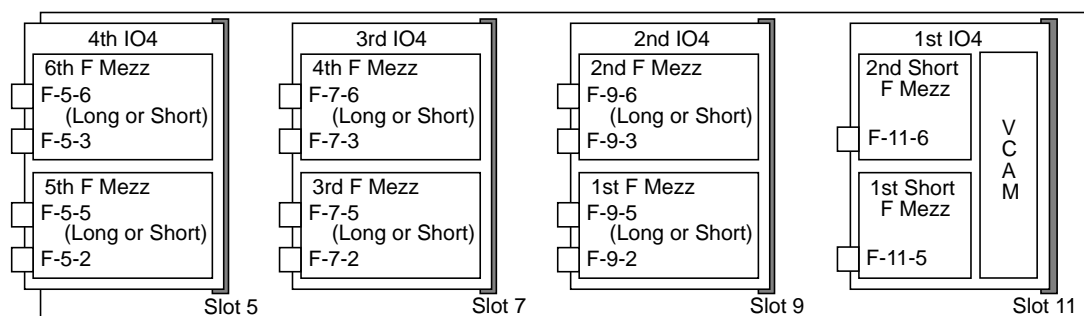


Figure 3-58 I/O Adapter Labelling

Note: Figure 3-55 shows every possible position of an F Mezz board filled. It is highly unlikely that any rack system would be configured in this manner. It is likely that the system would have SCSI expansion Mezz boards or other Mezz board options installed on some of the IO4 mezzanine locations.

3.11.5.2 Onyx Graphics System Configuration

Install, cable, and configure the system boards as follows:

Note: Graphics machines with a Cardcage 3 upgrade require an additional, dedicated IO4 board with either one or two long F Mezz boards mounted on it.

1. Mount the F Mezz cards to the IO4 board that came as part of the Cardcage 3 upgrade. Use the standoffs and mounting hardware provided.
2. If the IO4 board that came as part of the Cardcage 3 upgrade will be the second IO4 in the system, install it in Slot 9. If it will be the third IO4, install it in Slot 7. And if it will be the fourth IO4 board, install it in Slot 5.
3. In configurations where a single graphics pipe (board set) will occupy Cardcage 3, install the Remote VCAM board in Slot 1. If the configuration calls for a second graphics pipe in Cardcage 3, install the second Remote VCAM in Slot 12.
4. Systems with a single graphics pipe in Cardcage 3 are cabled as shown in Figure 3-56. Systems with two graphics pipes are cabled as shown in Figure 3-57.

- Attach the ribbon cables to the IO4 board connectors as shown. Route each cable from CC2 down through the cable ports immediately behind the main I/O panel. Attach the remaining end of each cable to the corresponding connector on the Remote VCAM.

Note: All cables are the 60-pin micro-strip cable (P/N 9290049). These cables are silver mylar and are split into separate ribbons at the connectors.

The I/O adapter labeling for each FCI connector changes with the location of the F Mezz cards. Ensure that F Mezz cards installed in the locations shown in the following figures are cabled exactly as illustrated.

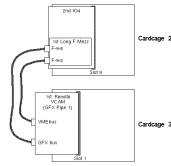


Figure 3-59 Cabling for a Single Graphics Pipe in Cardcage 3

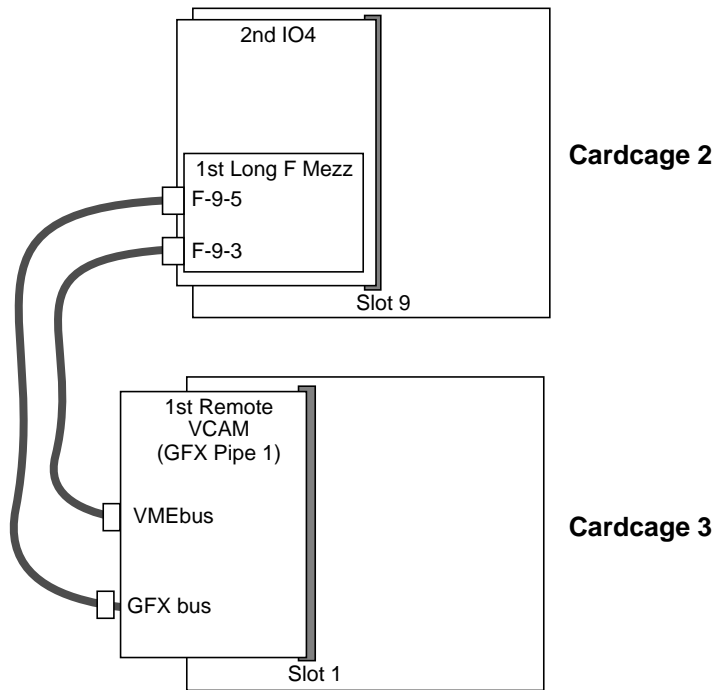


Figure 3-60 Cabling for a Single Additional Graphics Pipe in Cardcage 3

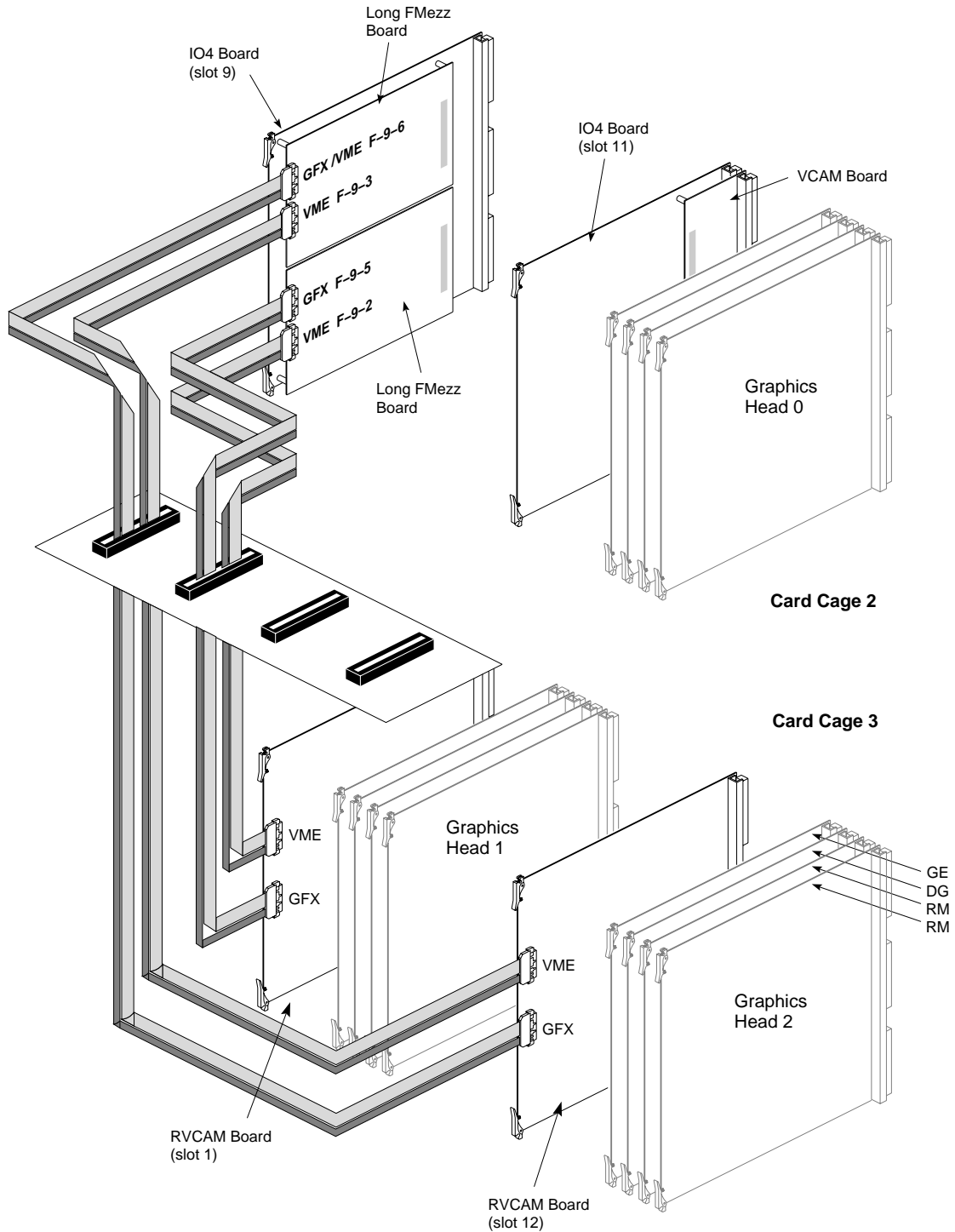


Figure 3-61 Cabling for Two Additional Graphics Pipes in an Onyx Cardcage 3

Note: No jumper or terminator boards are installed on a Cardcage 3 graphics backplane. There are no optional configurations other than using either or both of the pipes provided

6. Install one 512 power board and five 505 Power boards as shown in Figure 3-58.

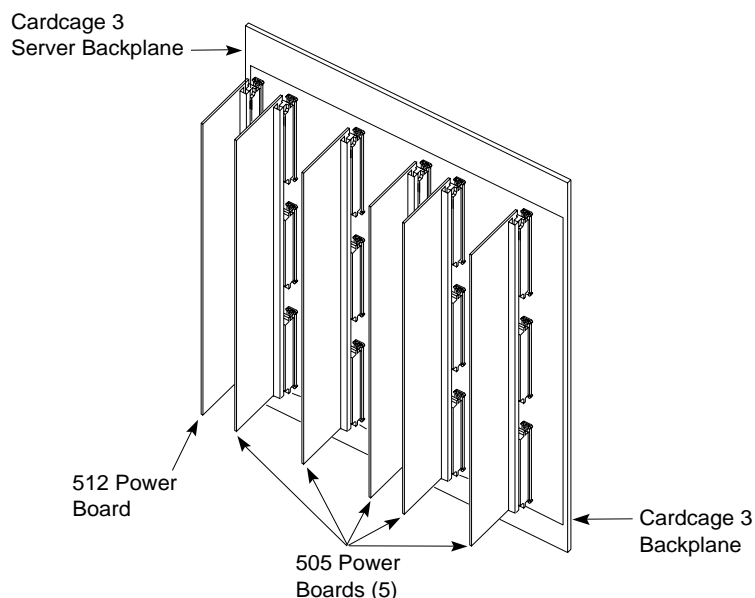


Figure 3-62 Cardcage 3 Power Board Installation

[SGIVIDEO: cc3powerboards.mv](#)

[Installing Power Boards on the Cardcage 3 Backplane](#)

[The video clip above illustrates how to install power boards on the Cardcage 3 backplane.](#)

7. Reinstall the access panel isolating the Cardcage 3 backplane from the SCSIBox(es).
8. Reinstall and cable the SCSIBox(es).
9. Install the SCSI cable access port cover and inside blanking cover (if present).
10. Reinstall the side panels.
11. Attach the hinge of the new I/O option door to the system chassis.
12. Install the graphics board set(s) as indicated by the labels on the card guide.
13. Close the Cardcage 3 I/O option door, then close the chassis rear door.
14. Connect the AC power cord to the supply voltage and power up the system as described in Section 3.8, "Bringing the System Up and Down." Then, continue with Section 3.12, "Software Configuration."

3.11.5.3 Challenge Server System Configuration

The Cardcage 3 upgrade for servers provides up to four additional VMEbuses. This upgrade can require an additional IO4 board, and Short and/or Long F Mezz cards, depending on the number of VMEbuses desired.

Note: The Cardcage 3 upgrade in Challenge XL systems requires a PROM upgrade to the System Controller board. See Section 3.13, “Upgrading the PROM on the System Controller Board,”.

The placement of the F Mezz cards in Cardcage 2, and whether additional IO4 boards are required, is determined in part by the configuration of the installed IO4 board and by the type of F Mezz card shipped with the upgrade. The cardcage configuration is then determined by the installation of jumper and/or terminator boards on the rear of the backplane.

Note: Each remote VCAM is only capable of supplying a maximum of 1 amp in the $-12V$ and $-5V$ range. This may limit or restrict the number and/or type of VME boards installed in each Cardcage 3 VMEbus bank. The installer should pay special attention to this fact when installing a single remote VCAM supporting multiple banks of VME boards.

The following subsections provide examples of some of the many possible configurations.

One Cardcage 3 VMEbus

1. Open the rear chassis access door and the Cardcage 2 I/O panel. Check the configuration of the IO4/VCAM board assembly in Slot 15 of Cardcage 2. If an open Mezz card slot is available, withdraw the IO4/VCAM from the cardcage and mount the Short F Mezz card using the standoffs and mounting hardware provided.

Note: If the installed IO4 board’s Mezz card slots are occupied, or if you are installing a Long F Mezz card, mount the card on a second IO4 board. Install the second IO4/F Mezz assembly in Slot 13.

2. Install the Remote VCAM board in Slot 1 of Cardcage 3.
3. Attach the silver mylar ribbon cable to the IO4 board connector as shown in Figure 3-59 or Figure 3-60 (depending on the type of F Mezz card installed). Route the cable from CC2 down through the cable port immediately behind the main I/O panel. Attach the remaining end of the cable to the upper connector on the Remote VCAM board.

Note: The bottom connector on the Remote VCAM board is dedicated to the graphics bus and must never be used in a Cardcage 3 configured for one or more VMEbuses.

Note: All cables are the 60-pin micro-strip cable (P/N 9290049). These cables are silver mylar and are split into separate ribbons at the connectors.

The I/O adapter labelling for each FCI connector changes with the location of the F Mezz cards. Ensure that F Mezz cards installed in the locations shown in the following figures are cabled exactly as illustrated.

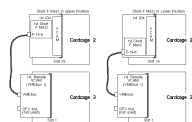


Figure 3-63 Cabling for One Cardcage 3 VMEbus with a Single Short F Mezz Card

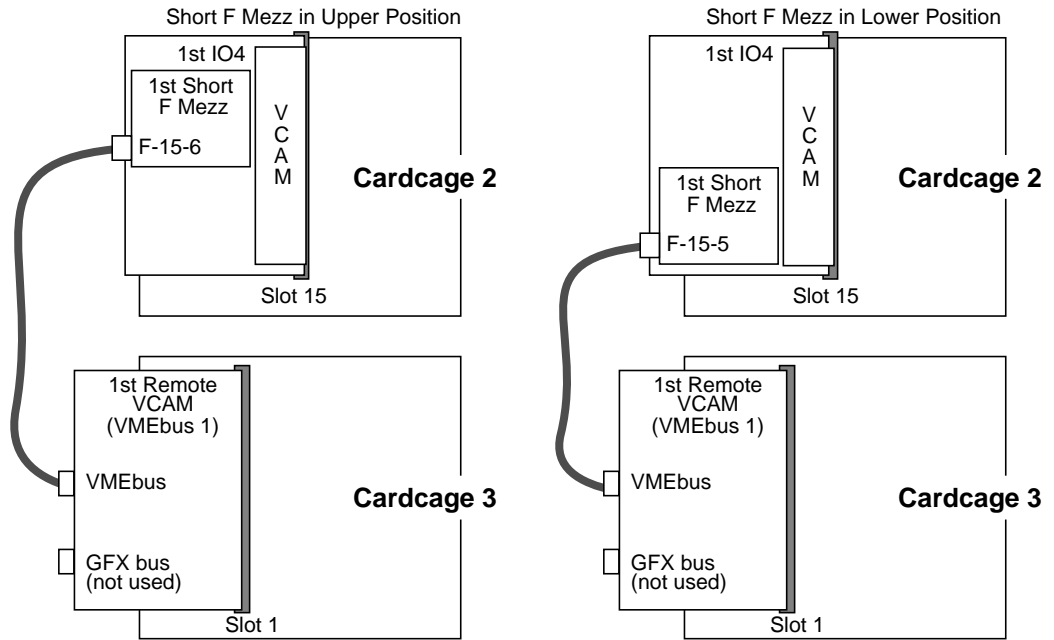


Figure 3-64 Cabling for One Cardcage 3 VMEbus with a Single Short F Mezz Card

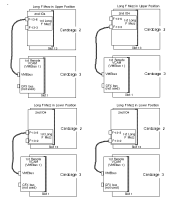


Figure 3-65 Cabling for One Cardcage 3 VMEbus with a Single Long F Mezz Board

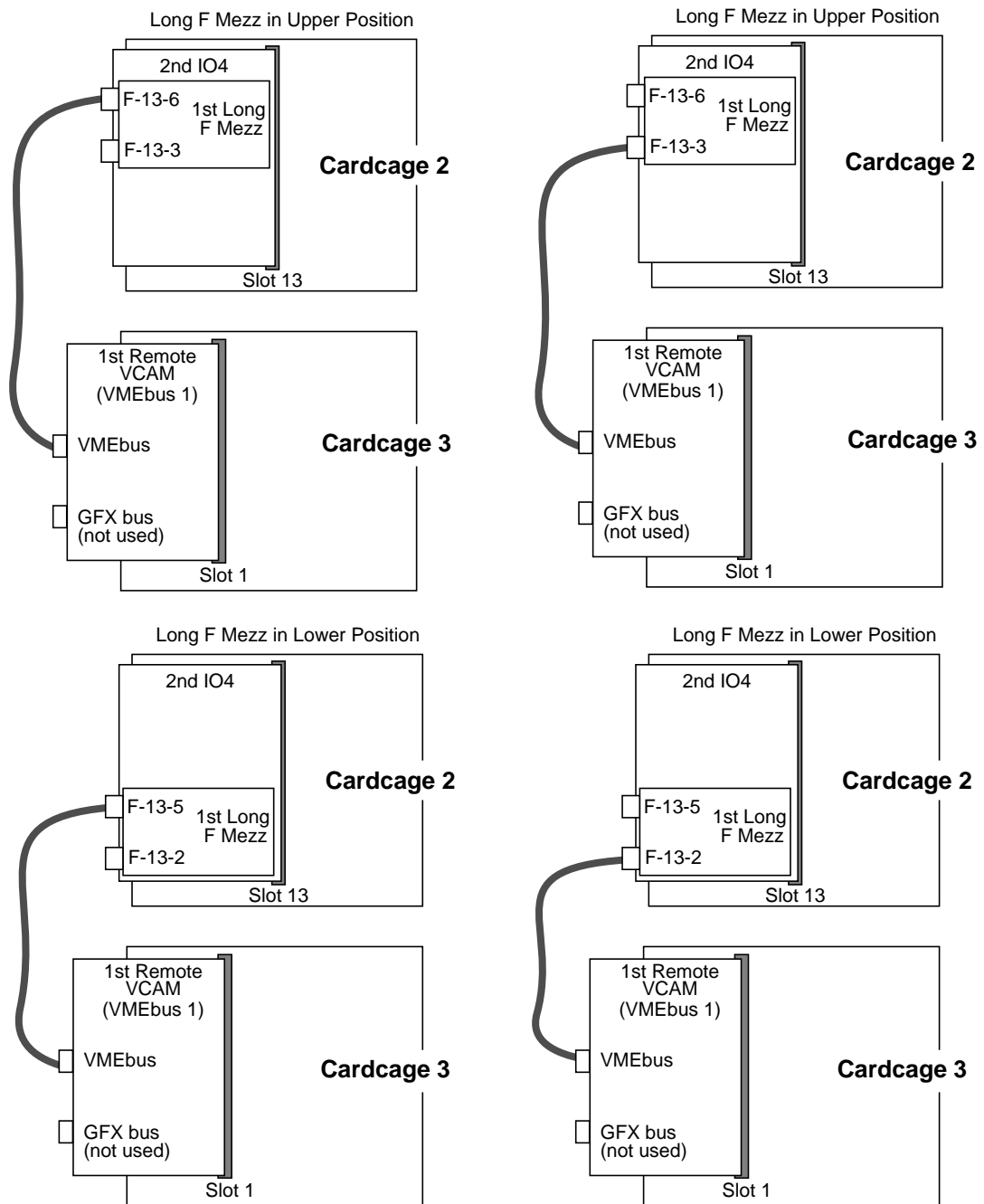


Figure 3-66 Cabling for One Cardcage 3 VMEbus with a Single Long F Mezz Board

4. Working from the front of the chassis, connect the four separate VMEbuses by installing jumper boards in the locations called out in Figure 3-61. Install a single terminator board as shown.

Note: There are three separate types of jumper board: J1, J2, and J3. Each jumper board must be inserted into its corresponding connector on the backplane.

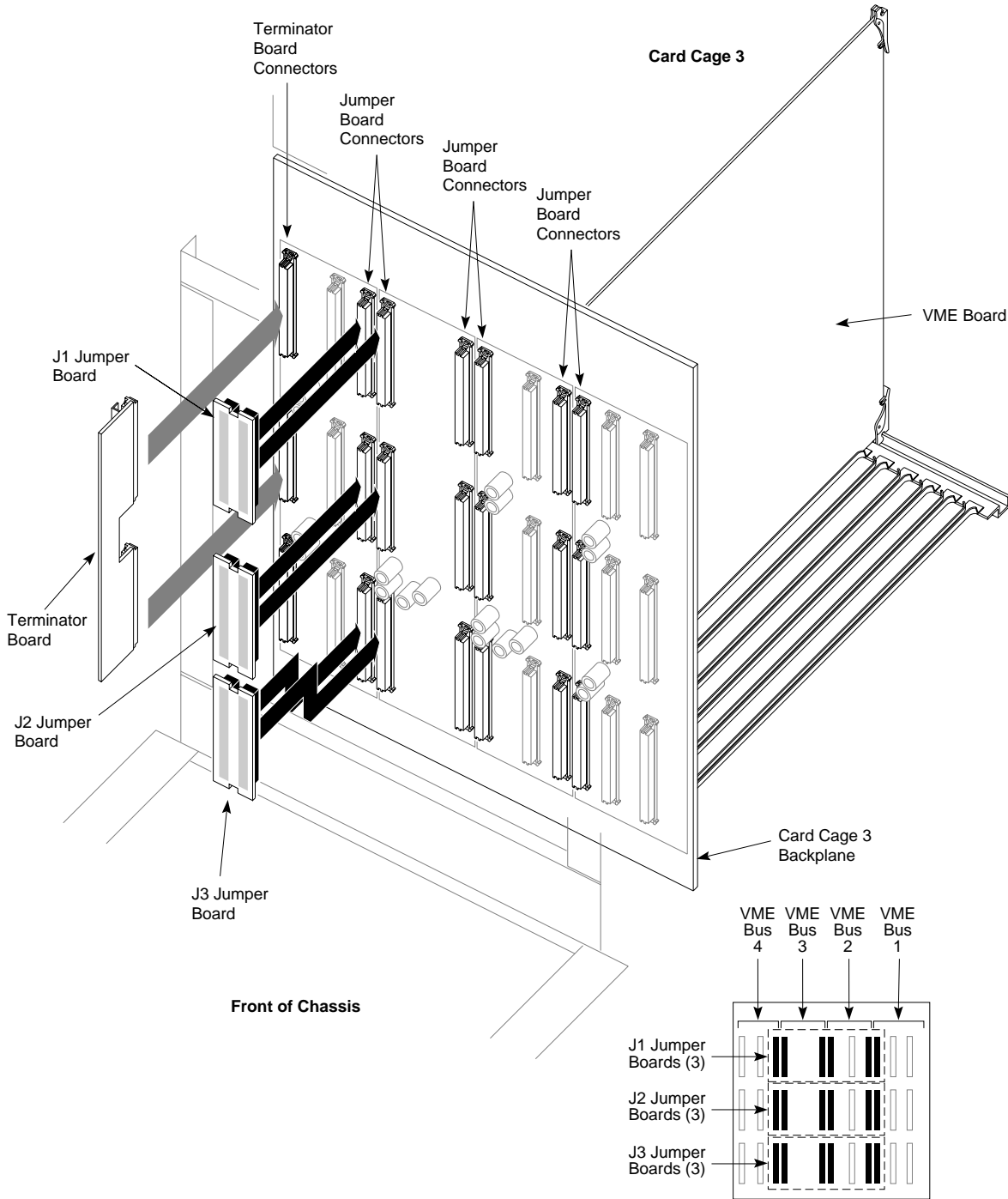


Figure 3-67 Jumper Board Configuration for One VMEbus

5. Install one 512 Power board and three 505 Power boards in the locations shown in Figure 3-62.

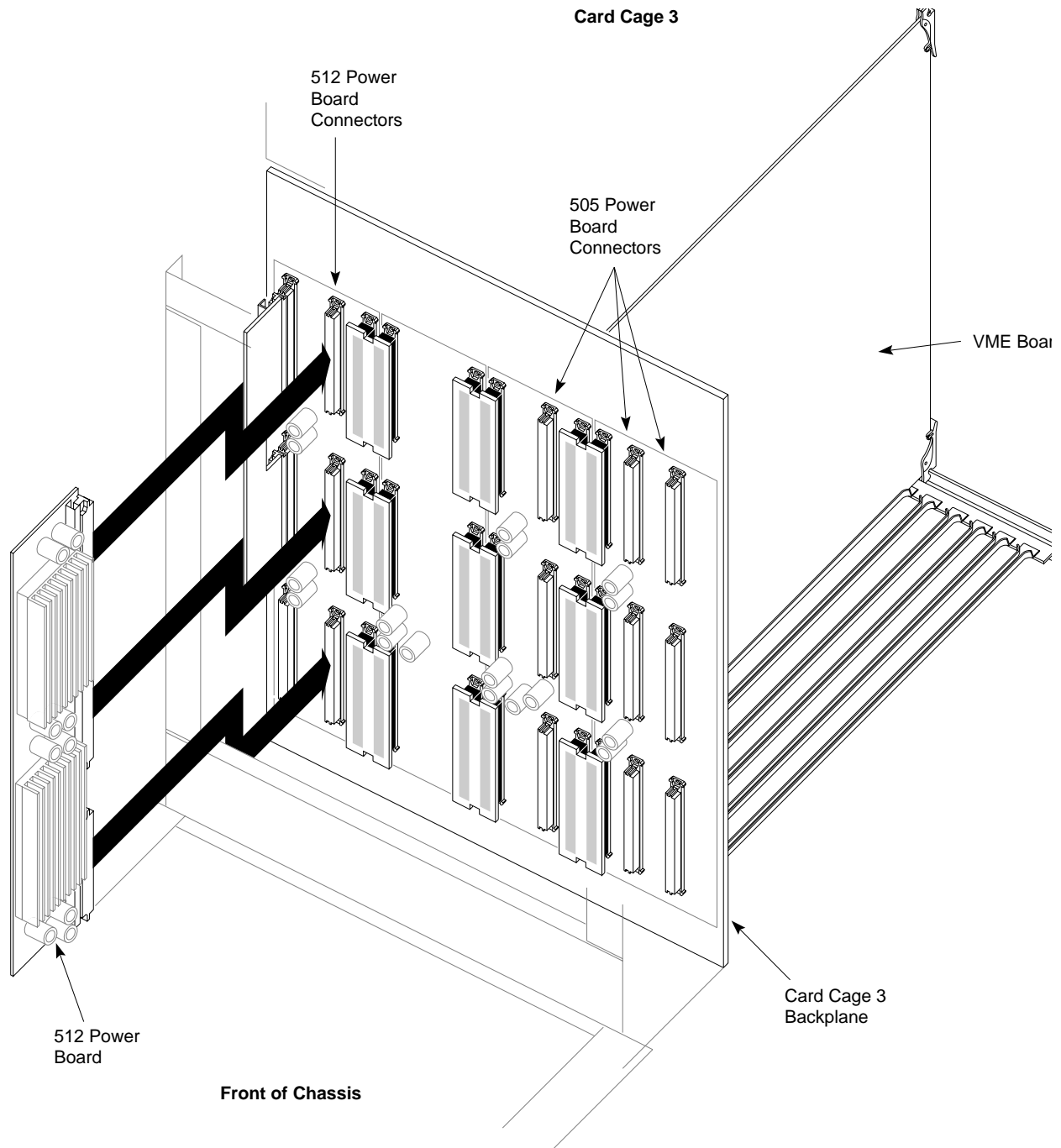


Figure 3-68 Power Board Installation

SGIVIDEO: [cc3powerboards.mv](https://www.youtube.com/watch?v=cc3powerboards.mv)

[Installing Power Boards on the Cardcage 3 Backplane](#)

The video clip above illustrates how to install power boards on the Cardcage 3 backplane.

6. Reinstall the access panel isolating the Cardcage 3 backplane from the SCSIBox(es).
7. Reinstall and cable the SCSIBox(es).
8. Install the SCSI cable access port cover and inside blanking cover (if present).
9. Reinstall the side panels.
10. Attach the hinge of the new I/O option door to the system chassis.
11. Install the VMEbus boards as indicated by the labels on the card guide.

Note: The cardcage slots labeled “Remote VCAM VME” can be used for standard VMEbus boards.

If there are any empty card slots between boards, an interrupt board (P/N 030-0516-00x) must be installed in connector P1 (top) of that board slot.

12. Close the Cardcage 3 I/O option door, then close the chassis rear door.
13. Connect the AC power cord to the supply voltage and power up the system as described in Section 3.8, “Bringing the System Up and Down.” Then, continue with Section 3.12, “Software Configuration.”

Two Cardcage 3 VMEbuses

1. Open the rear chassis access door and the Cardcage 2 I/O panel. Check the configuration of the IO4/VCAM board assembly in Slot 15 of Cardcage 2. If one or two open Mezz card slots are available, withdraw the IO4/VCAM from the cardcage and mount one or both of the Short F Mezz cards using the standoffs and mounting hardware provided.

Note: If the installed IO4 board’s Mezz card slots are occupied, or if the upgrade was shipped with Long F Mezz cards, the cards must be mounted on a second IO4 board. Install the second IO4/F Mezz assembly in Slot 13.

2. Install the first Remote VCAM board in Slot 1 of Cardcage 3.
3. Install the second Remote VCAM board in Slot 12 of Cardcage 3.
4. Attach a silver mylar ribbon cable to each of the two IO4 board connectors as shown in Figure 3-63 or Figure 3-64. Route the cables from CC2 down through the cable ports immediately behind the main I/O panel. Attach the remaining end of the cables to the upper connector on each of the Remote VCAM boards.

Note: The bottom connector on the Remote VCAM board is dedicated to the graphics bus and must never be used in a Cardcage 3 configured for one or more VMEbuses.

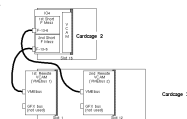


Figure 3-69 Cabling for Two Cardcage 3 VMEbuses with Two Short F Mezz Cards

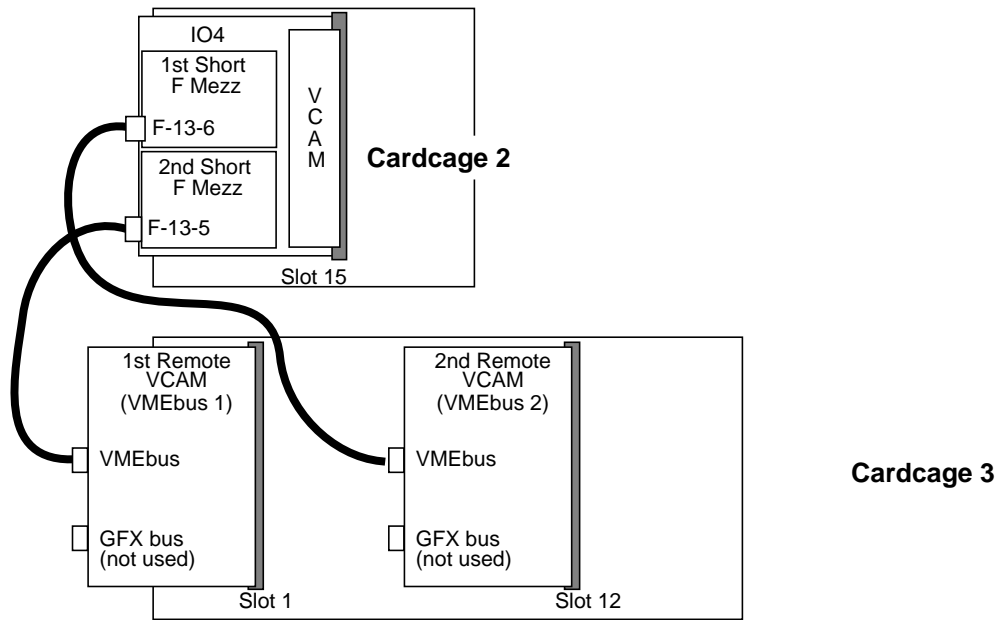


Figure 3-70 Cabling for Two Cardcage 3 VMEbuses with Two Short F Mezz Cards

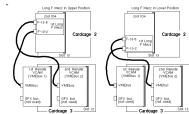


Figure 3-71 Cabling for Two Cardcage 3 VMEbuses with a Single Long F Mezz Card

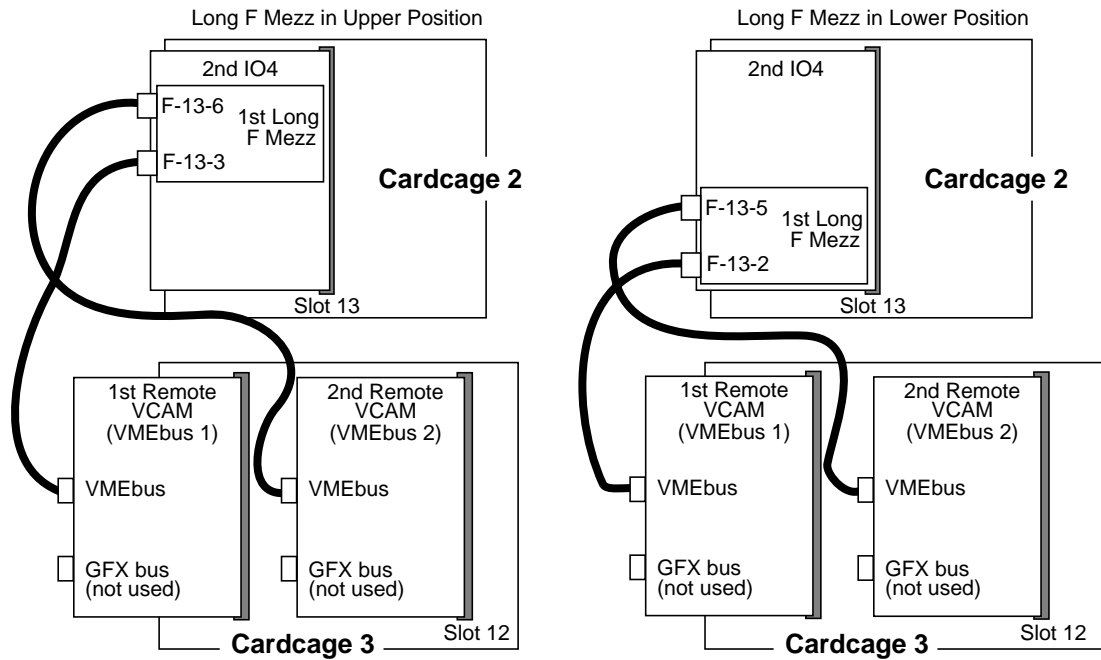


Figure 3-72 Cabling for Two Cardcage 3 VMEbuses with a Single Long F Mezz Card

5. Working from the front of the chassis, connect each pair of VMEbuses by installing jumper boards in the locations designated in Figure 3-65. Install the two terminator boards as shown.

Note: There are three separate types of jumper board: J1, J2, and J3. Each jumper board must be inserted into its corresponding connector on the backplane.

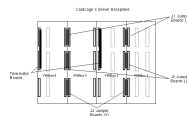


Figure 3-73 Jumper Board Configuration for Two VMEbuses

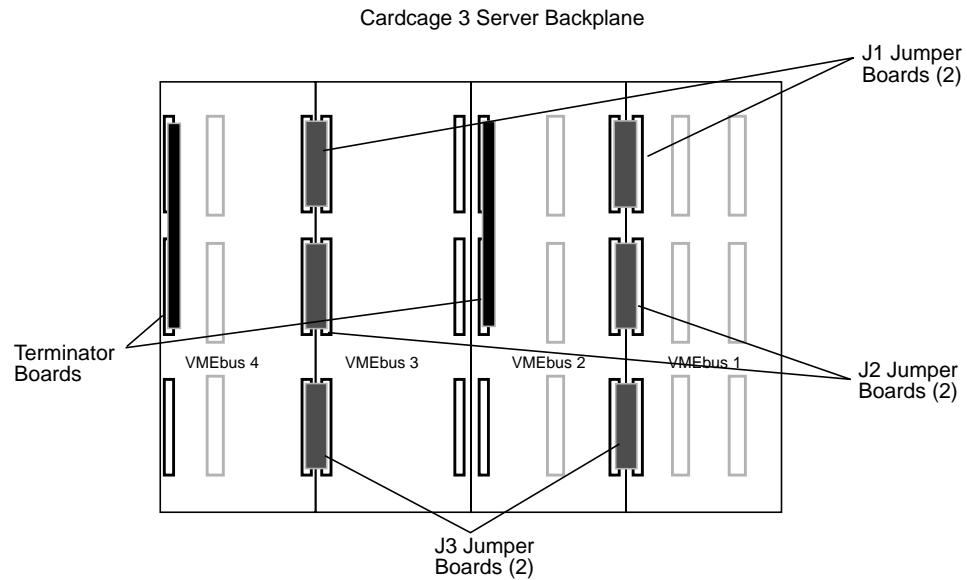


Figure 3-74 Jumper Board Configuration for Two VMEbuses

6. Install one 512 power board and three 505 power boards (refer to Figure 3-58).
7. Reinstall the access panel isolating the Cardcage 3 backplane from the SCSIBox(es).
8. Reinstall and cable the SCSIBox(es).
9. Install the SCSI access port cover and inside blanking cover (if present).
10. Reinstall the side panels.
11. Attach the hinge of the new I/O option door to the system chassis.
12. Install the VMEbus boards as indicated by the labels on the card guide.

Note: The cardcage slots labeled “Remote VCAM VME” can be used for standard VMEbus boards.

If there are any empty card slots between boards, an interrupt board (P/N 030-0516-00x) must be installed in connector P1 (top) of that board slot.

13. Close the Cardcage 3 I/O option door, followed by the chassis rear door.
14. Connect the AC power cord to the supply voltage and power up the system as described in Section 3.8, “Bringing the System Up and Down.” Then, continue with Section 3.12, “Software Configuration.”

Three Cardcage 3 VMEbuses

1. Open the rear chassis access door and the Cardcage 2 I/O panel. Check the configuration of the IO4/VCAM board assembly in Slot 15 of Cardcage 2. If one or two open Mezz card slots are available, withdraw the IO4/VCAM from the cardcage and mount one or two Short F Mezz cards using the standoffs and mounting hardware provided.

If the installed IO4 board's Mezz card slots are occupied, or if the upgrade was shipped with Long F Mezz cards, the F Mezz cards must be mounted on a second IO4 board. Install the second IO4/F Mezz assembly in Slot 13.

2. Install the first Remote VCAM board in Slot 1 of Cardcage 3.
3. Install the second Remote VCAM board in Slot 7 of Cardcage 3.
4. Install the third Remote VCAM board in Slot 12 of Cardcage 3.
5. Attach a silver mylar ribbon cable to each of the IO4 board connectors as shown in Figure 3-66 and Figure 3-67. Route the cables from CC2 down through the cable ports immediately behind the main I/O panel. Attach the remaining end of the cables to the upper connector on each of the Remote VCAM boards.

Note: The bottom connector on the Remote VCAM board is dedicated to the graphics bus and must never be used in a Cardcage 3 configured for one or more VMEbuses.

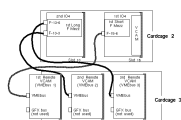


Figure 3-75 Cabling for Three Cardcage 3 VMEbuses with One Short and One Long F Mezz Card

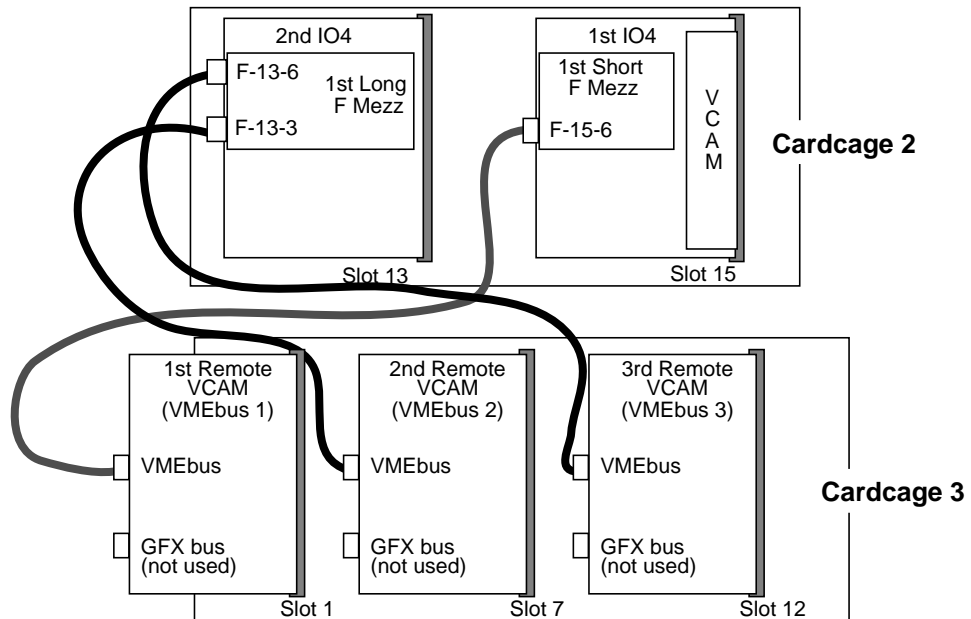


Figure 3-76 Cabling for Three Cardcage 3 VMEbuses with One Short and One Long F Mezz Card

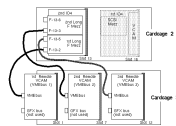


Figure 3-77 Cabling for Three Cardcage 3 VMEbuses with Two Long F Mezz Cards

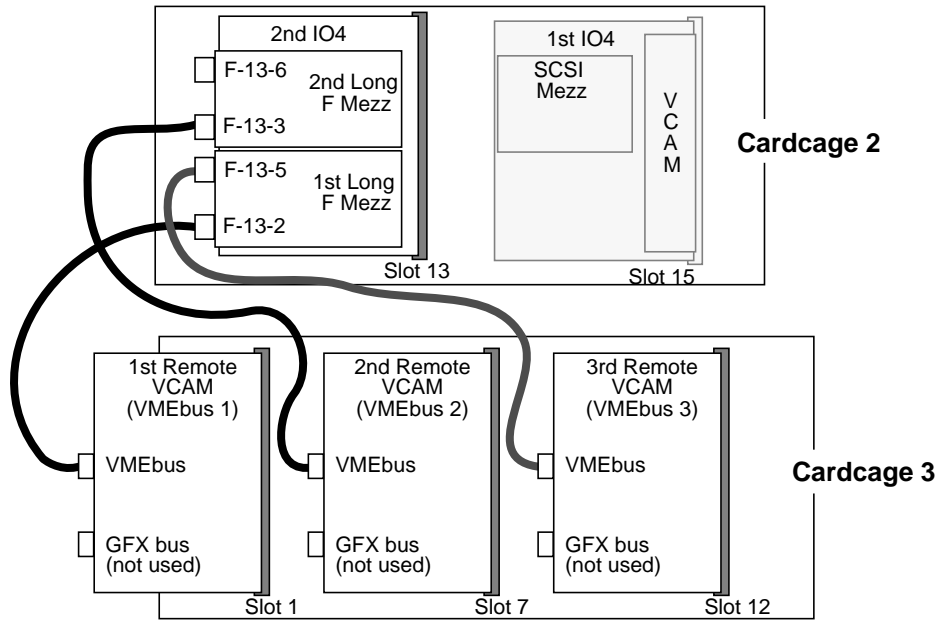


Figure 3-78 Cabling for Three Cardcage 3 VMEbuses with Two Long F Mezz Cards

6. Working from the front of the chassis, configure the Cardcage 3 backplane for three VMEbuses by installing the jumper and terminator boards in the locations called out in Figure 3-68.

Note: There are three separate types of jumper board: J1, J2, and J3. Each jumper board must be inserted into its corresponding connector on the backplane.

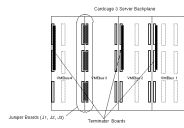


Figure 3-79 Jumper Board Configuration for Three VMEbuses

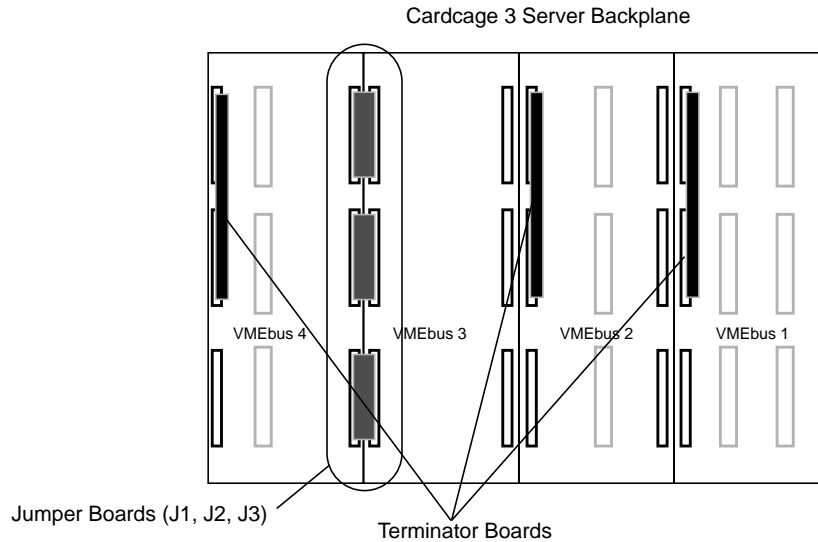


Figure 3-80 Jumper Board Configuration for Three VMEbuses

7. Install one 512 power board and three 505 power boards (refer to Figure 3-58).
8. Reinstall the access panel isolating the Cardcage 3 backplane from the SCSIBox(es).
9. Reinstall and cable the SCSIBox(es).
10. Install the SCSI access port cover and inside blanking cover (if present).
11. Reinstall the side panels.
12. Attach the hinge of the new I/O option door to the system chassis.
13. Install the VMEbus boards as indicated by the labels on the card guide.

Note: The cardcage slots labeled “Remote VCAM VME” can be used for standard VMEbus boards.

If there are any empty card slots between boards, an interrupt board (P/N 030-0516-00x) must be installed in connector P1 (top) of that board slot.

14. Close the Cardcage 3 I/O option door, then close the chassis rear door.
15. Connect the AC power cord to the supply voltage and power up the system as described in Section 3.8, “Bringing the System Up and Down.” Then, continue with Section 3.12, “Software Configuration.”

Four Cardcage 3 VMEbuses

1. Open the rear chassis access door and the Cardcage 2 I/O panel. Check the configuration of the IO4/VCAM board assembly in Slot 15 of Cardcage 2. If one or two open Mezz card slots are available, withdraw the IO4/VCAM from the cardcage and mount one or two Short F Mezz cards using the standoffs and mounting hardware provided.

If the installed IO4 board’s Mezz card slots are occupied, or if the upgrade was shipped with Long F Mezz cards, the F Mezz cards must be mounted on a second IO4 board. Install the second IO4/F Mezz assembly in Slot 13.

2. Install the first Remote VCAM board in Slot 1 of Cardcage 3.
3. Install the second Remote VCAM board in Slot 7 of Cardcage 3.
4. Install the third Remote VCAM board in Slot 12 of Cardcage 3.
5. Install the fourth Remote VCAM board in Slot 17 of Cardcage 3.
6. Attach a silver mylar ribbon cable to each of the IO4 board connectors as shown in Figure 3-69 and Figure 3-70. Route the cables from CC2 down through the cable ports immediately behind the main I/O panel. Attach the remaining end of the cables to the upper connector on each of the Remote VCAM boards.

Note: The bottom connector on the Remote VCAM board is dedicated to the graphics bus and must never be used in a Cardcage 3 configured for one or more VMEbuses.

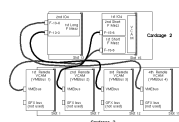


Figure 3-81 Cabling for Four Cardcage 3 VMEbuses with One Long and Two Short F Mezz Cards

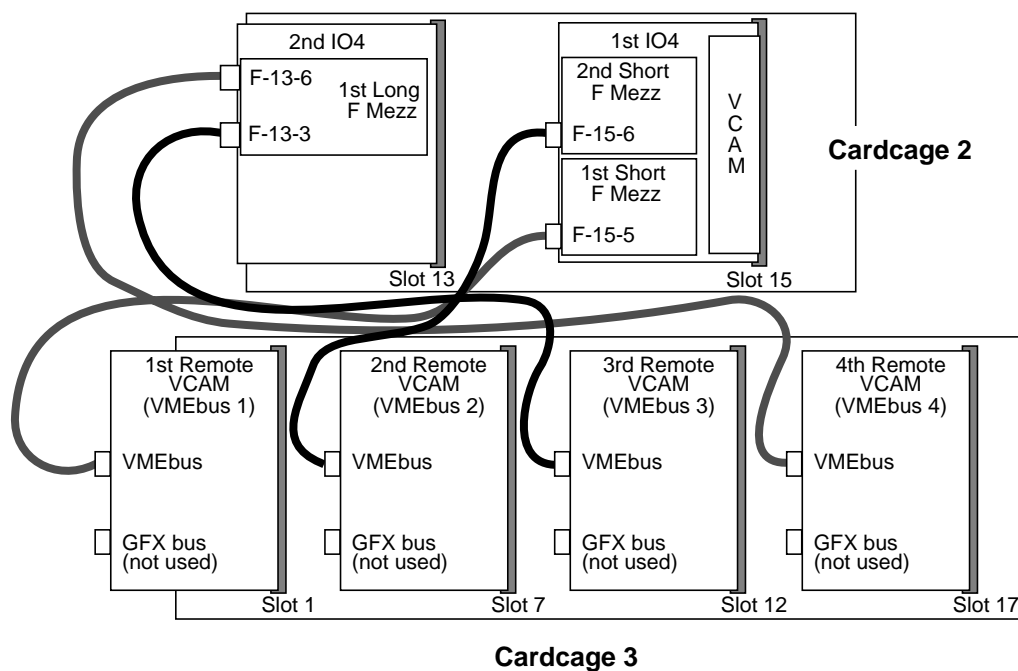


Figure 3-82 Cabling for Four Cardcage 3 VMEbuses with One Long and Two Short F Mezz Cards

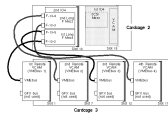


Figure 3-83 Cabling for Four Cardcage 3 VMEbuses with Two Long F Mezz Cards

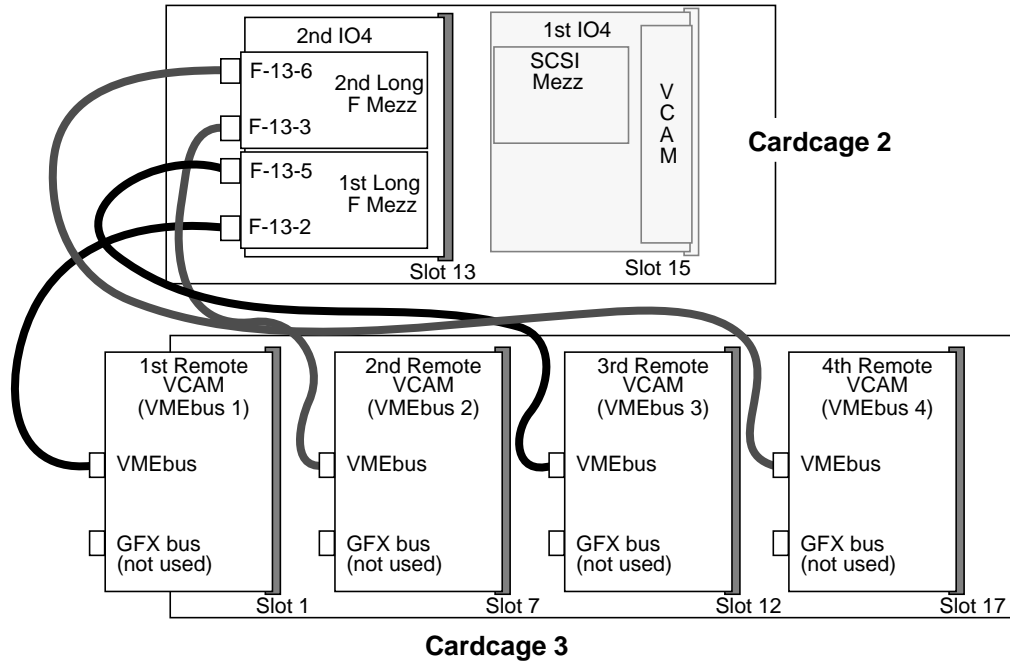


Figure 3-84 Cabling for Four Cardcage 3 VMEbuses with Two Long F Mezz Cards

7. Working from the front of the chassis, configure the Cardcage 3 backplane for four VMEbuses by installing the terminator boards in the locations called out in Figure 3-71.

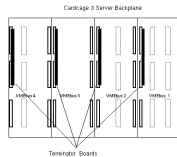


Figure 3-85 Terminator Board Configuration for Four VMEbuses

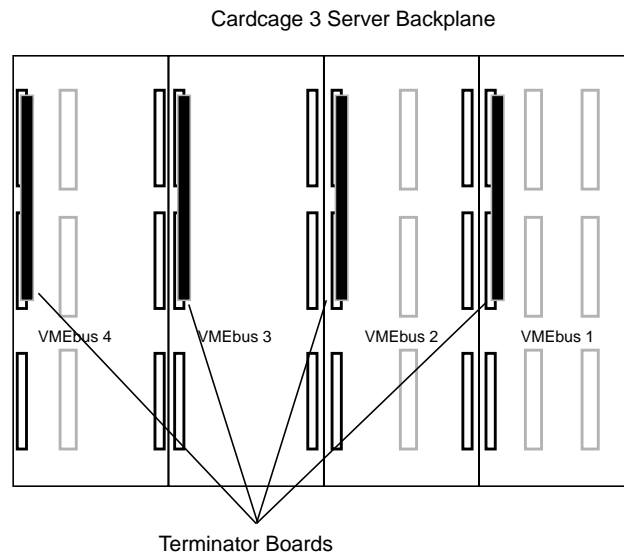


Figure 3-86 Terminator Board Configuration for Four VMEbuses

8. Install one 512 power board and three 505 power boards (refer to Figure 3-58).
9. Reinstall the access panel isolating the Cardcage 3 backplane from the SCSIBox(es).
10. Reinstall and cable the SCSIBox(es).
11. Install the SCSI access port cover and inside blanking cover (if present).
12. Reinstall the side panels.
13. Attach the hinge of the new I/O option door to the system chassis.
14. Install the VMEbus boards as indicated by the labels on the card guide.

Note: The cardcage slots labeled “Remote VCAM VME” can be used for standard VMEbus boards.

If there are any empty card slots between boards, an interrupt board (P/N 030-0516-00x) must be installed in connector P1 (top) of that board slot.

15. Close the Cardcage 3 I/O option door, followed by the chassis rear door.
16. Connect the AC power cord to the supply voltage and power up the system as described in Section 3.8, “Bringing the System Up and Down.” Then, continue with Section 3.12, “Software Configuration.”

3.12 Software Configuration

After installing the Cardcage 3 and other related hardware upgrades, you may need to use some or all of the information in the following three subsections to properly configure the system.

3.12.1 VMEbus Drivers

After setting up the hardware as previously described, modify the `/var/sysgen/system/irix.sm` file as follows:

1. Power up the system and then open up a shell.
2. Become superuser and use an editor (such as `vi`) to open the `/var/sysgen/system/irix.sm` file.
3. Locate the appropriate vector statement in the file. Be sure the board controller number matches the vector line you modify. See the following example:

```
VECTOR: bustype=VME module=jag ipl=1 ctrlr=0 adapter=0 iospace=(A16S,  
0, 0x800)  
probe_space=(A16S, 0, 1)
```

Note: Later in this procedure, you will change the adapter number (i.e., `adapter=0`) to reflect the position of the F Mezz board on the IO4 board. The adapter number, 0, designates the primary bus in the midplane. Changing the adapter number through the following software procedure will enable the configuration that you have just set up through hardware installation.

4. Determine the slot position of the IO4 board that has the targeted F Mezz board mounted on it (see the “IO4 Board Locations and Labelling” section).
5. Determine the adapter position(s) of the F Mezz board that you are using (see the “I/O Adapter Labelling” section).

You can also use the `hinv -v -b` command to determine both the IO4 slot number and the IO4 adapter position of the F Mezz board connector.

6. Translate the adapter position number into its corresponding *virtual* adapter number using Table 3-22. For example, physical adapter 5 translates to position 2 and adapter 6 translates to position 3.

I/O Adapter Number	Translated Adapter Number
2	0
3	1
5	2
6	3

Table 3-22 Translating I/O Adapter Numbers

Note: The software requires this virtual translation to help determine the corresponding VMEbus bank.

7. You can now determine and change the adapter number (i.e., `adapter=0`) in the vector statement by using the following formula and entering the values just derived:

```
adapter number = [IO4 slot# x (multiplied by) 4] + translated  
adapter_position
```

As an example, say you wish to enable a separate VMEbus for VME boards attached through Short F Mezz board connector 6 on an IO4 board in slot 15. According to the formula, you would take the IO4 slot number 15, multiply it by 4, and then add the translated adapter position number 3 to obtain a value of 63.

Afterwards, you must then change the default adapter number, 0 (i.e., `adapter=0`), to a value of 63. This tells the driver where its controller can be found.

8. If applicable, remove the * (asterisk) from the desired vector line and edit the statement with the new adapter number value.
9. If you wish to add another VME device or enable another VMEbus, edit the next vector line with the desired adapter number.

Note: If you are adding a third-party board that has not been acquired through Silicon Graphics, you may have to select a different IO space address range value in the vector statement. Check the third-party board documentation and compare the range against the preset ranges.

10. Halt the system and then reboot. During boot-up, you should see a message similar to the following:

```
... automatically reconfiguring the system...
```

Note: If you do not see this message, this indicates that either the hardware was not properly configured or that the software file was not properly modified. Recheck the hardware and software configuration.

11. Halt and reboot the system again to fully enable all drivers and the system kernel.
12. Run the `hinv` command to verify that the additional boards are recognized by the operating system.

3.12.2 SCSI Expansion and Software Configuration

SCSI buses are added to the Challenge/Onyx system by adding additional IO4 boards or adding SCSI mezzanine boards to existing IO4s.

SCSI bus connector and cable labeling is done to provide physical identification of the buses. Label syntax is:

- DF SCSI *SSn* (for differential buses)
- SE SCSI *SSn* (for single-ended buses)

SS is the EBus slot number of the IO4 where the cable originates and *n* is the relative bus number on the IO4. In the directory */dev* are the names for each SCSI bus that are derived from the *SSn* label using the syntax:

```
/dev/{r}dsk/dksSSndDsP
```

SSn is the same as the cable/connector label. *dDsP* reports the drive D and slice/partition P.

Note: The first IO4 in a system has a simplified */dev* identifier and the *SS* slot designator is not required. SCSI buses on additional IO4s in the system must use the *SS* slot designator.

Reconfiguration of the kernel is not required for SCSI expansion. Challenge/Onyx SCSI devices always use the naming scheme where the device name requires specifying the originating IO4 board's slot number.

After the new configuration information has been input, type the following commands to the shell:

```
% su
# cd /dev
# ./MAKEDEV dks
```

3.12.3 Software Configuration of I/O Ports on Additional IO4s

Each IO4 has built-in Ethernet, serial, and parallel ports. These devices are configured in IRIX by modifying vector statements in */var/sysgen/system/irix.sm*. The vector statements are located in the file under the subheading of "bustype=EPC".

Note that the parallel port does not require the same configuration as serial and Ethernet ports. It uses a physical naming scheme where the name of the device requires specifying the slot number in which the IO4 resides.

The serial and Ethernet ports on IO4s require specifying the EBus slot number of the particular IO4 where they originate. For serial ports, there is one vector line per IO4 board with the "unit" field values as shown in Table 3-23:

Location	/dev/ttyXX	Unit=
First IO4	tty?1, tty?2, tty?3, tty?4	0
Second IO4	tty?45, tty?46, tty?47	1
Third IO4	tty?49, tty?50, tty?51	2
Fourth IO4	tty?53, tty?54, tty?55	3

Table 3-23 Serial Port Vector Field Values

The vector line field "slot=" value must be set to the decimal number of the EBus slot in which the IO4 is installed.

Note: The first IO4 board in the system always uses a special "slot" value of 0.

After the new configuration information has been input, you must run */dev/MAKDEV* to create the */dev/tty** entries. Execute this by typing the following commands to the shell:

```
% su
# cd /dev
# ./MAKEDEV ttys
```

For the Ethernet interfaces, there is one vector line per board. Each "unit" field number corresponds to the device name numeric suffix: et0, et1, et2, and et3. As with the serial ports, the vector line field value for "slot=" must be set to the decimal number of the EBus slot the IO4 occupies. As noted previously, the first IO4 board always uses the "slot" value 0.

To create `/dev` entries for added parallel ports, run the `/dev/MAKEDEV` file as follows:

```
% su
# cd /dev
# ./MAKEDEV plp
```

This process will make entries for all the parallel devices seen by the `hinv` command.

3.13 Upgrading the PROM on the System Controller Board

This section describes how to upgrade the PROM on the System Controller board in the Challenge rackmount system. The System Controller board is one of the power boards that plug into the midplane in the rackmount system. This board contains the control logic for the system Status Panel display and also supplies power for the Ebus.

This firmware upgrade corrects the POKA failure that resulted when the Cardcage 3 was added to the Challenge rackmount system. Without a PROM upgrade, the POKA_FAIL condition may lead to system shutdown by the System Controller.

(The PROM upgrade causes the System Controller to wait slightly longer for backplane voltage to rise. With the additional capacitance of the power boards in Cardcage 3, system backplane voltage takes longer to rise to its operating value. Without the PROM upgrade, the System Controller does not wait long enough for the voltage to rise and shuts the system down prematurely with a POKA failure. The difference in time is approximately 100 ms.)

Note: For a complete list of reporting error problems, see the associated software release notes.

This upgrade applies to the following versions of the System Controller board:

- 030-0265-005 and below
- 030-0380-002 and below

Note: Despite the two different part numbers, these boards are interchangeable in the field. The 030-0380-00x board is a slightly improved version of the 030-0265-xxx board.

3.13.1 Removing the System Controller Board

To remove the System Controller board, follow these instructions:

Caution: Use proper electrostatic discharge (ESD) precautions when handling components by using an antistatic surface and wearing a grounding strap.

1. Ensure that the system is backed up; then power down the system.
2. Open the front of the rackmount (XL chassis) system to access the System Controller board.
3. Remove the System Controller board from its slot on the front of the midplane.

4. Place the board on a soft, antistatic surface (such as an antistatic mat or foam padding).

Note: The soft, compliant surface helps absorb the shock to prevent possible IC pin breakage when you install the PROM.

3.13.2 Installing the New PROM

See Figure 3-72 for the location of the PROM on the System Controller board.

Follow these instructions to install the new firmware:

Caution: Use proper electrostatic discharge (ESD) precautions when handling components by using an antistatic surface and wearing a ground strap.

1. Locate the old PROM (see Figure 3-72), then use an IC puller to remove this PROM from its location.
2. Note the orientation of the notch in Figure 3-72, then install the new PROM (P/N 070-1117-005). Be very careful not to bend or break any pins.
3. Attach the deviation authorization label to the System Controller PCB (DA# 799).
4. Install the updated System Controller board into its power board location.

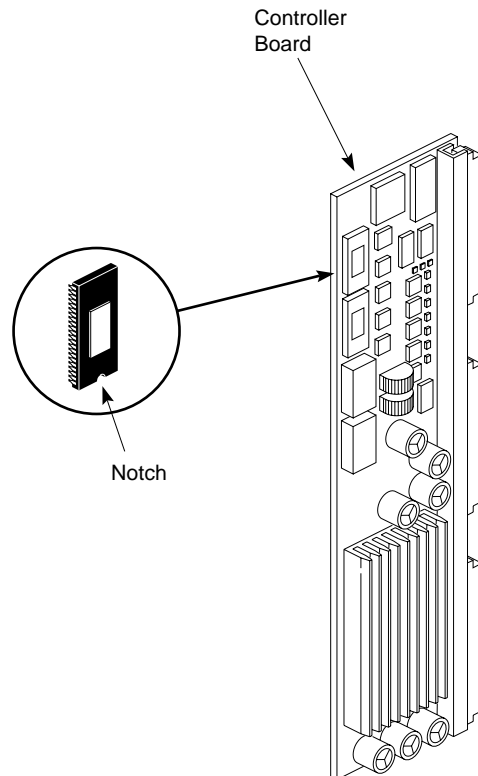


Figure 3-87 System Controller PROM Location

Appendix A

Specifications

Table A-1 and Table A-2 describe the physical characteristics and the environmental specifications for the Everest rackmount systems. Table A-3 and Table A-4 list the specifications for both of the supported monitors. Refer to the *CHALLENGE/Onyx Site Preparation Guide* for additional information, including the power requirements.

Note: Refer to the owner's guide specific to the system (Challenge or Onyx) for additional system specifications. For example, see the *CHALLENGE™ Rackmount Owner's Guide*, p/n 007-1735-xxx for servers and or the *Onyx™ XL Rackmount Owner's Guide*, p/n 007-1736-xxx for graphics systems.

A.1 Physical Characteristics

The physical dimensions of the rackmount chassis are shown in Table A-1.

Dimension	Size
Height	52.3 in. (133 cm)
Width	27.0 in. (68.6 cm)
Depth	48.0 in. (122 cm)
Weight	540-800 lb (245-363 kg), Challenge 560-800 lb (254-363 kg), Onyx
Shipping Weight	Up to 1200 lb (545 kg)

Table A-1 Physical Characteristics

A.2 Environmental Specifications

The environmental requirements are shown in Table A-2.

Temperature	Range
Operating Temperature	15° to 35° C
Nonoperating Temperature	−40° to 60° C (at sea level)
Thermal Output	9600 BtU/hr, maximum
Heat Dissipation	10,900 BtU/hr, chassis
Relative Humidity	20% to 80%, noncondensing

Table A-2 Environmental Requirements

A.3 Monitor Specifications

The specifications for the 21-inch Hitachi and the 19-inch Mitsubishi color monitors are provided in Table A-3 and Table A-4, respectively.

Parameter	Characteristics
CRT Type	21 (20V) inches diagonal, 0.28 mm dot pitch, black matrix, bonded A/R antistatic panel, short persistence
– Input Signal	0.714 Vpp analog
– Video	Separate H,V, or Composite H/V
– Sync	TTL level or Sync on Green at 0.3 Vpp
Resolution	
– Horizontal	Up to 1600 dots
– Vertical	Up to 1200 lines
Video Bandwidth	110 MHz
Horizontal Scan Freq	78 kHz
Vertical Scan Freq	Up to 120 Hz
Active Display Area	Active display area is changed by the graphics board standard.
– Horizontal	370 mm
– Vertical	285 mm

Table A-3 21-inch Hitachi Monitor

Parameter	Characteristics
Misconvergence	Less than 0.3 mm at center, 0.5 mm maximum at corners.
Power Supply	AC 100 to 120/200 to 240 V
Dimensions	488 (W) x 467 (H) x 534 (D) mm (includes tilt and swivel base)
Weight	36 kg (40 kg packed)
Temperature	
- Operating	5° to 40° C
- Nonoperating	-20° to 60° C
Relative Humidity	
- Operating	5 to 95%, noncondensing
- Nonoperating	5 to 95%, noncondensing

Table A-3 21-inch Hitachi Monitor

Parameter	Characteristics
CRT Type	20 (19V) inches diagonal, 0.31 mm dot trio pitch, black matrix, bonded A/R antistatic panel, short persistence
Input Signal	
- Video	0.714 Vpp analog
- Sync	Sync on Green 1.0 Vpp RGB analog
Resolution	
- Horizontal	Up to 1280 dots
- Vertical	Up to 1024 lines
Horizontal Scan Freq	30-78kHz
Vertical Scan Freq	50-130Hz
Active Display Area	Active display area is changed by the graphics board standard.
- Horizontal	343 mm
- Vertical	274 mm
Power Supply	AC 100 to 120/200 to 240V, 50/60Hz, 155W (max)

Table A-4 19-inch Mitsubishi Monitor Specifications

Parameter	Characteristics
Dimensions	495 (W) x 493 (H) x 543 (D) mm (includes tilt and swivel base)
Weight	36 kg (40 kg packed)
Temperature	
- Operating	0° to 40° C
- Nonoperating	-20° to 60° C
Relative Humidity	
- Operating	10% to 95%, noncondensing
- Nonoperating	10% to 95%, noncondensing

Table A-4 19-inch Mitsubishi Monitor Specifications

Appendix B

Drive Maintenance

This appendix describes the preventive maintenance required for systems having 1/4-inch tape drives, 4-mm DAT, and 8-mm tape drives, as well as CD-ROM drives.

B.1 Operating and Maintaining the 4-mm DAT and 8-mm Tape Drives

These are the manufacturers' recommended cleaning schedules:

- Clean the 4-mm DAT drive every 25 hours of use.
- Clean the 8-mm tape drive once every 30 GB of data transferred or after 15 passes.

Note: When the drive heads are dirty and need cleaning, the units may exhibit either read or write errors.

Use only an approved cleaning kit when cleaning the drives. You can use a cleaning kit a limited number of times before you must replace it. For example, you can use the 4-mm drive cleaning kit approximately 60 times; however, you can use the 8-mm drive cleaning cartridge only 12 times. Refer to the information supplied with the cleaning kit to determine the replacement interval. Do not use cleaning kits that are intended for use in audio DAT units, since these cassettes are not recognized by the drives covered in this guide.

B.2 Archive Python 4320 NT (4-mm DAT Drive)

The Archive Python 4320 NT provides 1.3 GBs of storage on a 60-meter Digital Data Storage (DDS) DAT cassette and 2.0 GB of storage on a 90-meter DDS DAT cassette. The 4320 NT drive complies with the American National Standards Institute (ANSI) DDS format and uses a small DAT with 4-mm tape. The data transfer rate is 183 KB per second. Note that these capacity and transfer rate figures are approximate.

B.2.1 Loading and Unloading Cassettes

To load a tape cassette, insert it into the drive and push gently on the middle of the cassette until the tape is fully recessed in the drive unit. Insert the cassette so that the arrow on the top of the cassette enters the drive first.

When you load a cassette into the drive, the unit checks to see if the tape is initialized. This checking process takes between 10 and 20 seconds. If the tape has never been initialized, the drive will initialize it when you first start to write data to the tape. Initializing the tape takes an extra 30 seconds beyond what is required to write the data.

Note: Do not remove the tape from the drive while it is being initialized.

To remove a cassette, press the unload button on the face of the drive. The unit automatically rewinds the tape and ejects it partway. Grasp the cassette and remove it from the drive. Note that the unload button is disabled when the drive is in use.

B.2.2 Cleaning the 4-mm DAT Drive

To clean a 4-mm DAT drive:

1. Insert the cleaning cassette into the drive. The drive automatically detects that the cassette is a cleaning cassette, then loads and runs the cassette. After about 10 to 15 seconds, the cleaning is complete and the drive ejects the cassette.
2. Remove the cleaning cassette from the drive and make a note, either in a log book or on the cassette itself, of the date when you used the cleaning kit.

Note: Every time you use the cleaning cassette, the drive uses a new, unused portion of the tape. Eventually, the entire tape is used and you must obtain a new cleaning cassette. It is, therefore, a good idea to keep track of the number of times you use each cleaning cassette.

B.2.3 Removing a Jammed 4-mm Cassette

To remove a tape that has jammed in a 4-mm tape drive, follow these steps:

1. Power cycle the tape drive and then try ejecting it.
2. If this does not eject the drive, power cycle it while holding down the unload button.

If neither of these two steps ejects the jammed cassette, contact your service provider.

B.2.4 4-mm Drive Front Panel Lights

The 4-mm drive has two LEDs, one green and one amber, that indicate the status of the unit (see Table B-1).

LED	Action	Meaning
Amber	On (lit)	The drive is reading or writing the tape (normal operation).
Amber	Flashing rapidly	A hardware fault occurred, or condensation was detected in the unit (error).
Green	On (lit)	A cassette is loaded in the drive, and it does not generate excess errors (normal operation).
Green	Flashing slowly	A cassette is inserted but is generating excess soft errors beyond a predefined error threshold (warning: heads may need cleaning).
Green	Flashing slowly with amber LED	A prerecorded audio cassette is inserted and is being played automatically.
Green	Flashing rapidly	The drive cannot write the tape correctly (error).

Table B-1 4-mm DAT Drive Front Panel LEDs

B.3 Exabyte 8-mm Tape Drive

The Exabyte[®] 8-mm tape drive provides 2.3 GB of data storage on a standard 8-mm cartridge tape.

B.3.1 Cleaning the 8-mm Tape Drive

Cleaning the tape drive requires use of an Exabyte or Exabyte-approved 8-mm cleaning cartridge.

Caution: Use of cleaning materials not approved by Exabyte can void the tape drive's warranty.

Follow these steps to clean the tape drive:

1. Check to see if an 8-mm tape cartridge is present in the drive. If so, press the unload button and remove the cartridge. Leave the drive's door open.
2. Insert the Exabyte or compatible cleaning cartridge and close the drive. The tape drive will automatically run through the 15-second cleaning cycle. The cleaning tape automatically ejects when the cleaning is complete.

Note: If the cleaning cartridge ejects from the drive before the 15-second cleaning cycle ends, the cartridge has reached end-of-life and should be discarded. Do not rewind the cleaning cartridge or use it for more than its specified number of cleaning cycles.

3. Remove the cleaning cartridge from the drive, record the date on the label, and store it for future use.

B.3.2 Removing a Jammed 8-mm Tape Cartridge

To remove a tape that has jammed in an 8-mm tape drive, follow these steps:

1. Power cycle the tape drive and then try ejecting the tape.
2. If this does not eject the tape, power cycle the drive again while holding down the unload button.

If neither of these two steps ejects the jammed cassette, contact your service provider.

B.3.3 8-mm Drive Front Panel Lights

The 8-mm tape drive has two front panel lights: an amber LED and a green LED. In general, the green LED indicates whether or not the drive is ready to accept commands, and the amber LED indicates that the drive is busy or an error has occurred. Table B-2 lists the LED status and error messages.

Amber LED	Green LED	Meaning and Corrective Action
On	On	Power-on initialization—approximately 60 seconds.
Off	Off	Passed power-on self-tests.
Off	On	Tape is loaded, drive is ready.
Off or On	Slow Flashing	The drive is reading or writing a tape (normal operation).
On, Off, or Flashing	Flashes four times, then stays On	Servo error—press the unload button to reset the drive. If this does not clear the problem, power cycle the drive. If the problem persists, call your service provider.
Slow Flashing	On or Off	A CRC error occurred within the first two seconds of a power-on reset. Power cycle the drive. If the problem persists, the drive needs service.
Slow Flashing	On or Off	An unrecoverable fault has occurred during operation. Press the unload button to reset the drive. If this does not correct the problem, power-cycle the unit and clean the tape heads. If these steps fail, call your service provider.
Fast Flashing	Off	The drive failed a power-on self-test. Try power cycling the drive. If the problem persists, the drive needs service.

Table B-2 8-mm Tape Drive Front Panel LEDs

B.4 CD-ROM Care and Maintenance

CD-ROM drives are most vulnerable to damage when they are unpacked and not yet mounted in a computer system. When handling a drive after unpacking, there are two major types of damage to be aware of:

- rough handling (impact damage)
- electrostatic discharge (ESD)

Dropping an unpacked drive onto a hard surface can cause damage. A sharp jolt can cause the laser to track improperly.

Avoid touching the drive's printed circuit board (PCB). Leave the unit in ESD protective wrap as long as possible. Use a static-conductive mat or antistatic grounding devices when inspecting or handling the drive. Additional handling tips are:

1. Keep the drive in the packing box or antistatic bag until the installation.
2. Handle the drive by its frame; avoid touching the drive's PCB.
3. Install drives in a clean work area.
4. Wear a properly grounded ESD strap when handling the drive.

To remove dust or other particles from a CD, use compressed air. You may also clean the CD in running water and then blot it dry with a soft lintless cloth. Do *not* use a paper towel because the paper fibers and material imbedded in the paper can scratch the CD, and the paper might leave behind paper dust. Wipe the cloth directly outward from the center of the disc (radially). Do not rub in a circular motion as you would with a standard phonograph record. The reason for this difference is that if you accidentally scratch a CD while cleaning it, a radial scratch will probably affect less data per track than a scratch that follows a track; the CD-ROM drive can correct for small, radial scratches.

Note: Do *not* use solvents or other common cleaners, and *do not* use your mouth to blow dust or other particles off the disc.

Individual discs should be handled by the edges only (see Figure B-1). Touching and scratching the bottom of the disc can mar the finish and degrade the optical readability of the medium. Do not write, label, or mark on any surface of the compact disc. An auto-eject occurs when a very dirty or badly scratched disc (or a disc placed in the operating case caddy, label-side down) is inserted.

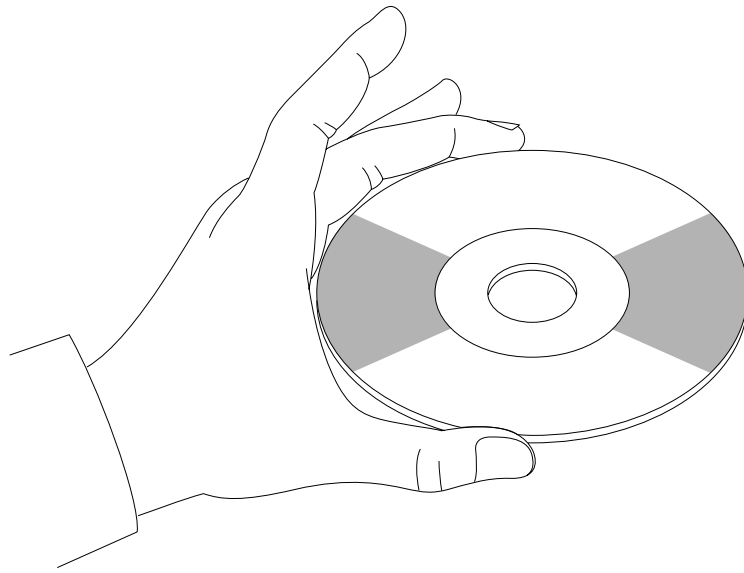


Figure B-1 Handling a Compact Disc

B.4.1 CD-ROM Environmental Considerations

Bringing a disc from a cold to a warm environment may cause moisture to form on its surface. Wipe any condensed moisture off with a soft, lint-free cloth (not a paper towel) before use. Allow approximately one hour for the disc to acclimate to room temperature.

Protect the discs from dust, scratches, and warping by storing them in a caddy or nonfunctional plastic storage container (known as a jewel case). Never leave or store discs in the following areas:

- locations exposed to direct sunlight
- dusty and humid environments
- areas directly exposed to heating appliances or heat outlets
- a vehicle parked in the sun

B.4.2 CD-ROM Front Panel Operational Features

A number of operation controls are located on the front panel of the CD-ROM drive:

- The *headphone jack* accepts a 3.5-mm diameter stereo plug. Monitoring of audio signals is available.
- The *volume control knob* (located to the right of the headphone jack) adjusts the sound level of the headphones.
- An *emergency eject hole* (located just above the volume control) ejects the caddy when the normal procedure does not work. Power off the CD-ROM drive and insert the end of a large, straightened paper clip into the hole until the caddy ejects.

- A *drive busy indicator LED* (located to the left of the eject button) blinks to indicate drive activity. The LED stays dark when no disc caddy is loaded in the drive. See Figure B-2 for details on blink patterns and the status they indicate for the drive.
- The *eject button* works *only* when the CD-ROM drive is powered on. The caddy will not eject if the CD-ROM is in an active (busy) state. After pushing the eject button, two to three seconds will elapse before release occurs.

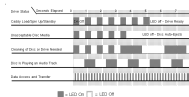


Figure B-2 CD-ROM Drive LED Status Indicators

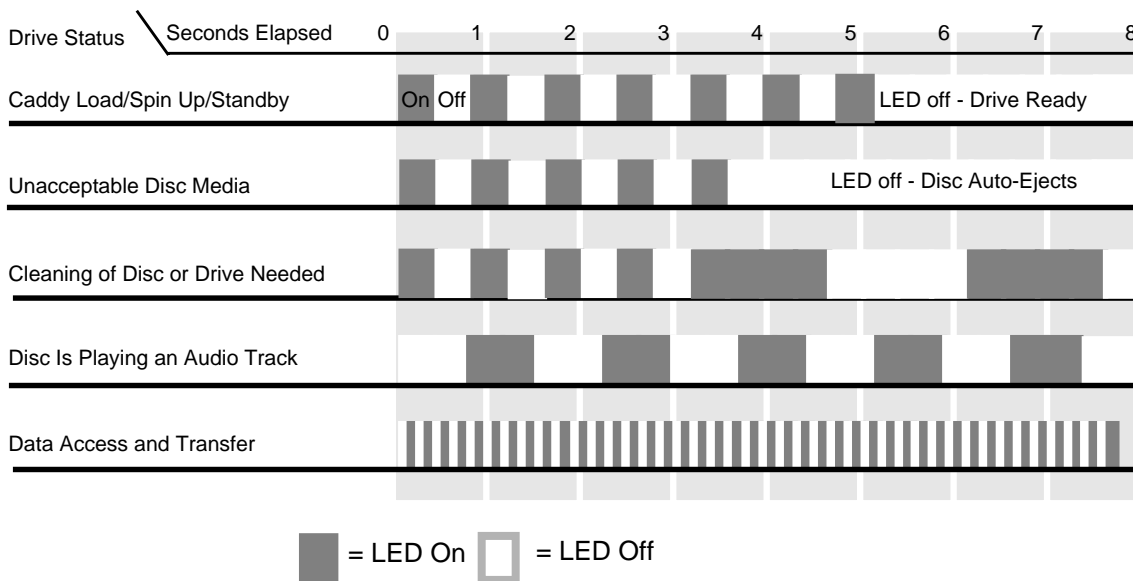


Figure B-3 CD-ROM Drive LED Status Indicators

B.5 150-MB Tape Drive Preventive Maintenance

Head cleaning is the only preventive maintenance required by the 1/4-inch tape drive. The tape head should be cleaned after every eight hours of tape drive operation and after every two hours of operation when new tapes are used exclusively.

Note: Clean the heads every two to eight hours of operation to ensure that the tape drive functions correctly.

Clean the tape head by following these steps:

1. Remove the tape cartridge from the tape drive.
 2. Push the head loading lever to the right, as if you had installed a tape. This will engage the tape head, allowing you to reach it.
 3. Dip a clean, non-fibrous cotton swab in either tape head cleaning fluid or Freon-TF, and wipe the tape head (see Figure B-3).
 4. Use a second, clean swab and wipe the head again to remove any residue.
- Caution:** Use cotton swabs that do not have wooden stems. The tip of the swab can break off and become lodged in the tape drive.

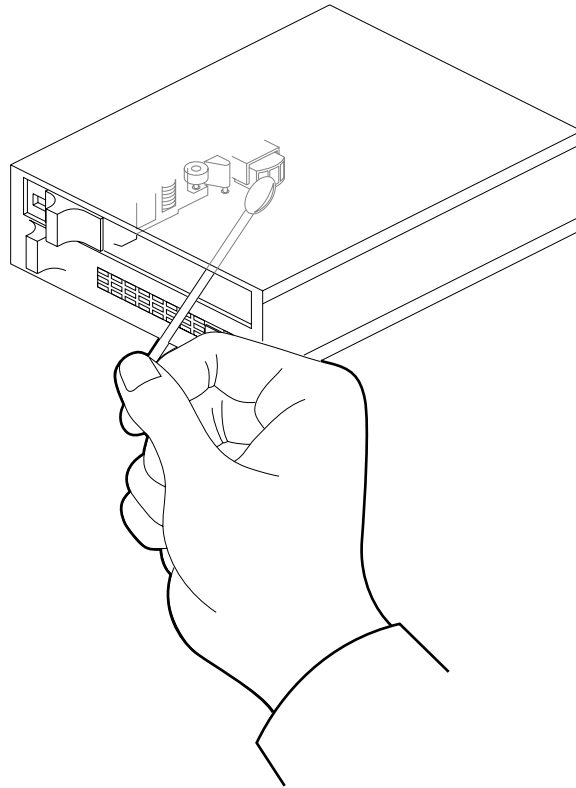


Figure B-4 Tape Head Cleaning

Appendix C

Connectors and Cables

This appendix describes each of the system connectors and shows some of the monitor and keyboard cables that are available. It also describes the system interrupt cable.

C.1 Connectors

Table C-1 through Table C-19 and Figure C-18 show the system connectors and their pin assignments.

Description	Pins	Signals	Flow (from chassis)
Parallel port	1	STB (Data strobe)	
25-pin D-sub receptacle	2	Data 0	
	3	Data 1	
	4	Data 2	
	5	Data 3	
	6	Data 4	
	7	Data 5	
	8	Data 6	
	9	Data 7	
	10	Data ACK	
	11	Busy	
	12	PE: paper empty	
	13	SLCT: select/online	
	14	AUTOFD	
	15	ERROR	
	16	INIT (reset)	
	17	NO INK	
	18	not connected	
	19-25	GND	

Table C-1 I/O Panel Connectors - Parallel port 25-pin D-sub receptacle

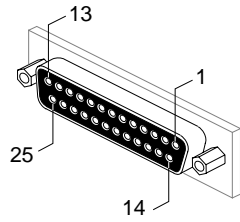


Figure C-1 Parallel port 25-pin D-sub receptacle

Description	Pins	Signals	Flow (from chassis)
Ethernet port	1	Logic Ground	
15-pin AUI (Attachment Unit Interface) according to IEEE 802.3 specification.	2	Collision +	two-way
	3	TXD +	two-way
Pin pairs 2:9, 3:10, and 5:12 are twisted pairs.	4	Logic Ground	
	5	RXD +	two-way
Cabling is 9-conductor.	6	Power Return	input
	7	not used	
	8	Logic Ground	
	9	Collision -	two-way
	10	TXD -	two-way
	11	Logic Ground	
	12	RXD -	two-way
	13	Power (+12V)	output
	14	Logic Ground	
	15	not used	

Table C-2 I/O Panel Connectors - Ethernet Port 15-pin AUI

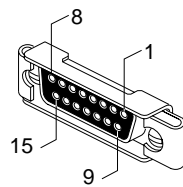


Figure C-2 Ethernet Port 15-pin AUI

Description	Pins	Signals	Flow (from chassis)
Serial port tty1	1	not used	
9-pin D-sub receptacle.	2	TXD	output
RS-232 protocol.	3	RXD	input
Serial ports 0 and 1 provide a choice of this or an 8-pin DIN receptacle. Only one receptacle from each port can be used at a given time.	4	RTS	output
	5	CTS	input
	6	GND	
	7	GND	
	8	DCD	input
	9	DTR	output

Table C-3 I/O Panel Connectors - Serial Port tty1 9-pin D-sub Receptacle

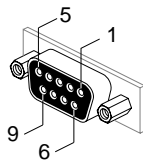


Figure C-3 Serial Port tty1 9-pin D-sub Receptacle

Description	Pins	Signals	Flow (from chassis)
Serial ports tty2, tty3 for unpowered peripherals.	1	not used	
9-pin D-sub receptacle.	2	TXD	output
RS-232 protocol.	3	RXD	input
Serial ports 0 and 1 provide a choice of this or an 8-pin DIN receptacle. Only one receptacle from each port may be used at a given time.	4	RTS	output
	5	CTS	input
	6	GND	
	7	GND	
	8	DCD	input
	9	DTR	output

Table C-4 I/O Panel Connectors - Serial Ports tty2, tty3 for Unpowered Peripherals

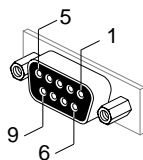


Figure C-4 Serial Ports tty2, tty3 for Unpowered Peripherals

Description	Pins	Signals	Flow (from chassis)
Serials ports tty2, tty3 for powered peripherals. 8-pin DIN receptacle.	1	DTR	output
	2	CTS	input
	3	Stereo Sync	output
	4	RXD	input
	5	TXD	output
	6	GND	
	7	GND	
	8	Power +10V	output

Table C-5 I/O Panel Connectors - Serial Ports tty2, tty3 for Powered Peripherals

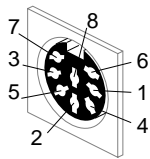


Figure C-5 Serial Ports tty2, tty3 for Powered Peripherals

Description	Pins	Signals	Flow (from chassis)
Serial port tty4 RS-422 protocol. 9-pin D-sub receptacle.	1	DTR	output
	2	TXD low ^a	two-way
	3	RXD low ^b	two-way
	4	DCD	input
	5	CTS	input
	6	GND	
	7	^a TXD high +	two-way
	8	^b RXD high +	two-way
	9	RTS	output

Table C-6 I/O Panel Connectors - Serial Port tty4 RS-422 Protocol

- a. Pins 2 and 7 must be twisted pair in cable.
- b. Pins 3 and 8 must be twisted pair in cable.

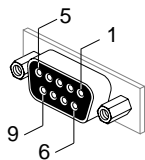


Figure C-6 Serial Port tty4 RS-422 Protocol

Description	Pins	Signals	Flow (from chassis)
System Interrupt IN ports 0, 1	tip ring sleeve	Interrupt Power +5V Shield	input

Table C-7 I/O Panel Connectors - System Interrupt IN Ports 0, 1

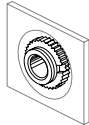


Figure C-7 System Interrupt IN Ports 0, 1

Description	Pins	Signals	Flow (from chassis)
System Interrupt OUT ports 0, 1, 2, 3	tip ring sleeve	Interrupt Power +5V Shield	output

Table C-8 I/O Panel Connectors - System Interrupt OUT Ports 0, 1, 2, 3

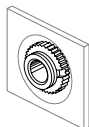


Figure C-8 System Interrupt OUT Ports 0, 1, 2, 3

Description	Pins	Signals	Flow (from chassis)
Keyboard/mouse port 0	1	KBD_RXD	input
6-pin receptacle	2	MOUSE_RXD	input
	3	SIG GND	
	4	Power +12V	output
	5	KBD_TXD	output
	6	not used	

Table C-9 I/O Panel Connectors - Keyboard/Mouse Port 0

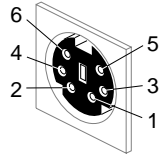


Figure C-9 Keyboard/Mouse Port 0

Description	Pins	Signals	Flow (from chassis)
Swap Ready port	center	SWAP_READY	two-way
BNC receptacle	shield	Chassis Ground	
Impedance 75 Ohm			

Table C-10 Video Panel Connectors - Swap Ready Port

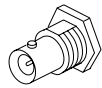


Figure C-10 Swap Ready Port

Description	Pins	Signals	Flow (from chassis)
Frame Grab port	center	FRAME_GRAB	input
BNC receptacle	shield	Chassis Ground	
Impedance 75 Ohm			

Table C-11 Video Panel Connectors - Frame Grab Port

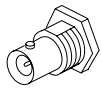


Figure C-11 Frame Grab Port

Description	Pins	Signals	Flow (from chassis)
Composite video ports A, B	center	CMPST_A or CMPST_B	output
BNC receptacle	shield	Chassis Ground	
Impedance 75 Ohm			

Table C-12 Video Panel Connectors - Composite Video Ports A, B



Figure C-12 Composite Video Ports A, B

Description	Pins	Signals	Flow (from chassis)
S-VIDEO ports A, B	1	LUMOND	output
4-pin receptacle	2	CHRMOND	output
NTSC or PAL-compatible	3	LUM	output
	4	CHRM	output

Table C-13 Video Panel Connectors - S-VIDEO Ports A, B

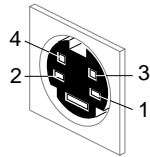


Figure C-13 S-VIDEO Ports A, B

Description	Pins	Signals	Flow (from chassis)
Monitor port	A1	Red	output
13W3 receptacle	A2	Green	output
	A3	Blue	output
	1	not used	
	2	Monitor type 0	input
	3	not used	
	4	Stereo Sync ^a	output
	5	^a Stereo Power +10V	output
	6	Monitor Type 1	input
	7	Monitor Type 2	input
	8	Ground	
	9	^a Ground	
	10	^a Ground	

Table C-14 Video Panel Connectors - Monitor Port

a. On some cables these signals are not used.

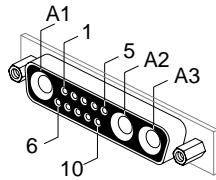


Figure C-14 Monitor Port

Description	Pins	Signals	Flow (from chassis)
Alpha port	center	Alpha	output
BNC receptacle	shield	Chassis Ground	
Impedance 75 Ohm			

Table C-15 Video Panel Connectors - Alpha Port



Figure C-15 Alpha Port

Description	Pins	Signals	Flow (from chassis)
Sync port	center	Sync	output
BNC receptacle	shield	Chassis Ground	
Impedance 75 Ohm			

Table C-16 Video Panel Connectors - Sync Port



Figure C-16 Sync Port

Description	Pins	Signals	Flow (from chassis)
Genlock IN, Genlock OUT	center	Genlock	two-way
BNC receptacle	shield	loop-through	
Impedance 75 Ohm		Chassis Ground	

Table C-17 Video Panel Connectors - Genlock IN, Genlock OUT



Figure C-17 Genlock IN, Genlock OUT

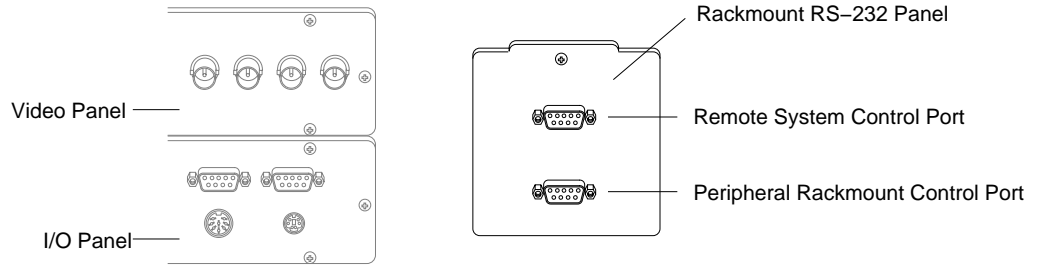


Figure C-18 Rackmount RS-232 Connector Panel

Description	Pins	Signals	Flow (from chassis)
Rackmount remote system control port	1	not used	
	2	TXD	output
9-pin D-sub receptacle	3	RXD	input
	4	RTS	output
	5	CTS	input
	6	not used	
	7	Ground	
	8	DCD	input
	9	DTR	output

Table C-18 Rackmount Remote System Control Port

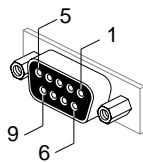


Figure C-19 Rackmount Remote System Control Port

Description	Pins	Signals	Flow (from chassis)
Peripheral rackmount power control port	1	PENE +	two-way
	2	PENE —	two-way
9-pin D-sub receptacle	3	not used	
	4	POKE +	two-way
	5	POKE —	two-way
	6	not used	
	7	not used	
	8	not used	
	9	not used	

Table C-19 Peripheral Rackmount Power Control Port

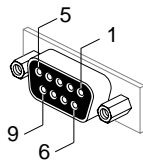


Figure C-20 Peripheral Rackmount Power Control Port

C.2 Monitor Cables

This section identifies the monitor cables provided by Silicon Graphics. See Table C-20 for a summary of monitor cables and Table C-21 through Table C-26 for specific details of each cable.

Description	Length	Connectors	Part Number
Extension cable	15'	13W3 receptacle, both ends	018-0285-001
Extension cable	15'	13W3 receptacle to 3 BNC plugs	018-0286-001
Extension cable	75'	13W3 plug, both ends	018-8094-002
Adapter cable	1'	13W3 receptacle to 3 BNC plugs	018-0343-001
Adapter cable	1'	13W3 plug to 3 BNC receptacles	018-0344-001
Extension cable	75'	3 BNC receptacles, both ends	018-0275-003

Table C-20 Monitor Cable Summary

Note: To attach a second graphics monitor to a Challenge/Onyx chassis, additional hardware is required to provide a second set of signals.

Part Number	Description
018-0285-001	Monitor extension cable, round, 15' length, shielded, 13W3 hybrid plugs at each end of cable.

Table C-21 Monitor Extension Cable, Round, 15' Length, Shielded, 13W3 Hybrid Plugs at Each End of Cable

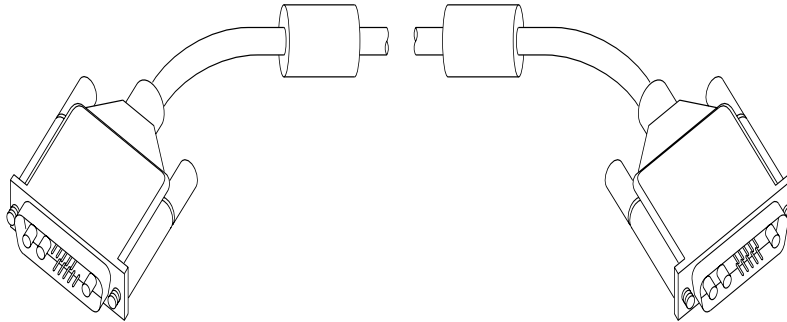


Figure C-21 Monitor Extension Cable, Round, 15' Length, Shielded, 13W3 Hybrid Plugs at Each End of Cable

Part Number	Description
018-0286-001	Monitor extension cable, round, 15' length, shielded, 13W3 hybrid plug at chassis end, 3 BNC plugs (RGB) at monitor end.

Table C-22 Monitor Extension Cable, Round, 15' Length, Shielded, 13W3 Hybrid Plug at Chassis End, 3 BNC Plugs (RGB) at Monitor End

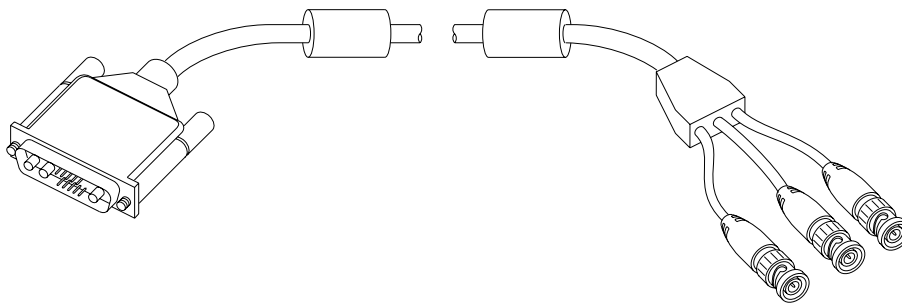


Figure C-22 Monitor Extension Cable, Round, 15' Length, Shielded, 13W3 Hybrid Plug at Chassis End, 3 BNC Plugs (RGB) at Monitor End

Part Number	Description
018-8094-002	Monitor extension cable, round, 75' length, shielded, 13W3 hybrid plugs at each end of cable.

Table C-23 Monitor Extension Cable, Round, 75' Length, Shielded, 13W3 Hybrid Plugs at Each End of Cable

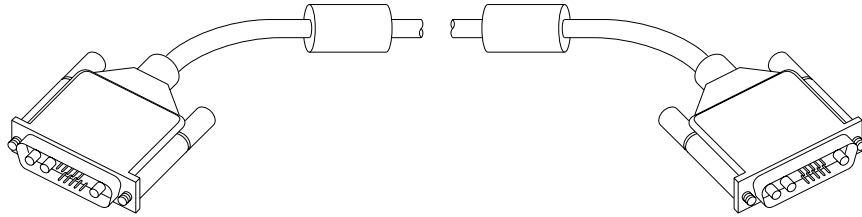


Figure C-23 Monitor Extension Cable, Round, 75' Length, Shielded, 13W3 Hybrid Plugs at Each End of Cable

Part Number	Description
018-0343-001	Monitor adapter cable, round, 1' length, shielded, 13W3 hybrid receptacle at one end, 3 BNC plugs (RGB) at other end.

Table C-24 Monitor Adapter Cable, Round, 1' Length, Shielded, 13W3 Hybrid Receptacle at One End, 3 BNC Plugs (RGB) at Other End

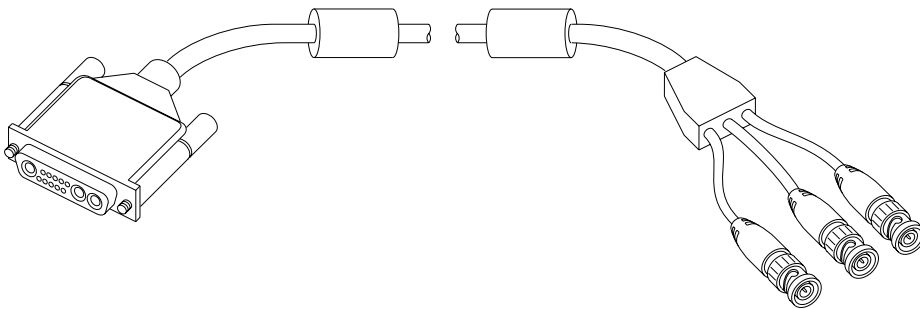


Figure C-24 Monitor Adapter Cable, Round, 1' Length, Shielded, 13W3 Hybrid Receptacle at One End, 3 BNC Plugs (RGB) at Other End

Part Number	Description
018-0344-001	Monitor adapter cable, round, 1' length, shielded, 13W3 hybrid plug at one end, 3 BNC receptacles (RGB) at other end.

Table C-25 Monitor Adapter Cable, Round, 1' Length, Shielded, 13W3 Hybrid Plug at One End, 3 BNC Receptacles (RGB) at Other End

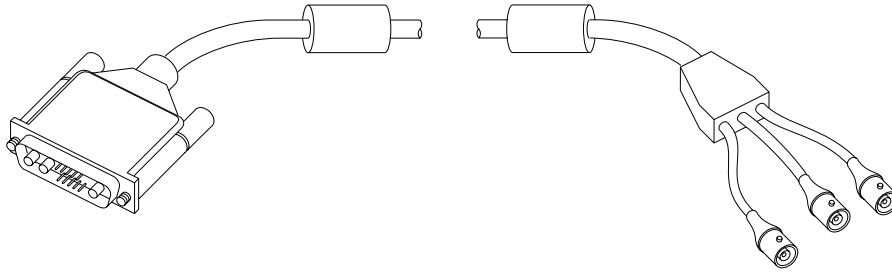


Figure C-25 Monitor Adapter Cable, Round, 1' Length, Shielded, 13W3 Hybrid Plug at One End, 3 BNC Receptacles (RGB) at Other End

Part Number	Description
018-0275-003	Monitor extension cable, round, 75' length, shielded, 3 BNC plugs (RGB) at both ends.

Table C-26 Monitor Extension Cable, Round, 75' Length, Shielded, 3 BNC Plugs (RGB) at Both Ends

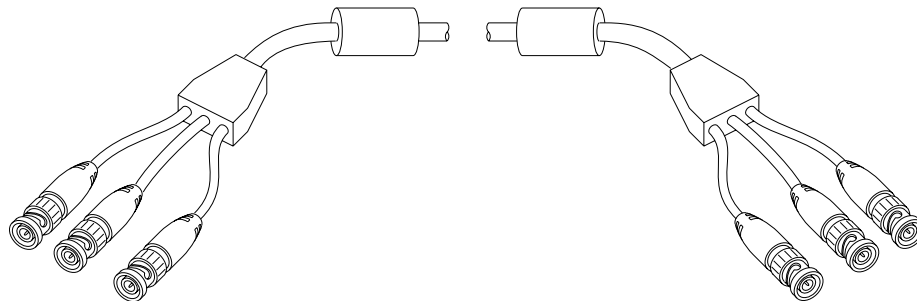


Figure C-26 Monitor Extension Cable, Round, 75' Length, Shielded, 3 BNC Plugs (RGB) at Both Ends

C.3 Input Device Cables

The main keyboard (and mouse) connects to a dedicated port using a standard 30-foot cable. If a longer cable is required, order the 75-foot extension cable. Both of these cables are shown in Table C-27 and Table C-28.

Part Number	Description
081-0345-001	Keyboard extension cable, round, 30' length, shielded, 6-pin circular mini-DIN plugs at both ends.

Table C-27 Keyboard Extension Cable, Round, 30' Length, Shielded, 6-pin Circular Mini-DIN Plugs at Both Ends

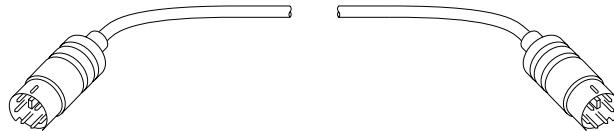


Figure C-27 Keyboard Extension Cable, Round, 30' Length, Shielded, 6-pin Circular Mini-DIN Plugs at Both Ends

Part Number	Description
081-0075-001	Keyboard extension cable, round, 75' length, shielded, 6-pin circular mini-DIN plugs at both ends.

Table C-28 Keyboard Extension Cable, Round, 75' Length, Shielded, 6-pin Circular Mini-DIN Plugs at Both Ends

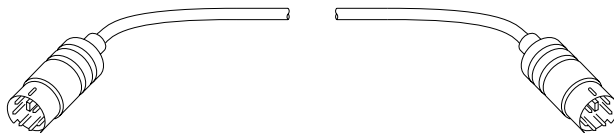


Figure C-28 Keyboard Extension Cable, Round, 75' Length, Shielded, 6-pin Circular Mini-DIN Plugs at Both Ends

C.4 System Interrupt Cable

Table C-29 shows the rackmount system interrupt cable.

Part Number	Description
9290054	Rackmount system interrupt cable, round, 35' length, 3.5 mm 3-conductor plugs at both ends, wired straight-through.

Table C-29 Rackmount System Interrupt Cable

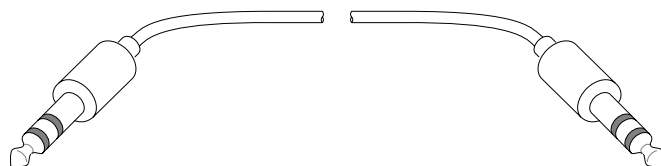


Figure C-29 Rackmount System Interrupt Cable

Supplementary SCSI Information

The Everest products support many types of SCSI protocols, resulting in a wide variety of SCSI channel configurations. This appendix introduces the supported SCSI protocols for Challenge/Onyx products, defines the components in a SCSI channel, and explains how to configure and label a SCSI channel.

D.1 Supported SCSI Protocols for Challenge/Onyx Products

SCSI devices continue to evolve with higher bus bandwidths, faster data transfer rates, and channels with longer cables and more devices.

A protocol establishes a SCSI bus's bandwidth, type, and data transfer rate. These factors are dependent on each other. For example, a 16-bit SCSI peripheral typically transfers more data at a faster rate than an 8-bit SCSI peripheral.

D.1.1 SCSI Bus Bandwidth

An 8-bit bus provides up to 8 SCSI IDs, and a 16-bit bus provides up to 16 SCSI IDs. Since a SCSI bus controller uses the first SCSI ID (ID #0), 8-bit buses use seven SCSI IDs for devices, and 16-bit buses use 15 SCSI IDs.

D.1.2 SCSI Bus Type

A SCSI bus type is either single-ended or differential. A single-ended SCSI peripheral uses inexpensive, open-collector-wired, OR busing configurations that use a signal comparison to ground. This limits the distance the signal can be driven because of noise considerations.

Differential SCSI peripherals use differential drivers and receivers with built-in hysteresis to provide improved signal noise immunity so that the bus can be driven to greater lengths, as shown in Figure D-1. Single-ended and differential SCSI peripherals use incompatible integrated circuitry and cannot be mixed on a bus.

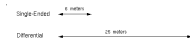


Figure D-1 Maximum SCSI Bus Length Based on Bus Type

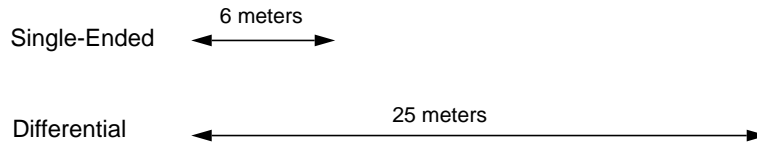


Figure D-2 Maximum SCSI Bus Length Based on Bus Type

D.1.3 SCSI Data Transfer Rate

Data transfer rates are either slow or fast, measured in megatransfers per second. Megatransfers are the number of million operations per bus cycle. An operation is either 8- or 16-bit in size. Megatransfers are based on a bus's burst data rate. Data transfer rates are dependent on the bus bandwidth. See Figure D-2.

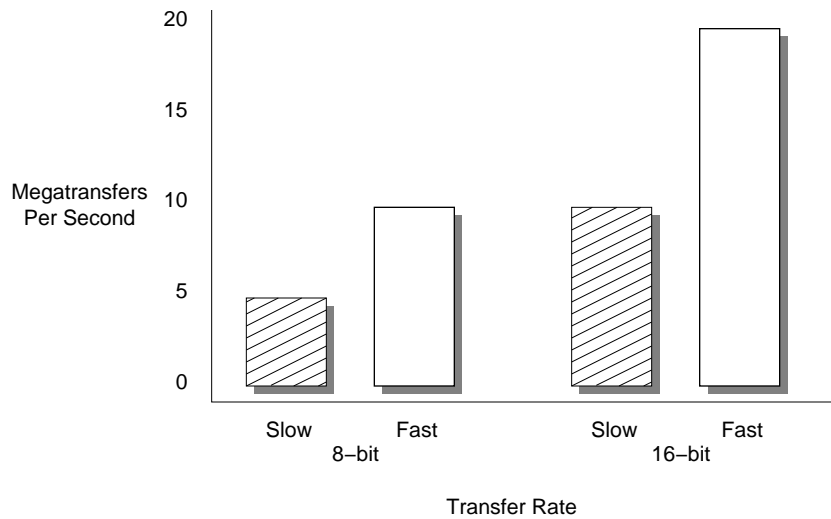


Figure D-3 SCSI Bus Data Transfer Rates

The System Controller negotiates independently with the devices on a bus to establish the acceptable transfer rate of each device, allowing a mix of fast and slow devices on the same bus.

D.1.4 SCSI Configuration Guidelines

These guidelines reflect the dependencies between SCSI bus bandwidths, types, and data transfer rates. Follow these guidelines help to minimize inconsistent or inoperable SCSI buses:

- Install single-ended and differential devices on separate buses.
- When calculating SCSI bus length, include all cable length inside devices, components, and chassis.

D.2 Identifying SCSI Channel Components

A SCSI channel can include a mix of these components:

- a board that generates the signal
- all cabling from the start to the end of a channel
- all converters and adapters in the cable path
- all SCSI devices connected to the channel
- a terminating device at the end of the channel

See Table D-1 through Table D-8 for a descriptions of the typical components in a Challenge/Onyx SCSI bus, and Figure D-11 for an overview of the default chassis SCSI implementations for the rackmount chassis.

This section describes the components of a SCSI channel and illustrates the location of the components for default chassis configurations.

SCSI Channel Component	Description
Figure D-3 IO4 Board	<p>IO4 board: an IO4 board provides SCSI bus signals for up to 8 SCSI buses. SCSI buses 0 and 1 are available directly on the IO4 board. Buses 2-4 require a mezzanine board attached to the lower mezzanine connector on the IO4 board, and buses 5-7 require a second mezzanine board attached to the upper mezzanine connector.</p> <p>IO4 boards support all SCSI protocols and use an adapter board to select the desired protocol for each bus.</p> <p>Several IO4 boards may reside in a system.</p>

Table D-1 SCSI Channel Component - IO4 Board

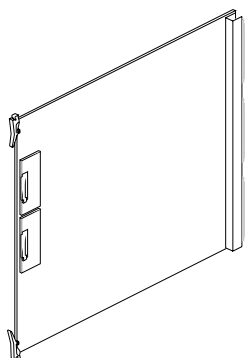


Figure D-4 IO4 Board

SCSI Channel Component	Description
Figure D-4 SCSI Mezzanine Board	<p>SCSI mezzanine board: a SCSI mezzanine board attaches to an IO4 board, up to 2 mezzanine boards for each IO4 board. Each SCSI mezzanine board supports 3 SCSI buses. On the inner connectors, two buses use differential protocol only, and on the outer connector, the bus is selectable as either single-ended or differential by using a channel adapter board.</p> <p>The first mezzanine board provides SCSI buses 2-4, with bus 2 on the outer center connector. The second mezzanine board provides SCSI buses 5-7, with bus 5 on the outer center connector.</p>

Table D-2 SCSI Channel Component - SCSI Mezzanine Board

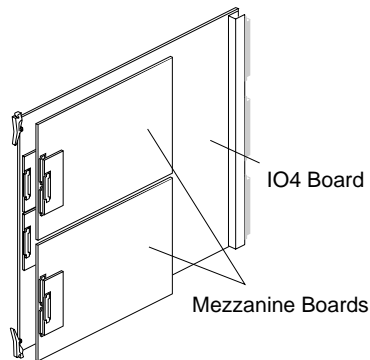


Figure D-5 SCSI Mezzanine Board

SCSI Channel Component	Description
Figure D-5 Channel Adapter Board	<p>Channel adapter board: a channel adapter board adapts a SCSI bus for either single-ended or differential protocol. Channel adapter boards attach directly to an IO4 board or to the outer connector on a SCSI mezzanine board. These are sometimes referred to as “personality modules.”</p>

Table D-3 SCSI Channel Component - Channel Adapter Board

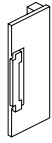


Figure D-6 Channel Adapter Board

SCSI Channel Component	Description
Figure D-6 SCSI Bulkhead (Deskside Version Shown)	<p data-bbox="870 579 1349 751">SCSI bulkhead (deskside version shown): a SCSI bulkhead supplies a blind-pluggable receptacle to each SCSI device bay in a SCSI box. Each receptacle provides up to two SCSI channels, selectable using a drive adapter board.</p> <p data-bbox="870 800 1349 856">The bulkhead also provides connectors at the end of the channels for termination.</p> <p data-bbox="870 905 1273 957">Several different SCSI bulkheads exist depending on the chassis involved.</p>

Table D-4 SCSI Channel Component - SCSI Bulkhead (Deskside Version Shown)

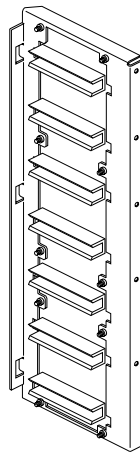


Figure D-7 SCSI Bulkhead (Deskside Version Shown)

SCSI Channel Component	Description
Figure D-7 Drive Adapter Board, 50-pin	Drive adapter board, 50-pin: a drive adapter board selects one of the two possible SCSI channels delivered to each drive bay. A drive adapter board resides on a drive sled and provides blind-pluggable connection between a SCSI device and the SCSI bulkhead. The 50-pin adapter board is used for drives that use a 50-pin cable, which are typically single-ended devices.

Table D-5 SCSI Channel Component - Drive Adapter Board, 50-pin

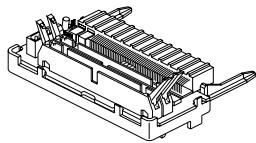


Figure D-8 Drive Adapter Board, 50-pin

SCSI Channel Component	Description
Figure D-8 Drive Adapter Board, 68-pin	Drive adapter board, 68-pin: a drive adapter board selects one of the two possible SCSI channels delivered to each drive bay. A drive adapter board resides on a drive sled and provides blind-pluggable connection between a SCSI device and the SCSI bulkhead. The 68-pin adapter board is used for drives that use a 68-pin cable, which are typically differential devices.

Table D-6 SCSI Channel Component - Drive Adapter Board, 68-pin

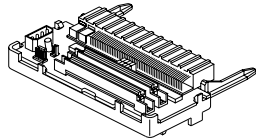


Figure D-9 Drive Adapter Board, 68-pin

SCSI Channel Component	Description
Figure D-9 SCSI Device (CD Player Shown)	SCSI device (CD player shown): a SCSI device is a storage and retrieval mechanism that uses the SCSI specification. Typical single-ended devices allow a maximum of 7 devices on a short channel. Newer differential devices have up to 15 devices on much longer channels.

Table D-7 SCSI Channel Component - SCSI Device (CD Player Shown)

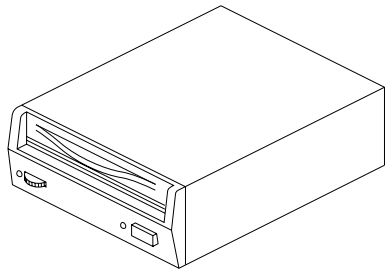


Figure D-10 SCSI Device (CD Player Shown)

SCSI Channel Component	Description
Figure D-10 SCSI Terminator	SCSI terminator: a SCSI terminator resides at the end of a SCSI channel and terminates the signals. A SCSI channel will not work unless it is properly terminated.

Table D-8 SCSI Channel Component - SCSI Terminator

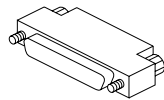


Figure D-11 SCSI Terminator

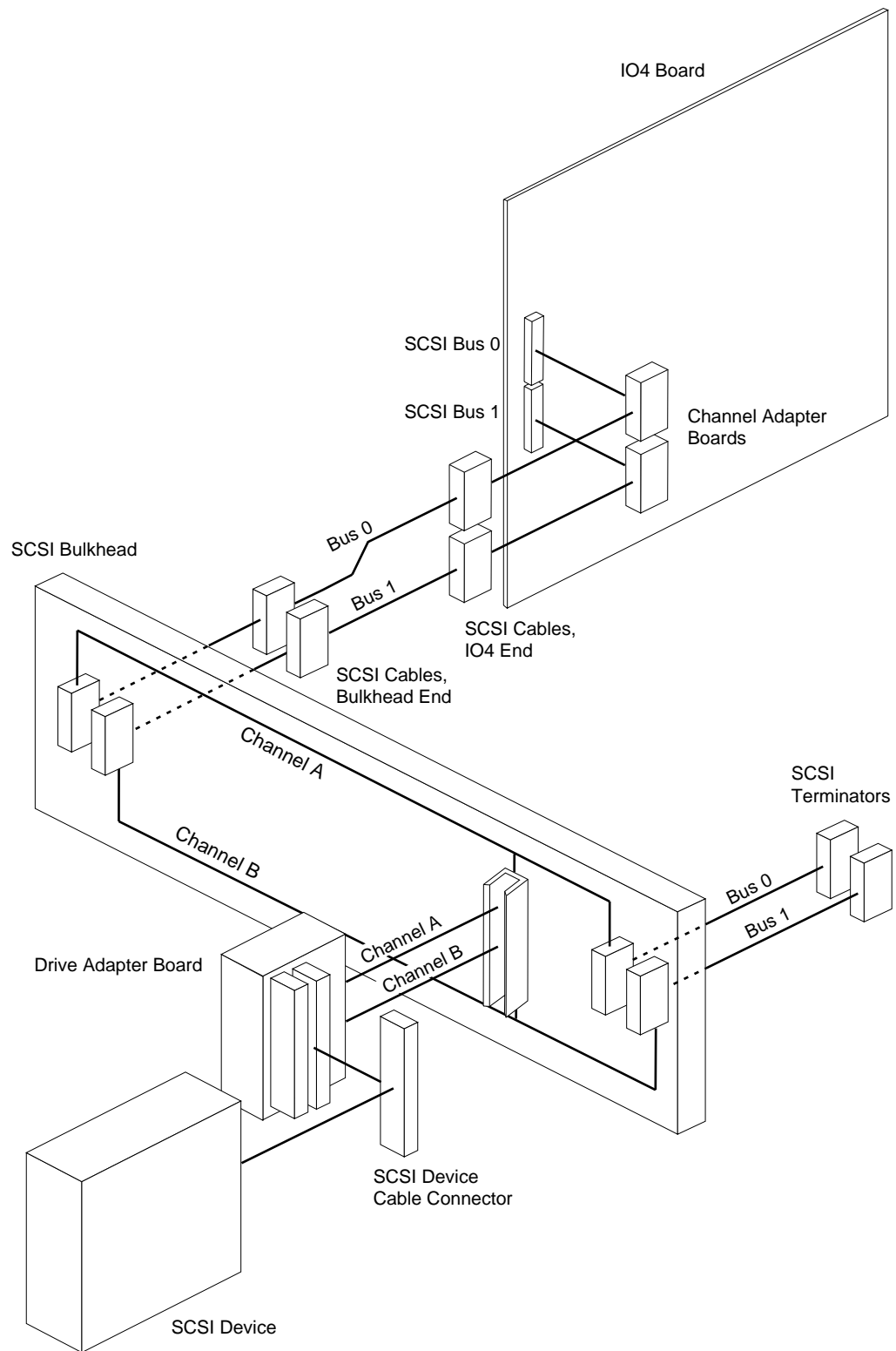


Figure D-12 Rackmount Internal SCSI Channel Components

D.3 Configuring a SCSI Channel

All components from the start to the end of a SCSI channel must be set to the same protocol (single-ended, differential, data transfer rate). Components are set to a SCSI protocol using one of several mechanical methods, such as selecting specific jumpers and connectors. By using jumpers and connectors, many different SCSI devices can use the same basic mechanical design within several chassis.

To configure a SCSI channel:

1. Verify the type of SCSI protocol required.
2. Identify each component in the SCSI channel using the chart in Section D.2, "Identifying SCSI Channel Components."
3. Obtain any missing components.
4. Configure all components to the desired protocol as shown in Section D.3.1, "Configuring IO4 and SCSI Mezzanine Boards," through Section D.3.3, "Configuring a SCSI Bus Terminator."

This section provides procedures for SCSI channel components that can be configured:

- IO4 and mezzanine boards
- channel adapter boards
- SCSI cables
- drive adapter boards

D.3.1 Configuring IO4 and SCSI Mezzanine Boards

IO4 boards and SCSI mezzanine boards require no configuration other than selecting the type of channel adapter board to use with SCSI buses 0, 1, 2, and 5. Buses 3, 4, 6, and 7 are fixed for differential SCSI only. See Figure D-12 for the position of the bus connectors.

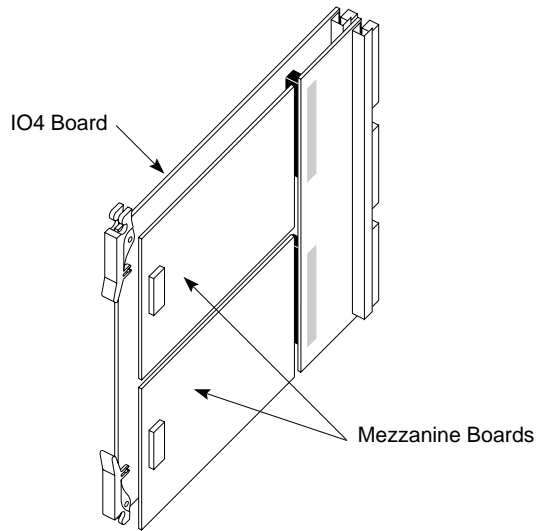


Figure D-13 IO4 Board with Maximum SCSI Bus Configuration

IO4 boards are shipped from the factory with a single-ended channel adapter board on SCSI bus 0, and a differential channel adapter board on SCSI bus 1. Each system also includes spare adapters to modify this configuration. By default, SCSI buses 0 and 1 support internal devices. The two SCSI bus signals are routed through the chassis using two SCSI channels, which are available at all drive bays. This arrangement allows a mix of single-ended and differential devices within the same drive box.

SCSI mezzanine boards are shipped from the factory with both a single-ended and differential channel adapter board for use with the first SCSI bus on the mezzanine board. The second and third mezzanine SCSI channels are fixed as differential only.

D.3.2 Configuring Channel Adapter Boards

Channel adapter boards determine the protocol of a SCSI channel leaving an IO4 or SCSI mezzanine board. There are two types of channel adapter board, which are color-coded to simplify identification: green for single-ended protocol and red for differential protocol.

Single-ended channel adapter boards include jumpers for setting the data transfer rate of the channel to either slow or fast. Table D-9 describes the jumper settings.

Speed	Use	Jumper Setting
Slow	Peripherals outside chassis	No jumpers installed
Fast	Peripherals inside chassis	Both jumpers installed

Table D-9 Setting the Single-ended SCSI Bus Speed (Transfer-rate Jumpers)

Figure D-13 shows the location and orientation of the transfer-rate jumpers on the single-ended channel adapter board:

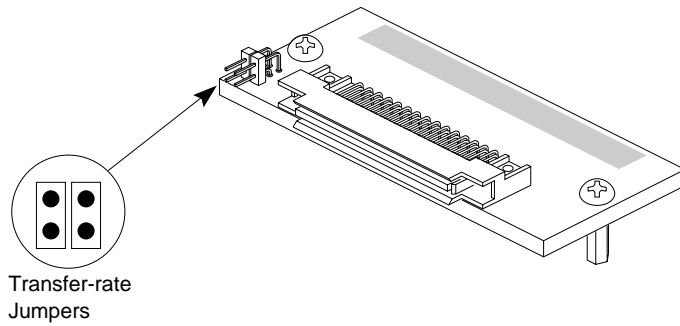


Figure D-14 Data Transfer-rate Jumpers on a Single-ended Channel Adapter Board

D.3.1 Configuring SCSI Cables

Cables do not have any special jumpers or other method to configure a specific protocol. However, a cable must meet the electrical specifications and length limitations of the protocol. Figure D-1 shows the maximum allowable length of a channel for each protocol. Most of the total channel length is taken up by the cabling between devices or chassis.

Note: A cable sold for use with one SCSI configuration may not be appropriate for other SCSI configurations. When in doubt, use a shorter cable.

D.3.2 Configuring a Drive Adapter Board

Drive adapter boards must match the SCSI device cable and the SCSI channel protocol.

To match the cabling of a SCSI device, check the type of connector on the SCSI device's cable. For cables with 50-pin connectors, use a 50-pin drive adapter board as shown in Figure D-14. For cables with 68-pin connectors, use a 68-pin drive adapter board as shown in Figure D-15.

Channel A Set for Single-ended, and
Channel B Set for Differential

Both Channels Set for Single-ended

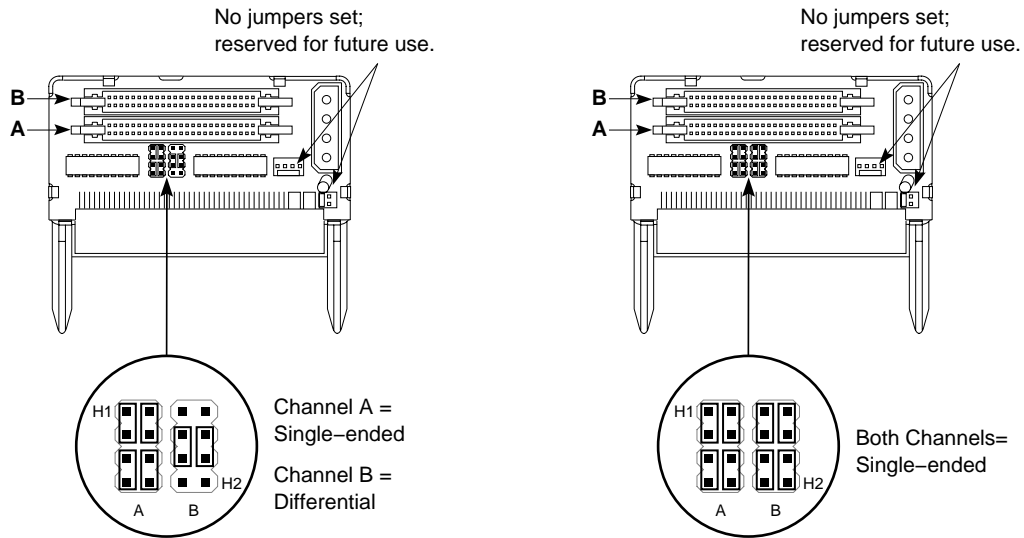


Figure D-15 Setting SCSI Protocols on a 50-pin Drive Adapter Board

Both Channels Set for Differential

Channel A Set for Single-ended
Channel B Set for Differential

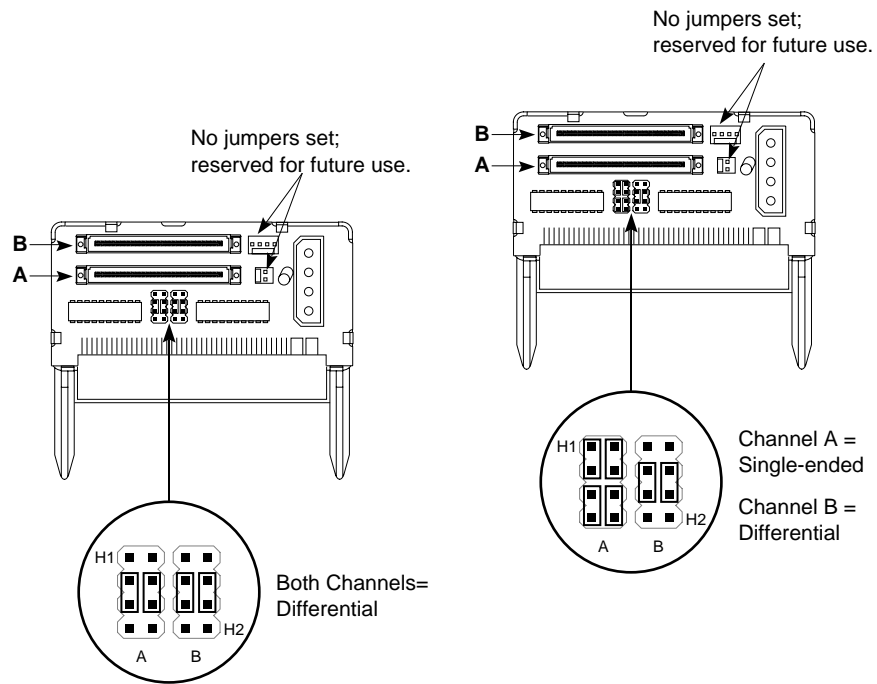


Figure D-16 Setting SCSI Protocols on a 68-pin Drive Adapter Board

D.3.3 Configuring a SCSI Bus Terminator

SCSI terminators must be matched to the protocol of the SCSI channel. There are two different terminators: one for single-ended protocol and one for differential protocol. These terminators are visually identical except for the manufacturing part numbers. See Table D-10 and Figure D-16.

Component	SGI Part Number	Distinguishing Marks
Single-ended Terminator	9660008	AMP 869516-1 ACTIVE
Differential Terminator	9660006	AMP 869515-1

Table D-10 SCSI Bus Terminator Part Numbers

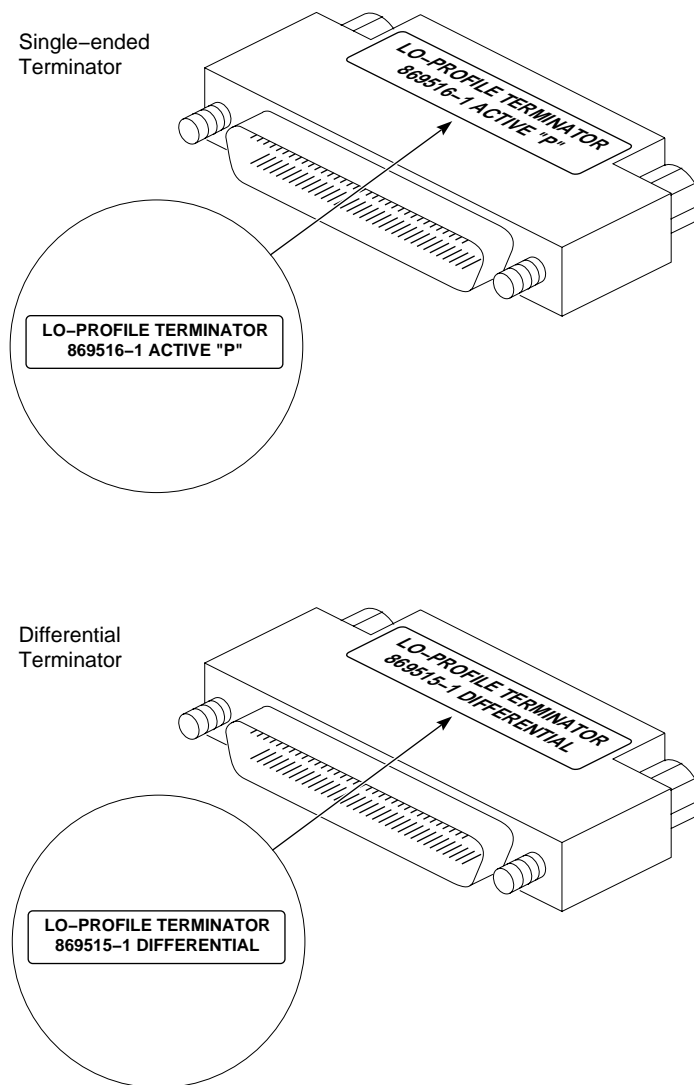


Figure D-17 Distinguishing Marks on a SCSI Terminator



Warning: Never use a single-ended SCSI terminator on a differential channel. Connecting a single-ended terminator to a differential channel shorts power to ground.

D.4 Labels on a SCSI Channel

This section describes the SCSI channel labels for individuals who need to determine the configuration of a SCSI channel or modify the SCSI labels for a rackmount chassis.

To simplify SCSI channel identification, labels are on the IO panel SCSI connectors, cables, SCSI devices, SCSIBoxes, and terminators. Depending on the component in question, a label may provide:

- a bus number to identify the I/O board that provides the SCSI signal
- a channel protocol to identify whether the channel is single-ended or differential
- a number to identify the channel inside a SCSIBox that supplies the SCSI bus, either A or B

To determine the protocol of a SCSI channel with missing or unreadable labels, check the configuration of one or more components on the channel using the data in Section D.3, “Configuring a SCSI Channel.” The easiest component to reach is the drive adapter board. Also, a channel adapter board is color-coded to simplify identification. Single-ended channel adapter boards are green, and differential channel adapter boards are red.

See Figure D-17 and Table D-11 through Table D-22 for descriptions of rackmount SCSI channel labels and their locations. See also Figure D-30 through Figure D-33.

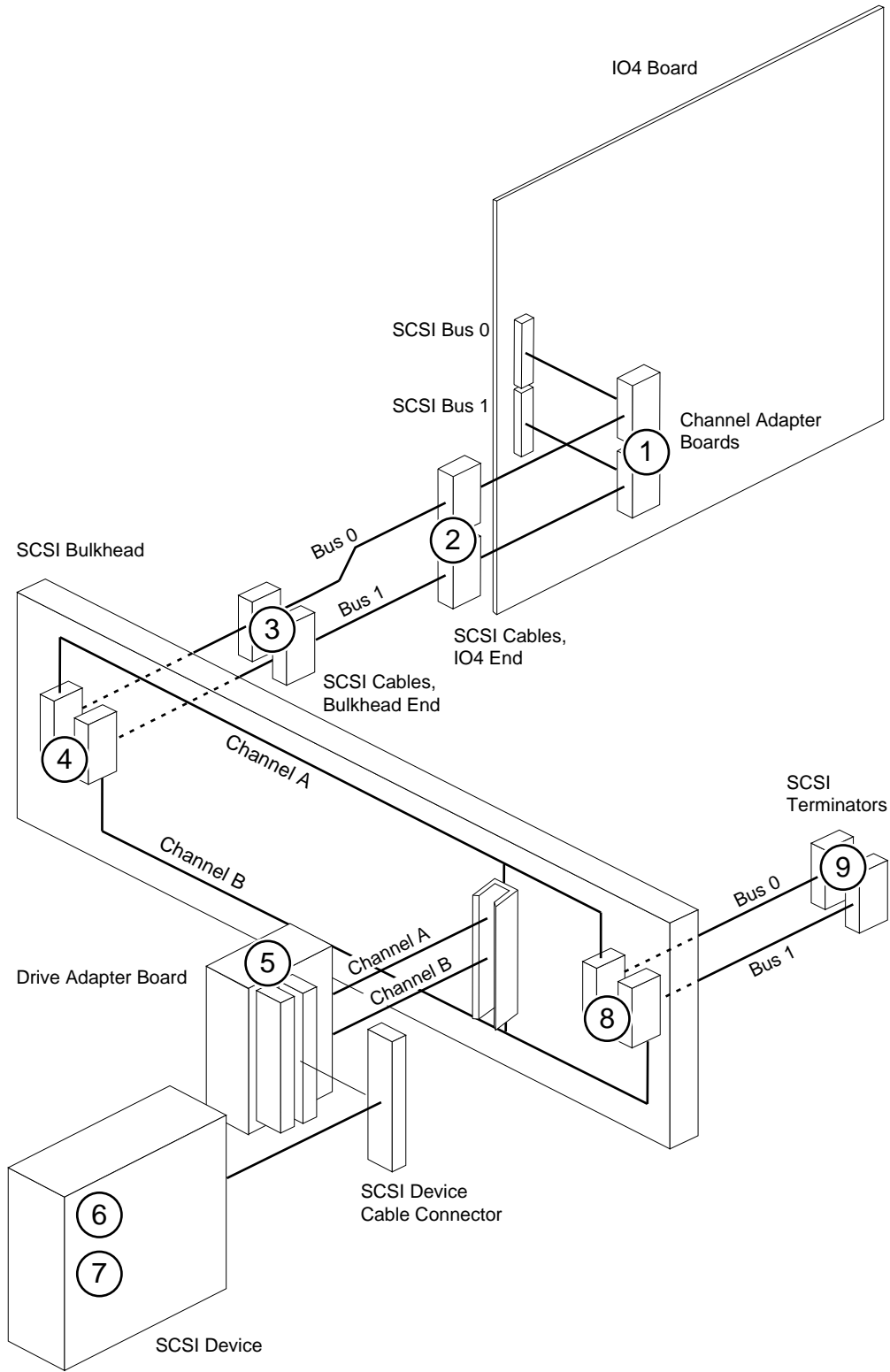


Figure D-18 Rackmount Internal SCSI Channel Label and Marking Locations

Key	Description	Placement Procedure
1	Channel adapter board label; identifies SCSI protocol (SE or DF) and bus number (0-7); SE SCSI 0 label is part number 024-0637-xxx; DF SCSI 1 label is part number 024-0640-xxx; secondary SCSIBoxes are labeled from label set part numbers 024-0610-xxx through 024-0654-xxx.	Select label based on the slot and bus number of the IO board. For example, in the default configuration bus 0 on an IO4 board in slot 13 gets the label SE SCSI 130. Place label on flat face of the cable connector, aligning the bottom of the text along the inner, long edge of the connector.

Table D-11 Channel Adapter Board Label



Figure D-19 Channel Adapter Board Label

SE SCSI 0

or

DF SCSI 1

Figure D-20 Channel Adapter Board Label

Key	Description	Placement Procedure
2	SCSI cable label, board end; identifies SCSI protocol (SE or DF) and the bus number (0-7); SE SCSI 0 label is part number 024-0637-xxx; DF SCSI 1 label is part number 024-0640-xxx; secondary SCSIBoxes are labeled from label set part numbers 024-0610-xxx through 024-0654-xxx.	fig on the slot and bus number of the I/O board. For example, in the default configuration bus 0 on an IO4 board in slot 13 gets the label SE SCSI 130. Place label on flat face of the cable connector, aligning the bottom of the text along the inner, long edge of the connector.

Table D-12 SCSI Cable Label, Board End



Figure D-21 SCSI Cable Label, Board End

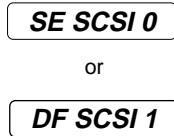


Figure D-22 SCSI Cable Label, Board End

Key	Description	Placement Procedure
3	SCSI cable label, bulkhead end; identifies SCSI protocol (SE or DF) and the bus number (0-7); SE SCSI 0 label is part number 024-0637-xxx; DF SCSI 1 label is part number 024-0640-xxx; secondary SCSIBoxes are labeled from label set part numbers 024-0610-xxx through 024-0654-xxx.	Select label based on the slot and bus number of the I/O board. For example, in the default configuration bus 0 on an IO4 board in slot 13 gets the label SE SCSI 130. Place label on flat face of the cable connector, aligning the bottom of the text along the inner, long edge of the connector.

Table D-13 SCSI Cable Label, Bulkhead End

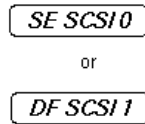


Figure D-23 SCSI Cable Label, Bulkhead End

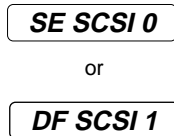


Figure D-24 SCSI Cable Label, Bulkhead End

Key	Description	Placement Procedure
4	Bulkhead SCSI cable connector; in early revisions, no markings for channel connectors A and B; channel A is the bottom connector, and channel B is the top connector; in later revisions, A and B markings are included on the bulkhead.	None required.

Table D-14 Bulkhead SCSI Cable Connector

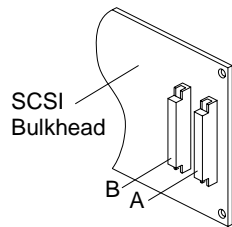


Figure D-25 Bulkhead SCSI Cable Connector

Key	Description	Placement Procedure
5	Drive adapter board markings for SCSI channels A and B; on 50-pin adapter boards, the two selectable connectors are marked JA1 and JB1; on 68-pin adapters, the connectors are marked J1_A and J1_B.	None required.

Table D-15 Drive Adapter Board Markings for SCSI Channels A and B

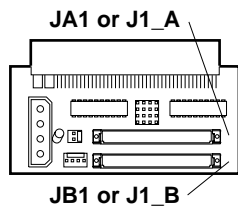


Figure D-26 Drive Adapter Board Markings for SCSI Channels A and B

Key	Description	Placement Procedure
6a	SCSI device label for devices with large front bezels; identifies the SCSI channel (A or B), and the device ID number (1-15); part number 024-0632-xxx.	Place label on the inner face of the drive door, along the hinged edge of the door and as close as possible to the corresponding drive.

Table D-16 SCSI Device Label for Devices with Large Front Bezels



Figure D-27 SCSI Device Label for Devices with Large Front Bezels

Key	Description	Placement Procedure
6b	SCSI device label for devices with restricted space on the front bezel; identifies the SCSI protocol (SE or DF) and bus number (0-7); SE SCSI 0 label is part number 024-0637-xxx; DF SCSI 1 label is part number 024-0640-xxx; secondary SCSIBoxes are labeled from label set part numbers 024-0610-xxx through 024-0654-xxx.	Select label based on the slot and bus number of the I/O board. For example, in the default configuration bus 0 on an IO4 board in slot 13 gets the label SE SCSI 130. Place label on flat face of the cable connector, aligning the bottom of the text along the inner long edge of the connector.

Table D-17 SCSI Device Label for Devices with Restricted Space on the Front Bezel



Figure D-28 SCSI Device Label for Devices with Restricted Space on the Front Bezel

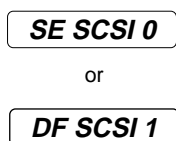


Figure D-29 SCSI Device Label for Devices with Restricted Space on the Front Bezel

Key	Description	Placement Procedure
6c	SCSI device label for devices with minimal space on the front bezel; identifies the SCSI channel (A or B); part number 024-0671-xxx.	Place label directly on the face of the drive, ensuring that the label does not block airflow. Indicate whether the device is configured for channel A or B.

Table D-18 SCSI Device Label for Devices with Minimal Space on the Front Bezel



Figure D-30 SCSI Device Label for Devices with Minimal Space on the Front Bezel

Key	Description	Placement Procedure
7a	SCSIBox base label; part number 024-0655-xxx.	Place label on the bottom lip of the inside of the SCSIBox (in front of the drives). For each channel, indicate the channel protocol (SE for single-ended, DF for differential) and the SCSI bus (0 or 1). See Figure D-30.

Table D-19 SCSIBox Base Label



Figure D-31 SCSIBox Base Label

Key	Description	Placement Procedure
7b	SCSIBox cover label; identifies SCSI protocol (SE or DF) and bus number (0-7); SE SCSI 0 label is part number 024-0637-xxx; DF SCSI 1 label is part number 024-0640-xxx; secondary SCSIBoxes are labeled from label set part numbers 024-0610-xxx through 024-0654-xxx.	Select label based on the slot and bus number of the I/O board. For example, in the default configuration bus 0 on an IO4 board in slot 13 gets the label SE SCSI 130. Place label on the inner face of the drive door, in the upper left corner.

Table D-20 SCSIBox Cover Label

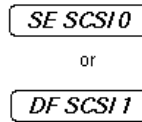


Figure D-32 SCSIBox Cover Label

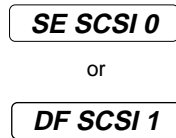


Figure D-33 SCSIBox Cover Label

Key	Description	Placement Procedure
8	Bulkhead terminator connector; in early revisions, no distinction between connectors A and B; channel A is the bottom connector, and channel B is the top connector; in later revisions, A and B markings are included on the bulkhead.	None required.

Table D-21 Bulkhead Terminator Connector

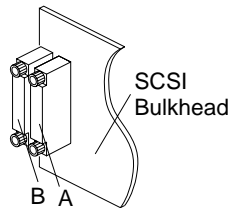


Figure D-34 Bulkhead Terminator Connector

Key	Description	Placement Procedure
9	SCSI terminator connector label; identifies SCSI protocol (SE or DF) and bus number (0-7); SE SCSI 0 label is part number 024-0637-xxx; DF SCSI 1 label is part number 024-0640-xxx; secondary SCSIBox terminators are labeled from label set part numbers 024-0610-xxx through 024-0654-xxx.	Select label based on the slot and bus number of the I/O board. For example, in the default configuration bus 0 on an IO4 board in slot 13 gets the label SE SCSI 130. Place label on flat face of the terminator.

Table D-22 SCSI Terminator Connector Label

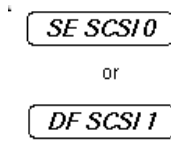


Figure D-35 SCSI Terminator Connector Label

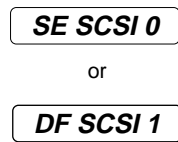


Figure D-36 SCSI Terminator Connector Label

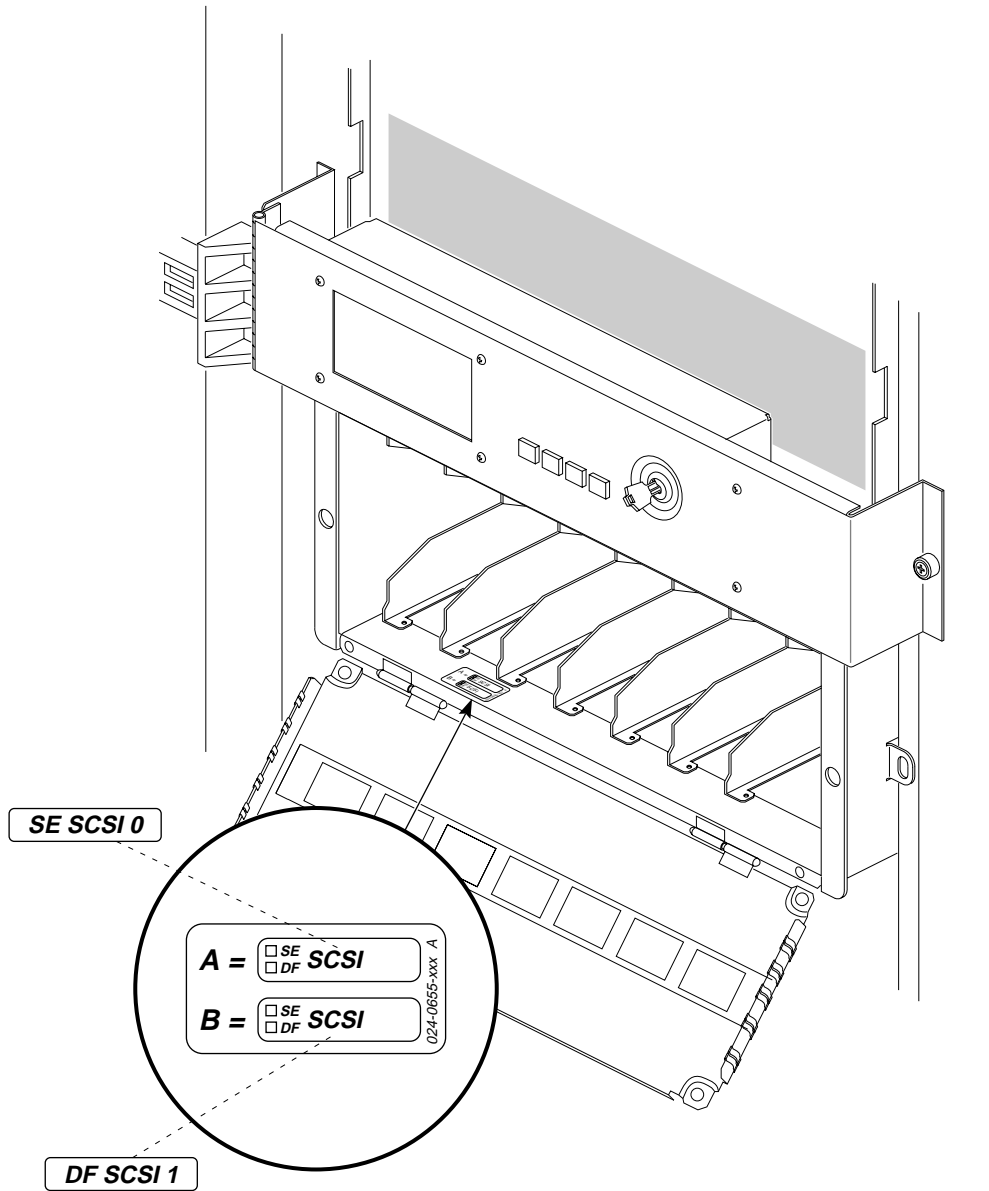


Figure D-37 SCSI Label Placement on a Rackmount “Stubbi” SCSIBox

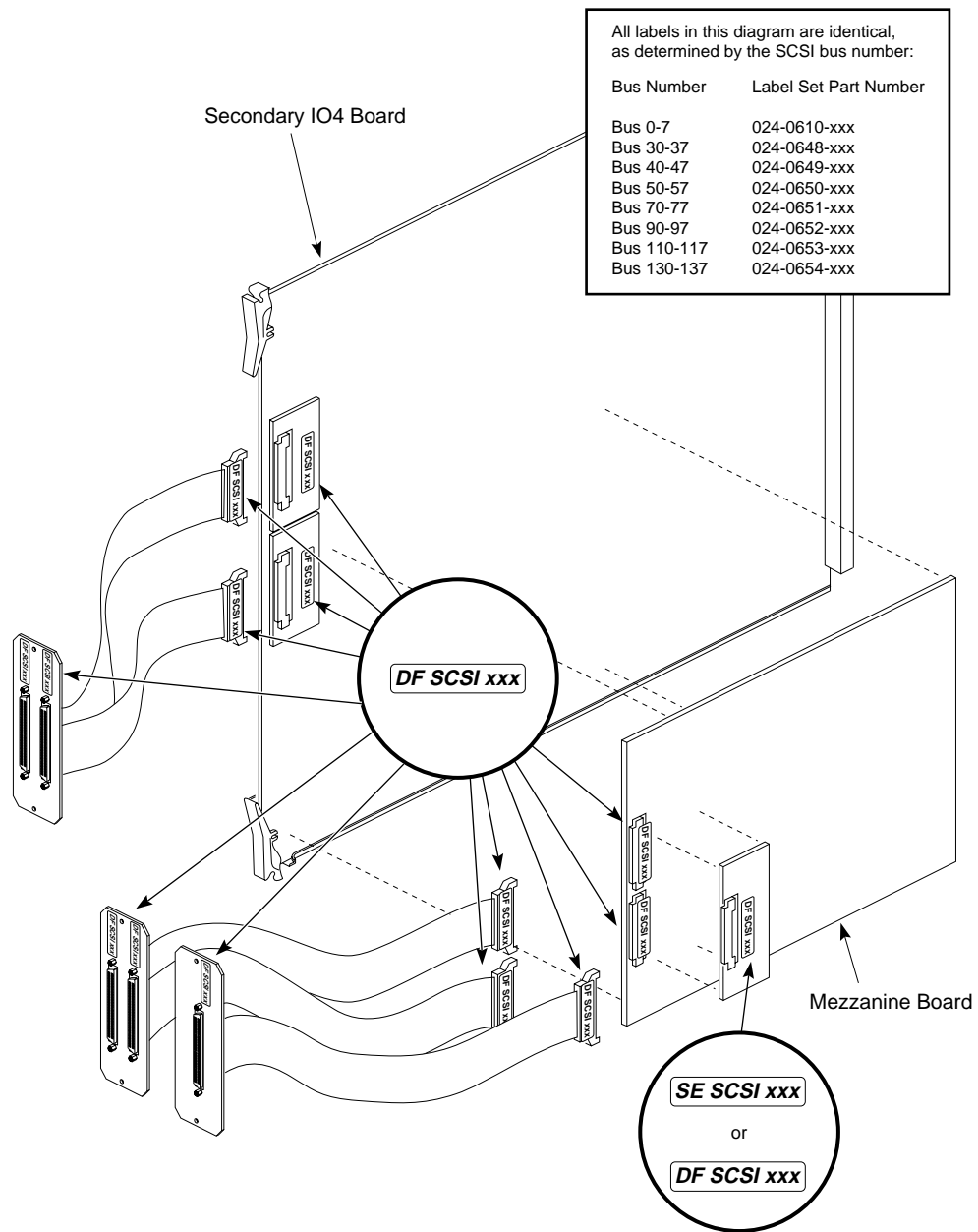


Figure D-38 SCSI Label Placement for Secondary I/O Boards, Mezzanine Boards, and I/O Plates

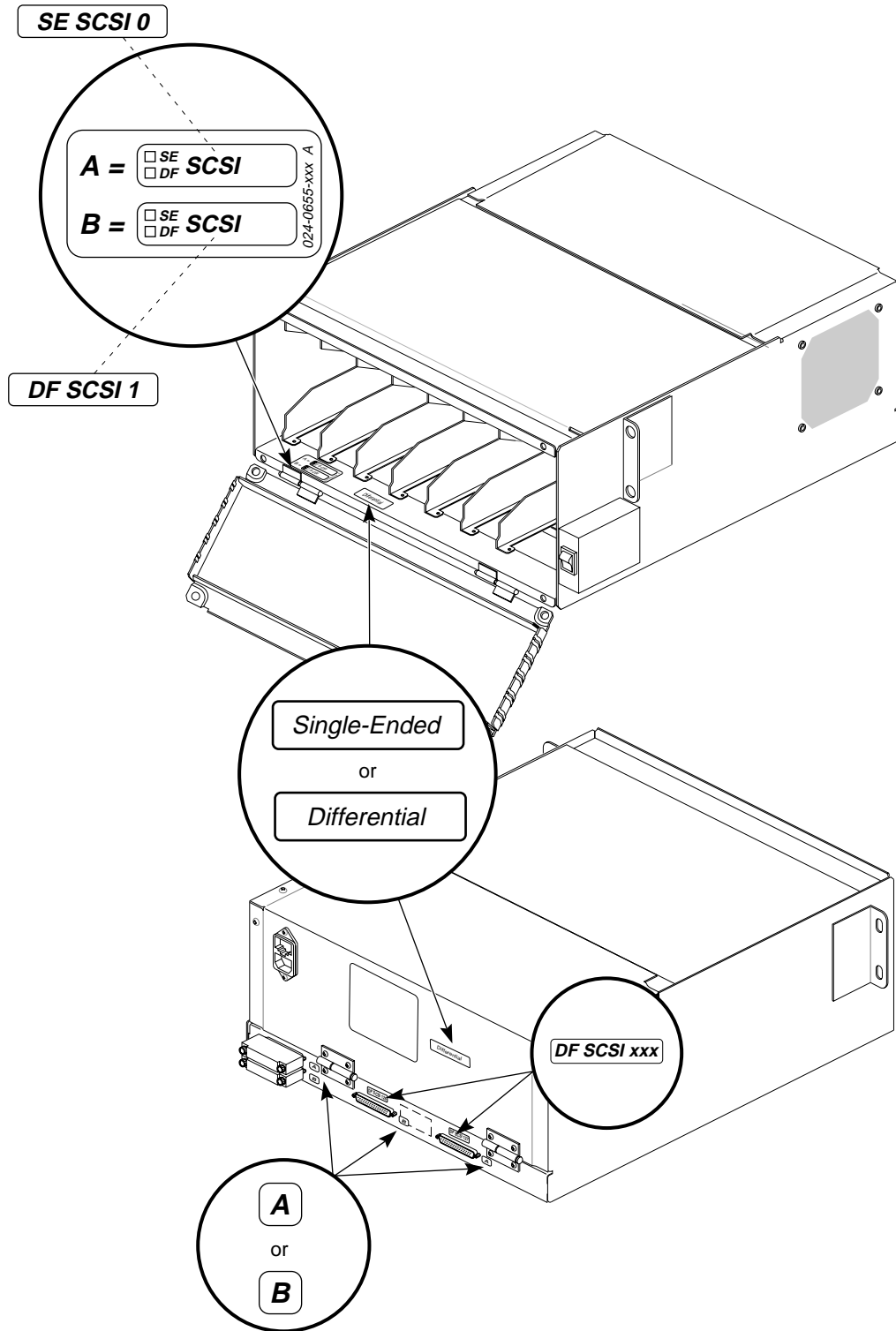


Figure D-39 SCSI Label Placement on a Vault SCSIBox 2

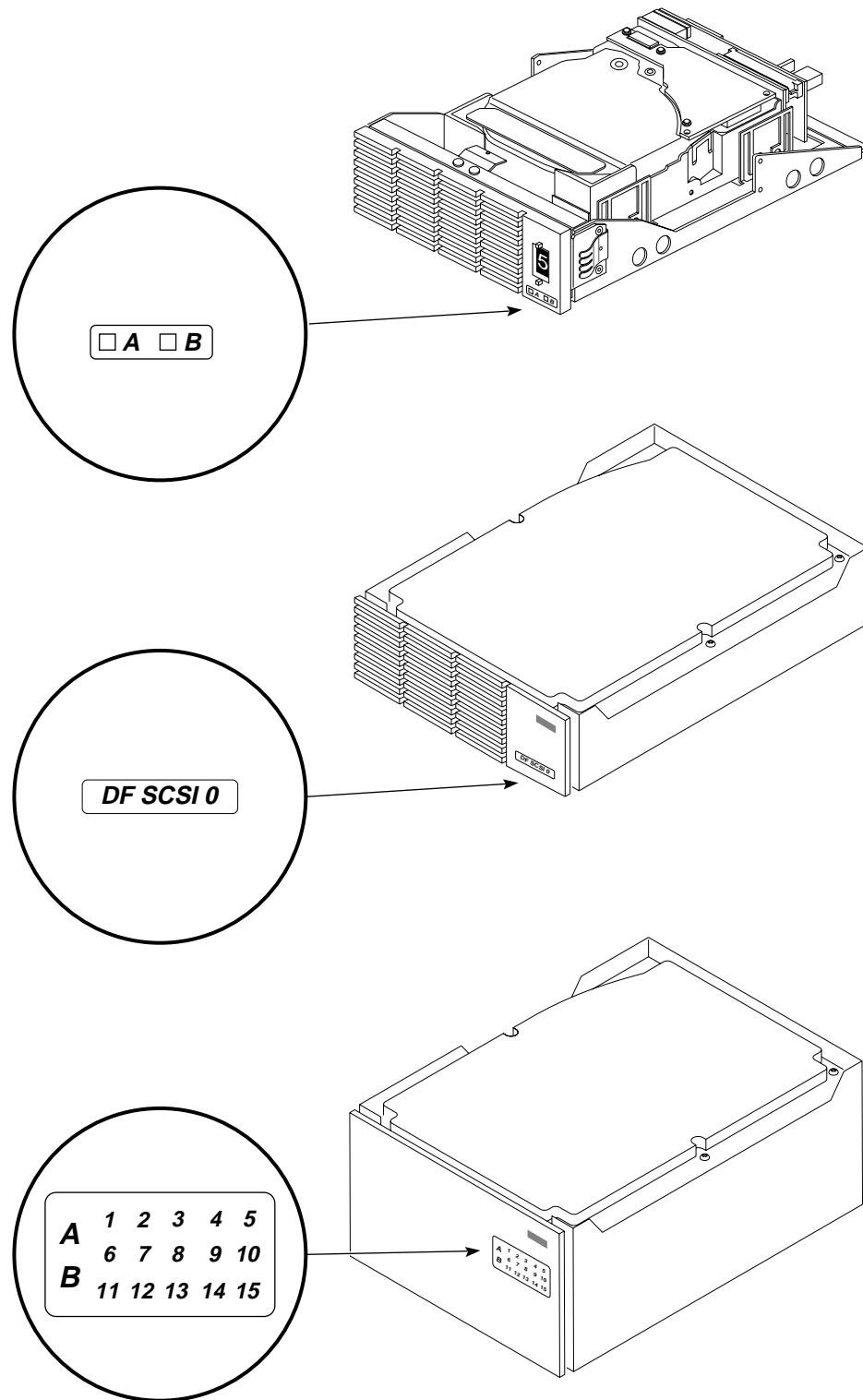


Figure D-40 Location of SCSI Labels on Devices

Appendix E

System Controller Error and Status Messages

Table E-1 through Table E-4 describe all of the error, status, and system event messages that can be displayed by the System Controller.

E.1 CPU Status Messages

Table E-1 lists the master CPU status messages.

Master CPU Status Message	Context and Meaning of Message
BOOT ARBITRATION NOT STARTED	The system CPU board(s) have not begun the arbitration process.
BOOT ARBITRATION IN PROGRESS	The System Controller is searching for the master CPU boot processor.
ARBITRATION COMPLETE SLOT O _x Y PROC O _x Z	The chosen CPU master has identified itself to the System Controller and communication is fully established.
BOOT ARBITRATION INCOMPLETE NO MASTER	An error has occurred in the boot process and no CPU master is communicating with the System Controller.
BOOT ARBITRATION ABORTED	The operator pushed one of the front panel buttons during the boot process. This caused the System Controller to stop looking for the boot master processor.

Table E-1 System Controller Master CPU Status Messages

E.2 System Error Messages

Table E-2 lists all of the system error messages.

Error Message	Error Meaning
1.5VDC HIGH WARNING	The voltage is outside the desired tolerance range but will not cause system errors. Power system service may be needed soon.
1.5VDC OVER VOLTAGE	The system backplane 1.5VDC power source exceeded the upper tolerance limit.
1.5VDC LOW WARNING	The voltage is outside the desired tolerance range but will not cause system errors. Power system service may be needed soon.
1.5VDC UNDER VOLTAGE	The system backplane 1.5VDC power source dropped below the allowed limit.
12VDC HIGH WARNING	The voltage is outside the desired tolerance range but will not cause system errors. Power system service may be needed soon.
12VDC OVER VOLTAGE	The system backplane 12VDC power source exceeded the upper tolerance limit.
12VDC LOW WARNING	The voltage is outside the desired tolerance range but will not cause system errors. Power system service may be needed soon.
12VDC UNDER VOLTAGE	The system backplane 12VDC power source dropped below the allowed limit.
48VDC HIGH WARNING	The voltage is outside the desired tolerance range but will not cause system errors. Power system service may be needed soon.
48VDC OVER VOLTAGE	The system backplane 48VDC power source exceeded the upper tolerance limit.
48VDC LOW WARNING	The voltage is outside the desired tolerance range but will not cause system errors. Power system service may be needed soon.
48VDC UNDER VOLTAGE	The system backplane 48VDC power source dropped below the allowed limit.
5VDC HIGH WARNING	The voltage is outside the desired tolerance range but will not cause system errors. Power system service may be needed soon.
5VDC OVER VOLTAGE	The system backplane 5VDC power source exceeded the upper tolerance limit.

Table E-2 System Error Messages

Error Message	Error Meaning
5VDC LOW WARNING	The voltage is outside the desired tolerance range but will not cause system errors. Power system service may be needed soon.
5VDC UNDER VOLTAGE	The system backplane 5VDC power source dropped below the allowed limit.
-12VDC HIGH WARNING	The voltage is outside the desired tolerance range but will not cause system errors. Power system service may be needed soon.
-12VDC OVER VOLTAGE	The system backplane -12VDC power source exceeded the upper tolerance limit.
-12VDC LOW WARNING	The voltage is outside the desired tolerance range but will not cause system errors. Power system service may be needed soon.
-12VDC UNDER VOLTAGE	The system backplane -12VDC power source dropped below the allowed limit.
-5.2VDC HIGH WARNING	The voltage is outside the desired tolerance range but will not cause system errors. Power system service may be needed soon.
-5.2VDC OVER VOLTAGE	The system backplane -5.2VDC power source exceeded the upper tolerance limit.
-5.2VDC LOW WARNING	The voltage is outside the desired tolerance range but will not cause system errors. Power system service may be needed soon.
-5.2VDC UNDER VOLTAGE	The system backplane -5.2VDC power source dropped below the allowed limit.
AMBIENT OVER TEMP	The incoming ambient air temperature is too high to provide proper system cooling.
BLOWER A FAILURE	The system blower fan A has failed.
BLOWER B FAILURE	The system blower fan B has failed.
BLOWER A RPM LOW	The System Controller has stepped up the blower speed to compensate for a low RPM reading.
BLOWER B RPM LOW	The System Controller has stepped up the blower speed to compensate for a low RPM reading.
BLOWER A RPM HIGH	The blower is running faster than expected. The system is <i>not</i> shut down.

Table E-2 System Error Messages

Error Message	Error Meaning
BLOWER B RPM HIGH	The blower is running faster than expected. The system is <i>not</i> shut down.
BLOWER A RPM FAILURE	The A blower RPMs are below tolerance after being stepped up to full speed.
BLOWER B RPM FAILURE	The B blower RPMs are below tolerance after being stepped up to full speed.
BOOT ERROR	A system processor failed to respond to the System Controller during boot arbitration.
BRD/CHASSIS OVER TEMP	A detector in a card cage or chassis sensed a temperature over allowed limit.
CPU NOT RESPONDING	The CPU system master is not responding to requests transmitted over the serial link.
FP BUTTON STUCK	The System Controller has detected a front panel button that has been depressed for more than 30 seconds. The System Controller cannot function properly under this condition.
NO SYSTEM CLOCK	The system backplane clock has failed.
POKA FAIL	Power ok A (POKA); a voltage source supporting the Power Enable A signal failed.
POKB FAIL	Power ok B (POKB); a voltage source supporting the Power Enable B signal failed.
POKC FAIL	Power ok C (POKC); a voltage source supporting the Power Enable C signal failed.
POKD FAIL	Power ok D (POKD); a voltage source supporting the Power Enable D signal failed.
POKE FAIL	Power ok E (POKE); a voltage source supporting the Power Enable E signal failed. The system will not power down because of this condition.
POWER FAIL WARNING	The Off-Line Switcher has detected an AC power loss.

Table E-2 System Error Messages

E.3 System Event Messages

Table E-3 lists the system event messages.

Event Message	Event Meaning
NMI	A non-maskable interrupt (NMI) was entered onto the system backplane from a front panel menu option in the System Controller.
SCLR DETECTED	The System Controller detected an SCLR on the system backplane. The reset was initiated from the System Controller front panel by an operator.
SYSTEM OFF	The key switch was turned to the Off position and the System Controller powered down the system.
SYSTEM ON	The System Controller has successfully powered up the system.
SYSTEM RESET	The System Controller detected an SCLR and initiated a system boot arbitration process. An SCLR process can be generated by any processor board or by the System Controller.

Table E-3 System Event Messages

E.4 Internal System Controller Error Messages

Table E-4 lists all of the System Controller's internal error messages.

Error Message	Error Meaning
BAD MSG: CPU PROCESS	The CPU or System Controller process has received an invalid message.
BAD MSG: DISPLAY	The display process has received an invalid message.
BAD MSG: POK CHK	The power ok check process received an invalid message.
BAD MSG: SEQUENCER	The sequencer process has received an invalid message.
BAD MSG: SYS MON	The system monitor process has received an invalid message.
BAD ALARM TYPE	The firmware attempted to send an invalid alarm to the CPU.

Table E-4 Internal System Controller Error Messages

Error Message	Error Meaning
BAD WARNING TYPE	The firmware attempted to send an invalid warning to the CPU.
BAD WARNING/ALARM	The routine that decodes alarm and warning messages detected an invalid message.
COP FAILURE	The Computer Operating Properly (COP) timer has exceeded time limits. The System Controller firmware must write to a COP timer port before it times out. If the firmware exceeds the time allowed between writes to a COP port, an interrupt is generated. The System Controller firmware may have entered an endless loop.
DEBUG SWITCH ERROR	The System Controller detected data corruption in the non-volatile RAM debug switch location.
COP MONITOR FAILURE	A Computer Operating Properly (COP) clock monitor failure was detected. The System Controller clock oscillator is operating at less than 10 kHz.
FP CONTROLLER FAULT	An error was detected in the front panel LCD display control process.
FP READ FAULT	A read of the front panel status register did not complete successfully.
FREE MSG NODE ERROR	The free message node queue has overflowed.
FREE TCB NODE ERROR	The free timer control block queue has overflowed.
ILLEGAL OPCODE TRAP	The System Controller's microprocessor tried to execute an illegal instruction. Probably because of a stack overrun followed by a process switch.
PULSE ACCU INPUT	An interrupt was detected on the pulse accumulator input port. The port is not used and an interrupt is considered an error.
PULSE ACCU OVERFLOW	The pulse accumulator overflow port received an interrupt. This port is unused and the interrupt is considered an error.
SPI TRANSFER	An interrupt was detected on the synchronous serial peripheral interface. This interface is not supported and the interrupt is an error.

Table E-4 Internal System Controller Error Messages

Error Message	Error Meaning
STACK FAULT PID 0-6	One of the seven stack areas used by a System Controller process has overflowed its assigned boundaries.
TEMP SENSOR FAILURE	The System Controller detected an invalid measurement from the temperature sensor.
TIMER IN COMP 1	The timer input compare port received an interrupt. The port is not used and the interrupt is considered an error.
TIMER OUT COMP 1-5	One of the five timer output compare ports received an interrupt. The port that received the interrupt is not supported and the interrupt is considered an error.
XMITTER 1 TIMEOUT	The System Controller's 1st UART experienced a failure.
XMITTER 2 TIMEOUT	The System Controller's 2nd UART experienced a failure.

Table E-4 Internal System Controller Error Messages

E.5 System Controller Messages

Table E-5 lists all of the System Controller messages by message number

Code	System Controller Long Message
040	Memory board configuration has failed. Cannot load IO PROM.
041	All memory banks had to be disabled due to test failures.
042	The address line self-test failed. Cannot continue.
043	Memory board configuration has failed. Cannot load IO PROM.
044	Memory board configuration has failed. Cannot load IO PROM.
047	Memory board configuration has failed. Cannot load IO PROM.
048	Memory board configuration has failed. Cannot load IO PROM.
049	The PROM was unable to disable failing memory banks.
050	You must have at least 32 megabytes of working memory to load the IO PROM
051	The IP19 PROM did not recognize any memory boards in the system.
070	The IP19 PROM did not recognize any IO4 boards in the system.
071	Diagnostics detected a problem with your IO4 PROM.
072	Diagnostics detected a problem with your IO4 PROM.

Table E-5 System Controller Codes and Long Messages

Code	System Controller Long Message
073	Diagnostics detected a problem with your IO4 PROM.
074	Diagnostics detected a problem with your IO4 PROM.
075	Diagnostics detected a problem with your IO4 PROM.
078	An exception occurred while downloading the IO4 PROM to memory.
079	There must be an EPC chip on the IO board in the highest-numbered slot.
080	An exception occurred while configuring an IO board.
081	The IA chip on the master IO4 board has failed diagnostics.
082	The IA chip on the master IO4 board has failed diagnostics.
083	The IA chip on the master IO4 board has failed diagnostics.
084	The IA chip on the master IO4 board has failed diagnostics.
085	The IA chip on the master IO4 board has failed diagnostics.
086	The IA chip on the master IO4 board has failed diagnostics.
088	The IA chip on the master IO4 board has failed diagnostics.
089	The IA chip on the master IO4 board has failed diagnostics.
090	The IA chip on the master IO4 board has failed diagnostics.
091	The IA chip on the master IO4 board has failed diagnostics.
092	The IA chip on the master IO4 board has failed diagnostics.
093	The IA chip on the master IO4 board has failed diagnostics.
094	The IA chip on the master IO4 board has failed diagnostics.
087	The EPC chip on the master IO4 board has failed diagnostics.
096	The EPC chip on the master IO4 board has failed diagnostics.
251	The PROM code took an unexpected exception.
252	The PROM received a nonmaskable interrupt.

Table E-5 System Controller Codes and Long Messages

E.6 System Controller Diagnostic Codes

Table E-6 lists System Controller diagnostic error codes and their meanings:

Code	Meaning
000	Device passed diagnostics.
001	Failed dcache1 data test.
002	Failed dcache1 addr test.
003	Failed scache1 data test.
004	Failed scache1 addr test.
005	Failed icache data test.
006	Failed icache addr test.
007	Dcache test hung.
008	Scache test hung.
009	Icache test hung.
040	Memory built-in self-test failed.
041	No working memory was found.
042	Memory address line test failed.
043	Memory data line test failed.
044	Bank failed configured memory test.
045	Slave hung writing to memory.
046	Bank disabled due to downrev MA chip.
047	A bus error occurred during MC3 config.
048	A bus error occurred during MC3 testing.
049	PROM attempted to disable the same bank twice.
050	Not enough memory to load the IO4 PROM.
051	No memory boards were recognized.
052	Bank forcibly re-enabled by the PROM.
060	CPU doesn't get interrupts from CC.
061	Group interrupt test failed.
062	Lost a loopback interrupt.
063	Bit in HPIL register stuck.
070	No working IO4 is present.
071	Bad checksum on IO4 PROM.
072	Bad entry point in IO4 PROM.

Table E-6 System Controller Diagnostic Codes

Code	Meaning
073	IO4 PROM claims to be too long.
074	Bad entry point in IO4 PROM.
075	Bad magic number in IO4 PROM.
078	Bus error while downloading IO4 PROM.
079	No EPC chip found on master IO4.
080	Bus error while configuring IO4.
081	Bus error during IA register test.
082	Bus error during IA PIO test.
083	IA chip register test failed.
084	Wrong error reported for bad PIO.
085	IA error didn't generate interrupt.
086	IA error generated wrong interrupt.
087	EPC register test failed.
088	Bus error on map RAM rd/wr test.
089	Bus error on map RAM address test.
090	Bus error on map RAM walking 1 test.
091	Bus error during map RAM testing.
092	Map RAM read/write test failed.
093	Map RAM address test failed.
094	Map RAM walking 1 test failed.
095	EPC UART loopback test failed.
096	Bus err while testing EPC.
120	CPU can't access memory
123	CC bus tag data test failed.
124	CC bus tag addr test failed.
125	CPU forcibly re-enabled by the PROM.
126	CPU's EAROM can't be corrected.
127	CPU's EAROM checksum is bad.
128	CPU's EAROM has been repaired - power-cycle the system to re-enable.
240	CPU writing configuration info.
246	CPU testing dcache.

Table E-6 System Controller Diagnostic Codes

Code	Meaning
247	CPU testing icache.
248	CPU testing scache.
249	CPU initializing caches.
250	CPU returning from master's code.
251	Unexpected exception.
252	A nonmaskable interrupt occurred.
253	POD mode switch set or POD key pressed.
253	Unspecified diagnostic failure.
254	Diagnostic value unset.
255	Device not present.

Table E-6 System Controller Diagnostic Codes

Appendix F

Board Fault LED Error Messages

F.1 IP19 CPU Board

The IP19 has two power bricks that step down the 48 volts from the midplane/backplane to 5.0 and 3.3 volts. Each brick has a corresponding power fault LED, as shown in Figure F-1.

Note: The LEDs are red and indicate a fault when lit.

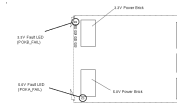


Figure F-1 IP19 Board Power Fault Indicators and Power Brick Locations

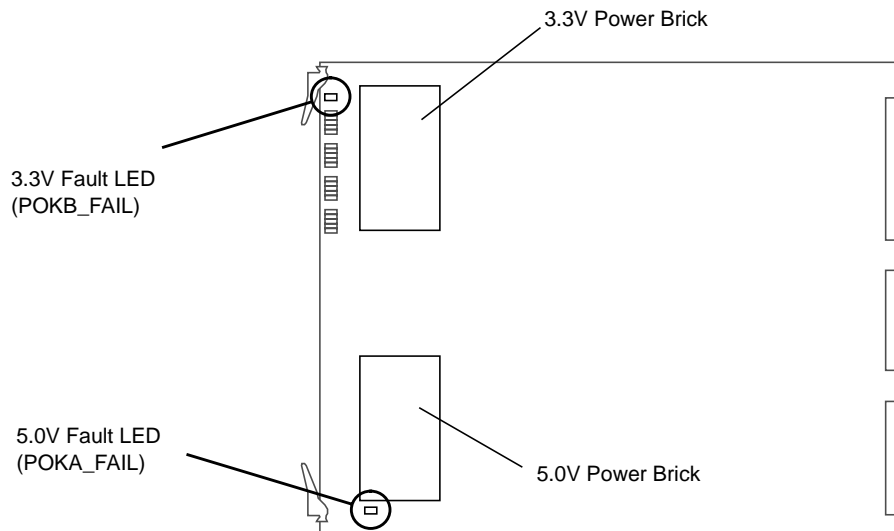


Figure F-2 IP19 Board Power Fault Indicators and Power Brick Locations

F.1.1 IP19 CPU Board Fault/Status Indicators

The IP19 board has a total of 24 fault indicators (see Figure F-2). A bank of six LEDs is assigned to each processor. Each bank displays 44 status values and 15 error values. The values are displayed by the banks as a binary number, with the most significant bit represented by the topmost LED (as viewed from the front of the cardcage). The status values are displayed as the system progresses through the power-on tests. If a constant value is displayed, convert the binary value to a decimal number and use Section F.1.2, “LED Status Codes,” to identify the status message. Each status message is displayed as a constant value and has the prefix “PLED” (PROM LED) attached to its description.

If a fatal error prevents the power-on tests from completing, the LEDs will flash the error value until the system is powered down or reset. Error messages have the prefix “FLED” (Flashing LED) attached to their descriptions. Section F.1.3, “LED Error Codes” lists the error codes.

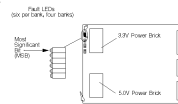


Figure F-3 IP19 Board Fault Indicators

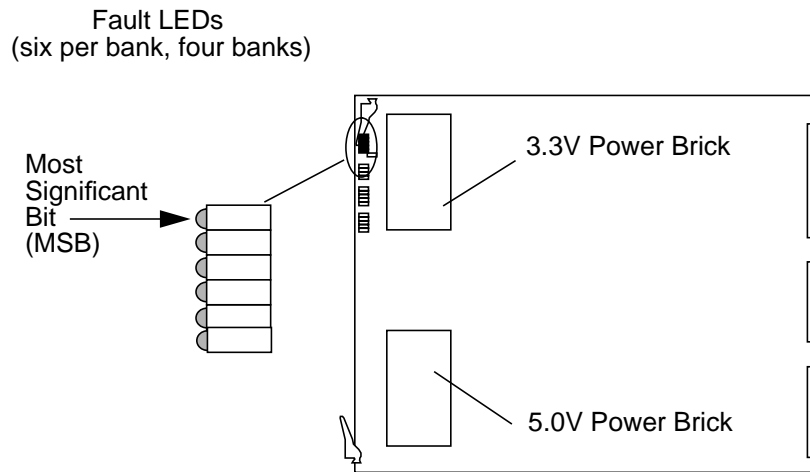


Figure F-4 IP19 Board Fault Indicators

F.1.2 LED Status Codes

These binary error codes apply to all of the microprocessors resident on the board. IP19 boards are configured with all four banks of LEDs, regardless of the number of microprocessors installed. See Table F-1.

LED Pattern Displayed X=Lit	Description (Constant Value Displayed)
MSB X O O O O O LSB	PLED_CLEAR_TAGS (1) - Clearing the primary data cache tags.
MSB O X O O O O LSB	PLED_CKCCLOCAL (2) - Testing CC chip local registers.
MSB X X O O O O LSB	PLED_CCLFAILED_INITUART (3) - Failed the local test but trying to initialize UART.
MSB O O X O O O LSB	PLED_CCINIT1 (4) - Initializing the CC chip local registers.
MSB X O X O O O LSB	PLED_CKCCCONFIG (5) - Testing the CC chip config registers (requires usable bus to pass). If test hangs, usually means bus has failed. Check oscillator.
MSB O X X O O O LSB	PLED_CCLFAILED_INITUART (6) - Failed the config reg test but trying to initialize UART.
MSB X X X O O O LSB	PLED_NOCLK_INITUART (7) - CC clock not running. Init UART anyway.
MSB O O O X O O LSB	PLED_CCINIT2 (8) - Initializing the CC chip config registers.
MSB X O O X O O LSB	PLED_UARTINIT (9) - Initializing the CC chip UART. If test hangs, usually means bad UART clock. Check connections to system Controller.
MSB O X O X O O LSB	PLED_CCUARTDONE (10) - Finished initializing the CC chip UART.
MSB X X O X O O LSB	PLED_CKACHIP (11) - Testing the A chip registers.
MSB O O X X O O LSB	PLED_AINIT (12) - Initializing the A chip.
MSB X O X X O O LSB	PLED_CKEBUS1 (13) - Checking the Ebus with interrupts.
MSB O X X X O O LSB	PLED_SCINIT (14) - Initializing the System Controller.
MSB X X X X O O LSB	PLED_BMARB (15) - Arbitrating for a bootmaster.

Table F-1 IP19 Board Test Status LED Codes

LED Pattern Displayed X=Lit	Description (Constant Value Displayed)
MSB O O O O X O LSB	PLED_BMASTER (16) - This processor is the bootmaster.
MSB X O O O X O LSB	PLED_CKEBUS2 (17) - Running second Ebus test. Run only by the bootmaster.
MSB O X O O X O LSB	PLED_POD (18) - Setting up this CPU slice for POD mode.
MSB X X O O X O LSB	PLED_PODLOOP (19) - Entering POD loop.
MSB O O X O X O LSB	PLED_CKPDCCACHE1 (20) - Checking the primary data cache.
MSB X O X O X O LSB	PLED_MAKESTACK (21) - Creating a stack in the primary data cache.
MSB O X X O X O LSB	PLED_MAIN (22) - Jumping into C code -- calling main.
MSB X X X O X O LSB	PLED_CKIAID (23) - Checking IA and ID chips on master IO4.
MSB O O O X X O LSB	PLED_CKEPC (24) - Checking EPC chip on master IO4.
MSB X O O X X O LSB	PLED_IO4INIT (25) - Initializing the IO4 PROM.
MSB O X O X X O LSB	PLED_NVRAM (26) - Getting NVRAM variables.
MSB X X O X X O LSB	PLED_FINDCONS (27) - Checking the path to the EPC chip, which contains the console UART.
MSB O O X X X O LSB	PLED_CKCONS (28) - Testing the console UART.
MSB X O X X X O LSB	PLED_CONSINIT (29) - Setting up the console UART.
MSB O X X X X O LSB	PLED_CONFIGCPUS (30) - Configuring out CPUs that are disabled.
MSB X X X X X O LSB	PLED_CKRAWMEM (31) - Checking raw memory (running Board Internal Self-Test [BIST]).
MSB O O O O O X LSB	PLED_CONFIGMEM (32) - Configuring memory.
MSB X O O O O X LSB	PLED_CKMEM (33) - Checking configured memory.

Table F-1 (continued) IP19 Board Test Status LED Codes

LED Pattern Displayed X=Lit	Description (Constant Value Displayed)
MSB 0 X 0 0 0 X LSB	PLED_WTCONFIG (34) - Writing evconfig structure: The bootmaster CPU writes the entire array. The slave CPUs only write their own entries.
MSB X X 0 0 0 X LSB	PLED_LOADPROM (35) - Loading IO4 PROM.
MSB 0 0 X 0 0 X LSB	PLED_CKSCACHE1 (36) - First pass of secondary cache testing. Tests the scache like a RAM.
MSB X 0 X 0 0 X LSB	PLED_CKPICACHE (37) - Checking the primary instruction cache.
MSB 0 X X 0 0 X LSB	PLED_BADEAROM (38) - The EAROM associated with the CPU is corrupt and couldn't be repaired.
MSB X X X 0 0 X LSB	PLED_CKSCACHE2 (39) - Checking secondary data cache writeback mechanism.
MSB 0 0 0 X 0 X LSB	PLED_CKBT (40) - Check the bus tags.
MSB X 0 0 X 0 X LSB	PLED_BTINIT (41) - Clearing the bus tags.
MSB 0 X 0 X 0 X LSB	PLED_CKPPROM (42) - Checksumming the I/O PROM.
MSB X X 0 X 0 X LSB	PLED_INSLAVE (43) - This CPU is entering slave mode.
MSB 0 0 X X 0 X LSB	PLED_PROMJUMP (44) - Jumpering to the I/O PROM.
MSB X 0 X X 0 X LSB	PLED_SLAVEJUMP (45) - A slave is jumping to the IO4 PROM slave code.

Table F-1 (continued) IP19 Board Test Status LED Codes

F.1.3 LED Error Codes

Table F-2 lists the IP19 board power-on test failure LED codes.

LED Pattern Displayed X=Lit	Description (Flashing Value Displayed)
MSB 0 X X X 0 X LSB	FLED_CANTSEEMEM (46) - Flashed by slave processors if they take an exception while trying to write their evconfig entries. Often means that processor is getting D-chip parity errors.

Table F-2 IP19 Board Power-on Test Failure LED Codes

LED Pattern Displayed X=Lit	Description (Flashing Value Displayed)
MSB X X X X O X LSB	FLED_NOUARTCLK (47) - The CC UART clock is not running. No System Controller access possible.
MSB O O O O X X LSB	FLED_INPOSSIBLE1 (48) - System fell through an unreturning subroutine (shouldn't be possible).
MSB X O O O X X LSB	FLED_DEADCOPI (49) - Coprocessor 1 is dead (no error does not mean coprocessor is good).
MSB O X O O X X LSB	FLED_CCCLOCK (50) - Cache controller (CC) clock is not running.
MSB X X O O X X LSB	FLED_CCLOCAL (51) - Failed CC local register tests.
MSB O O X O X X LSB	FLED_CCCONFIG (52) - Failed CC config register tests.
MSB X O X O X X LSB	FLED_ACHIP (53) - Failed A chip register tests.
MSB O X X O X X LSB	FLED_BROKEWB (54) - By the time this CPU arrived at bootmaster arbitration barrier, the rendezvous time had passed. CPU is running too slowly, the ratio of the bus clock rate to CPU clock rate is too high, or a bit in the CC clock is stuck on.
MSB X X X O X X LSB	FLED_BADCACHE (55) - CPU's primary data cache test failed.
MSB O O O X X X LSB	FLED_BADIO4 (56) - IO4 board is bad (can't get to console).
MSB X O O X X X LSB	FLED_UTLBMISS (57) - Took a TLB refill exception.
MSB O X O X X X LSB	FLED_XTLBMISS (58) - Took an extended TLB refill exception.
MSB X X O X X X LSB	FLED_CACHE (59) - Unused.
MSB O O X X X X LSB	FLED_GENERAL (60) - Took a general exception.
MSB X O X X X X LSB	FLED_NOTIMPL (61) - Took an unimplemented exception.
MSB O X X X X X LSB	FLED_ECC (62) - Took a cache error exception.

Table F-2 (continued) IP19 Board Power-on Test Failure LED Codes

F.1.4 LED Power-on Status Codes

When the Power-on Diagnostics (POD) run, a pair of LEDs from each bank of processor

LEDs flashes alternately. After the POD finishes and the system enters the PROM monitor, the LEDs on the bootmaster CPU will display a fixed value (binary 18). All other slave processors will loop on a pattern waiting for a command (see Figure F-3).

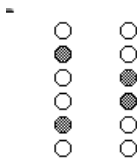


Figure F-5 Slave Processor LED Pattern

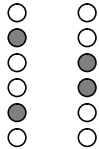


Figure F-6 Slave Processor LED Pattern

The bootmaster CPU will loop on the pattern shown in Figure F-4 when polling the CC UARTs.



Figure F-7 CPU LED Pattern When Polling

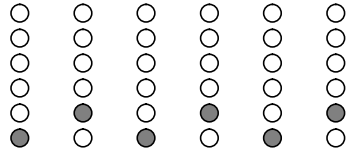


Figure F-8 CPU LED Pattern When Polling

F.2 MC3 Memory Board

The MC3 board currently has a single +5.0-volt power brick and a corresponding fault indicator. Later versions of this board may have an additional +3.3V brick, as shown in Table F-3 and Figure F-5.

Note: The LEDs are red and indicate a fault when lit.

LED Reference Designation	Color / Meaning When Lit	Description
B4P2 (POKA_FAIL)	Red - Fault	Bad 5.0V power brick
N8P2 (POKB_FAIL)	Red - Fault	Bad 3.3V power brick

Table F-3 MC3 Board Fault LEDs

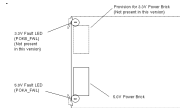


Figure F-9 MC3 Board Fault Indicators and Power Brick Locations

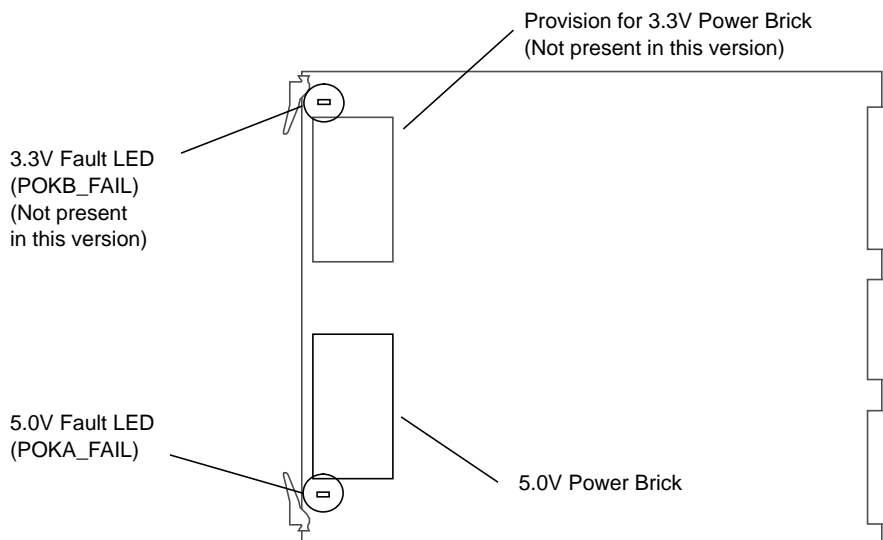


Figure F-10 MC3 Board Fault Indicators and Power Brick Locations

F.3 IO4/VCAM Board

The IO4 board has a single bank of five LEDs and two secondary regulators. These regulators convert +5 volts to +1.5 volts (see Table F-4 and Figure F-6). The IO4 also has three replaceable fuses, as shown in Figure F-6.

The VCAM board has three secondary regulators; +1.5, -12, and -5.2V.

Note: All LEDs are red and indicate a fault when lit. The bottom three LEDs provide power fault indications for the attached VMEbus Channel Adapter Module (VCAM). The VCAM fault LEDs are mounted on the IO4 board because the dimensions of the VCAM would make on-board LEDs extremely difficult to read. These LEDs are unlit when no VCAM is installed.

LED Reference Designation	Color / Meaning When Lit	Description
M2P6 (POKB_FAIL)	Red - Fault	Bad 1.5V regulator A (near top) on the IO4 board
M1P6 (POKB_FAIL)	Red - Fault	Bad 1.5V regulator B (near bottom) on the IO4 board
M0P6 (POKB_FAIL)	Red - Fault	Bad 1.5V regulator on the VCAM
L9P6 (POKA_FAIL)	Red - Fault	Bad +12V to -5.2V regulator on the VCAM
L8P6 (POKA_FAIL)	Red - Fault	Bad +12.0V to -12.0V regulator on the VCAM

Table F-4 IO4 Board Fault LEDs

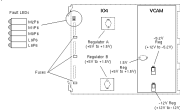


Figure F-11 First IO4 Board/VCAM Fault Indicator and Voltage Regulator Locations

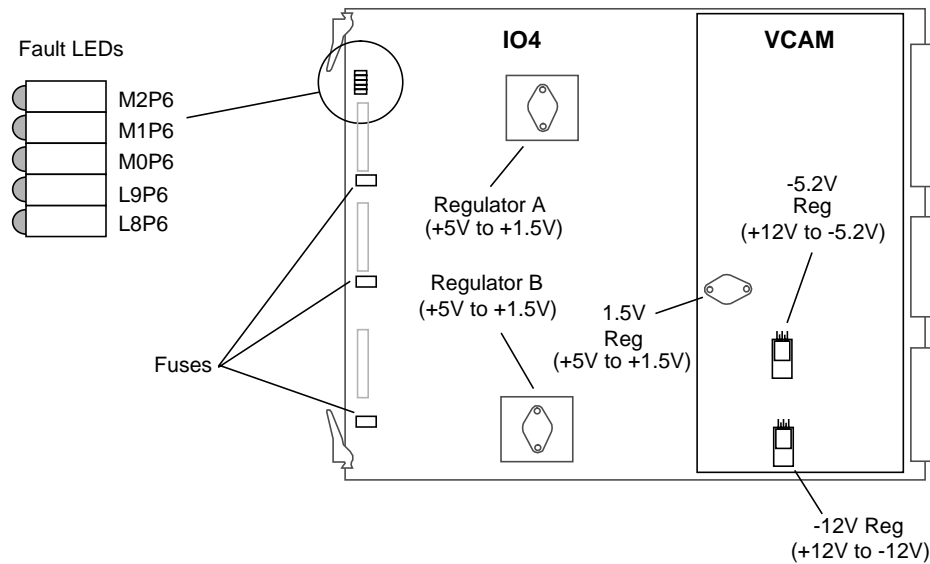


Figure F-12 First IO4 Board/VCAM Fault Indicator and Voltage Regulator Locations

F.4 Remote VCAM (RMT_VCAM) Board

The RMT_VCAM board has a bank of nine fault LEDs that flag power faults stemming from the Cardcage 3 backplane, the System Controller, and the three regulators on the RMT_VCAM itself. There are also six test points corresponding to the monitored voltages (see Table F-5 and Figure F-7).

Note: The voltage levels of the three on-board voltage regulators are monitored by two sets of LEDs: the three red LEDs and the bottom three amber LEDs. The red LEDs light when a voltage error is sensed and remain lit until the system is reset. The amber LEDs provide a “hot” measurement and light only when an error in the monitored voltage levels is currently present.

LED Reference Designation	Color / Meaning When Lit	Description
M0P6	Red - Fault	Bad +1.5V regulator on the RMT_VCAM
L9P6	Red - Fault	Bad -5.2V regulator on the RMT_VCAM
L8P6	Red - Fault	Bad -12V regulator on the RMT_VCAM
L7P6	Green - Good	5V input (V5_AUX) from System Controller to RMT_VCAM (should always be on)

Table F-5 Remote VCAM Fault LEDs

LED Reference Designation	Color / Meaning When Lit	Description
L6P6	Amber - Fault	Bad +12V input from the backplane
L5P6	Amber - Fault	Bad +5V input (VCC) from the backplane
L4P6	Amber - Fault	Bad +1.5V regulator on the RMT_VCAM
L3P6	Amber - Fault	Bad -5.2V regulator on the RMT_VCAM
L2P6	Amber - Fault	Bad -12V regulator on the RMT_VCAM

Table F-5 Remote VCAM Fault LEDs

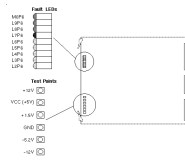


Figure F-13 Remote VCAM Fault Indicator LEDs and Test Points

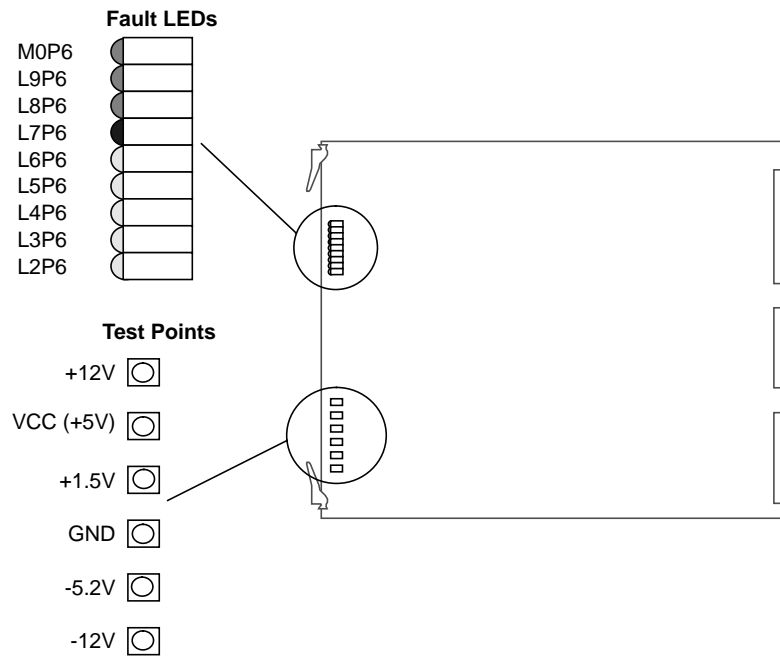


Figure F-14 Remote VCAM Fault Indicator LEDs and Test Points

F.5 Mezzanine (F Mezz and S Mezz) Boards

Both F mezzanine boards (long F mezz and short F mezz) have a 5V-to-1.5V regulator, identical to those on the IO4 and VCAM. Each F mezz board also has a single, red power fault LED, as shown in Figure F-8. The LED lights when the voltage level is out of range.

The S mezzanine board (not shown) has no regulators but has three removable fuses.

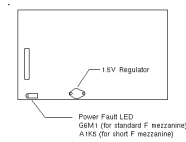


Figure F-15 F Mezzanine Board Fault LED and Voltage Regulator Locations

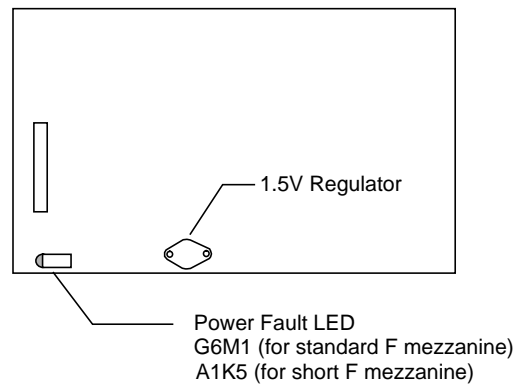


Figure F-16 F Mezzanine Board Fault LED and Voltage Regulator Locations

F.6 SCSIBox Drive Enclosure

There is a +5V and a +12V power fault LED located behind each drive in the SCSIBox. Both LEDs are green and are lit during normal operation (see Figure F-9).

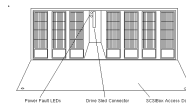


Figure F-17 SCSIBox Fault Indicators

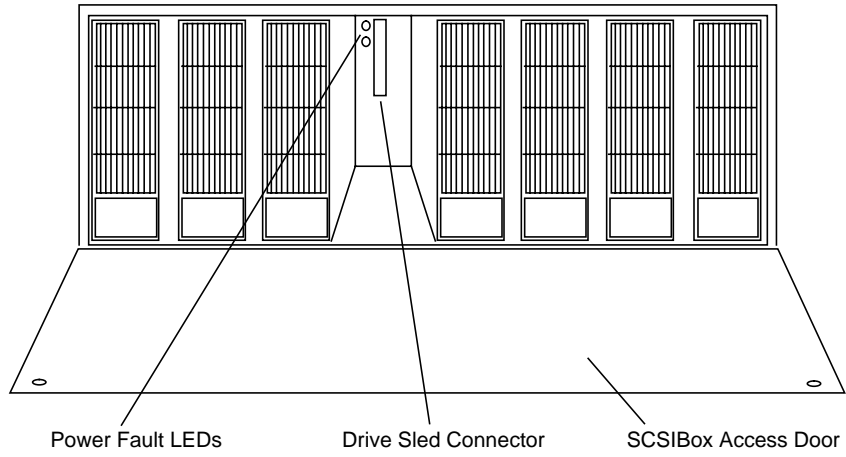


Figure F-18 SCSIBox Fault Indicators