CHALLENGE™ / Onyx™ L Deskside Installation Instructions

Document Number 108-7039-020

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Installation of this upgrade requires specific training and technical knowledge. These instructions are provided for use only by Silicon Graphics, Inc., Field Engineers or other Silicon Graphics trained personnel. This equipment utilizes electrical power internally that is hazardous if the equipment is improperly disassembled.

FCC Warning

This equipment has been tested and found compliant with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Attention

This product requires the use of external shielded cables in order to maintain compliance pursuant to Part 15 of the FCC rules.

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Document Number 108-7039-020

Silicon Graphics, Inc.
Mountain View, California

Chapter 1

Overview

This document introduces the CHALLENGE™/Onyx™ L deskside system (Model No. CMN A011) and provides the information necessary to install, configure, and test the system. This information is written for system support engineers (SSEs) or other authorized Silicon Graphics® employees who are responsible for the installation of these systems.

1.1 Product Description

The multiprocessor CHALLENGE L and Onyx L (hereinafter called the CHALLENGE/Onyx deskside) systems are an evolutionary enhancement over previous-generation Silicon Graphics deskside systems such as the 12-slot and 15-slot twin towers and 13-slot and 14-slot Single Towers. See Figure 1-1 and Figure 1-2.

Externally, the CHALLENGE (server) and the Onyx (graphics) deskside systems closely resemble the Single Tower and Crimson™ systems (previous generation Silicon Graphics deskside computers). These systems all use a similar chassis type, covers, drive and I/O doors; however, internally, the CHALLENGE/Onyx L system differs radically from the older-style systems and incorporates a complete redesign in comparison with the previous deskside system architecture. The CHALLENGE/Onyx deskside chassis has also undergone some subtle, but highly effective, changes that have contributed to the systems overall improvement. These internal and external improvements include

- greater internal storage capacity (The new chassis design supports up to seven internal drives.)
- greater main memory (up to 2 GB of RAM per MC3 using 64 MB SIMMs)
- memory interleaving for faster memory accessing
- more and faster CPUs (from 2 to 12 MIPS® R4400™ processors in the server configuration and from two to four processors in the graphics system)
- more I/O channels using add-on SCSI mezzanine boards and optional I/O connectivity
- enhanced graphics with the RealityEngine^2™ or VTX™ graphics board set
- improved system cooling

In addition, the CHALLENGE/Onyx deskside system provides these new key features:

- system status panel that provides a continuous display of current system operating conditions
- offline switching (OLS) power supply that operates at 110 or 220 VAC and provides up to a maximum of 1900 watts of power.

Other distinguishing features of this system include

- single chassis for both drives and cards
- dual small computer system interface (SCSI) channels
- all front-loading drives (FLDs)

Note: The CHALLENGE / Onyx system use a new front loading mounting device, a slide-lever *sled* design that is slimmer and less bulkier than the previous manual push-button tray model. In addition, the new sled mechanically inserts the drive into the bay to reduce possible shock to the drive.

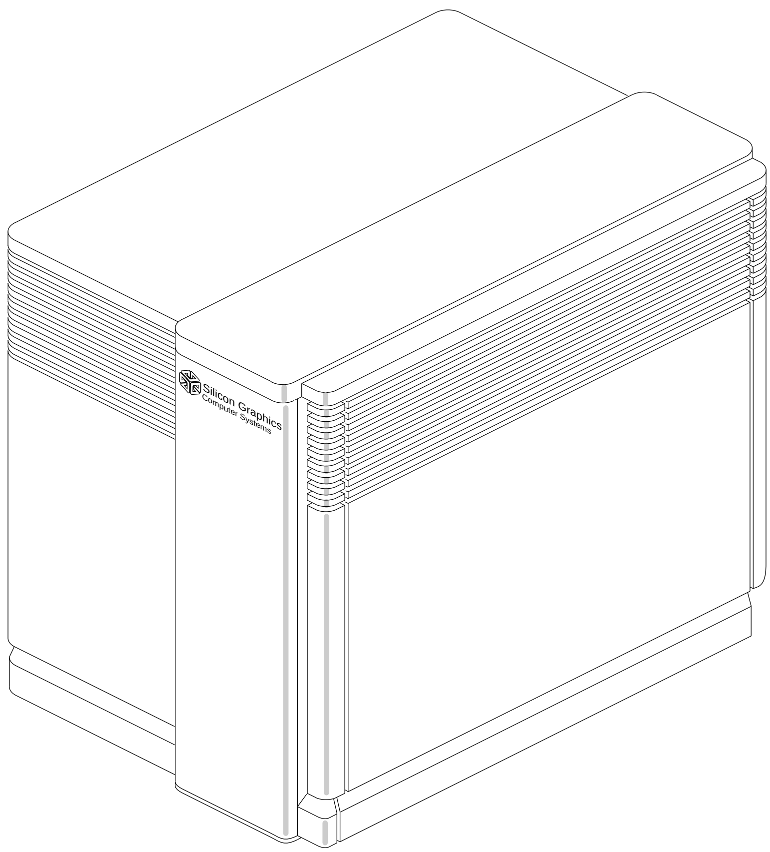


Figure 1-1 CHALLENGE / Onyx Deskside System

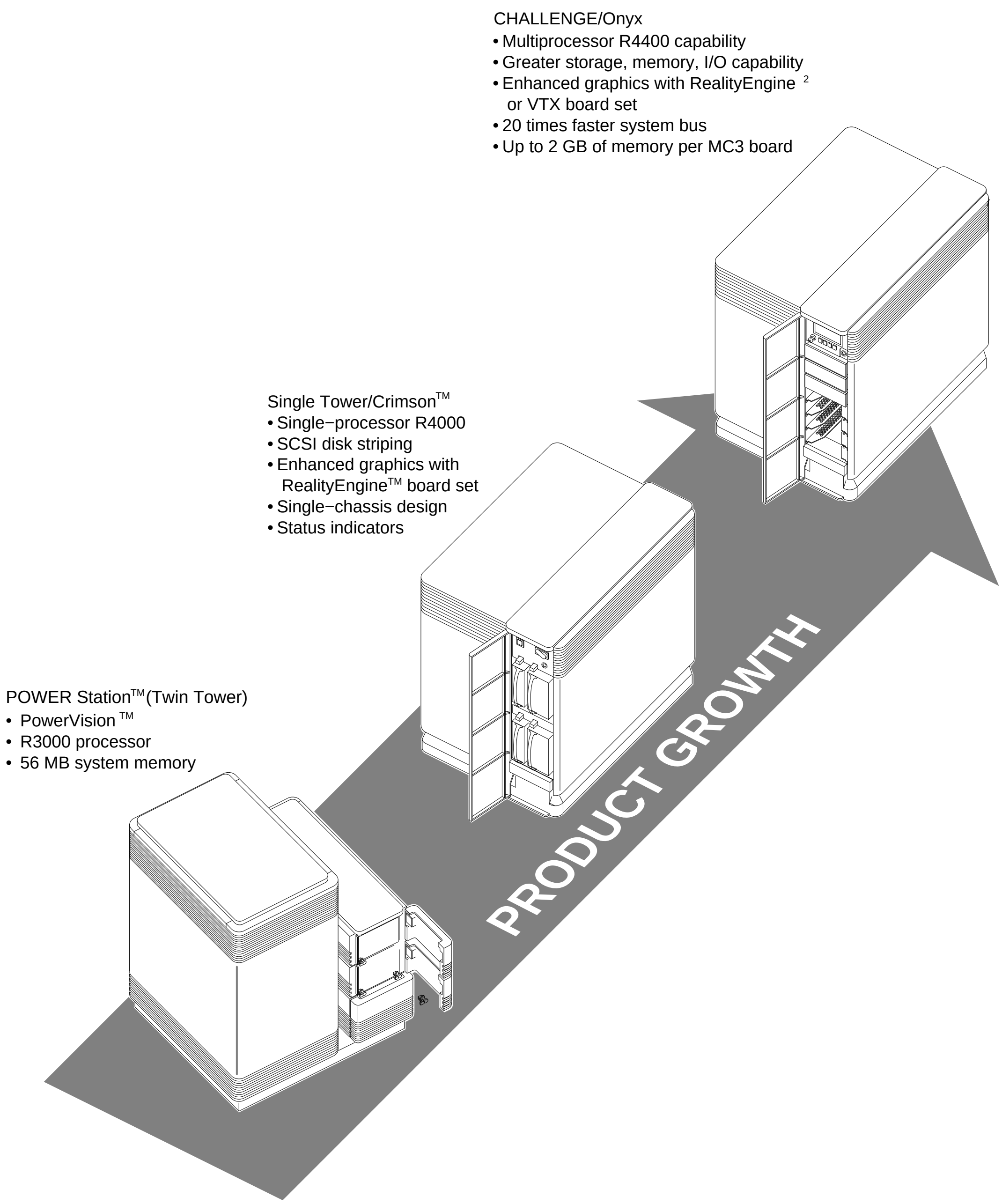


Figure 1-2 CHALLENGE / Onyx Deskside Product Evolution

1.2 Terminology

If you read many Silicon Graphics documents, or talk with various organizations in the company, you may encounter different terminology being used for the same concepts. To avoid confusion, Table 1-1 provides a list of these terms and their marketing and in-house aliases.

Marketing Term	In-house Name	Term Used in This Manual
CHALLENGE L and Onyx L deskside and CHALLENGE XL and Onyx XL rackmount systems	Everest	CHALLENGE / Onyx deskside and rackmount systems
CHALLENGE L and Onyx L deskside systems	Eveready	CHALLENGE / Onyx deskside systems
CHALLENGE XL and Onyx XL rackmount systems	Terminator	CHALLENGE / Onyx rackmount systems
CHALLENGEvault	Terminator 2 or T2	CHALLENGE Vault
RealityEngine^2	Mirage	RealityEngine^2
POWERpath-2	Everest system architecture	Everest system architecture
POWERpath-2 SYSTEM bus	Everest bus or Ebus	Everest bus or Ebus
POWERpath-2 Interleaved Memory board	MC3	MC3
POWERpath-2 I / O board	IO4 board	IO4 board
HIO bus	Ibus	Ibus
HIO modules	Mezz cards	Mezz cards
IRIX release 4D1-5.0	Sherwood	IRIX™ -5.0

Table 1-1 CHALLENGE / Onyx Multiname Terms

1.3 Safety

Read these safety statements carefully before you install or remove any part of the system.

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

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 part according to the manufacturer's instructions.**

Caution: This equipment is extremely sensitive to damage from electrostatic discharge (ESD), an electrical charge caused by the buildup of electrical potential on clothing and other materials. You must use the following ESD preventive measures:

- Attach a ground strap to your wrist when connecting / disconnecting boards or 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 provided antistatic bags until they are needed.
- Do not place boards on top of the antistatic bag unless the outside of the bag also has antistatic protection. If you are not sure that the outside of the bag is protected, place the boards on top of an antistatic mat.
- Remove a board from its antistatic bag only when you are properly grounded to the chassis ground with a ground strap.
- Do not disconnect the power cord from the wall socket *and* the chassis if you are servicing a system or installing a hardware upgrade. You will lose the system ground and could damage the equipment as a result.
- Do not use an ohmmeter on the boards.

Caution: There are 14 fuses installed on the SCSI backplane. These normally are not field replaceable, because they are soldered directly onto the backplane. However, for continued protection against risk of fire, replace them only with a Cooper Industries, Bussman Div., P / N MCR-5, 125 V, 5 A-rated fuse.

1.4 Restrictions and Important Notes

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

CHALLENGE / Onyx systems require IRIX™-5.0 (Sherwood) or later.

Chapter 2

Chassis Tour

This chapter provides an overview of the chassis for the CHALLENGE / Onyx deskside system; a description of the controls, connectors, and indicators; and a functional description of the backplane.

2.1 The New CHALLENGE/Onyx Deskside Components

Table 2-1 identifies the new principal components of the CHALLENGE / Onyx deskside systems as well as available options and briefly compares them with previous Crimson and Single Tower technology.

Product/Board Name	Description	Comments/Comparison
System processor boards		
IP19 (P / N 030-0249-*xxx*, two processor version and P / N 030-0250-*xxx*, 4 processor version)	R4400 multiprocessor CPU board	This board replaces the IP17 *single processor*, 50 MHz R4000 CPU in the Crimson and Single Tower systems. Not only is the IP19 board significantly faster, but it contains from two to four R4400s per CPU board. Another significant difference between the IP19 and the IP17 is that the IP17 board houses system main memory. In the CHALLENGE / Onyx system, main memory resides on the MC3 memory board.

Table 2-1 The New CHALLENGE / Onyx System Components

Product/Board Name	Description	Comments/Comparison
MC3 (P / N 030-0245-*xxx*)	Memory board	This board replaces the MC2 memory board used in the Single Tower system. The MC3 board supports memory interleaving, which enables faster read and write accesses across the bus. The MC3 also supports up to 2 GBs per memory board. The Single Tower and Crimson systems only support up to 256 MB of RAM.
IO4 base board (P / N 030-0240-*xxx*)	Basic system interface board. This board has interfaces to the SCSI bus and the Ethernet.	This board replaces the IO3 and has undergone the most changes of the base system boards as follows: — The IO4 board provides two standard SCSI channels and up to six additional channels using SCSU mezzanine boards. The IO3 provided only two channels. In addition, many of the IO4 channels can be configured as either differential or single-ended. The IO3 provided only single-ended SCSI connections. — The IO4 provides RS-232 support. These serial channels were previously provided through the CPU boards in the Crimson and Single Tower systems. — The IO4 also provides an RS-422 channel, a Centronics-compatible parallel port, and the standard attachment unit interface (AUI) 15-pin Ethernet connector. — A CHALLENGE (server) system can support up to three IO4 boards. The Single Tower and Crimson systems supported only one IO3 board.

Table 2-1 (continued) The New CHALLENGE / Onyx System Components

Product/Board Name	Description	Comments/Comparison
System bus	The Ebus	The Everest bus has a bandwidth of 1.2 GB per second and is 20 times greater than the bandwidth of the MP bus in the Single Tower and Crimson systems.
I/O Subsystem		
Front-loading devices (FLDs)	The CHALLENGE / Onyx drive now resides on a drive sled that mounts into a drive tray in the chassis.	The CHALLENGE / Onyx deskside system supports up to seven internal half-height drives. The Single Tower and Crimson systems supported only four drives.
Interface modules (mezzanine boards)	These boards provide a variety of additional interfaces by mounting directly to the IO4 base board. Some mezzanine (or mezz) boards provide additional SCSI channels; others, like the VCAM board, provide connections to the VMEbus and graphics subsystem.	See Figure 2-1.
VME channel adapter module (VCAM, P / N 030-0243-*xxx*)	This board provides the interface between the Everest system bus and the VMEBus. This board also connects the flat cable interface (FCI) module to the graphics subsystem. The VCAM mounts directly onto the IO4 base board. This board is always installed on the first IO4 board.	See Figure 2-2.
Flat Cable Interface modules (standard 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. The long board cannot be used with a VCAM.	See Figure 2-3.

Table 2-1 (continued) The New CHALLENGE / Onyx System Components

Product/Board Name	Description	Comments/Comparison
SCSI channel adapter boards	These small boards that mount directly to the SCSI bus connectors on the IO4 board are used to configure the SCSI bus for single-ended or differential operation. They are color-coded as follows: red = differential, green = single-ended.	See Figure 2-4.
IO4 Filter board	This board provides noise suppression for signals going between the IO4 board and the I/O panel. This board attaches directly to the I/O panel.	See Figure 2-5.
System Power		
Offline switching (OLS) power supply	This is a 1900-watt switching power supply that converts 110 or 220 VAC without jumper modification.	The OLS converts the input voltage to 48 VDC at 37 amps, then distributes the regulated voltage to a set of backplane power boards.
Power boards	Power boards are DC-to-DC converters that take the 48 volts from the offline switching (OLS) power supply and step it down for the buses, circuit boards, and SCSI drives.	These boards connect directly to the back of the backplane. See Section 2.4, “Backplanes,” for additional information.
Graphics I/O subsystem		
VTX/RealityEngine^2	This is the Onyx graphics board set. There are two flavors of this board set: VTX and RealityEngine^2 (RE^2). For a list of differences between the two graphic board sets, see Chapter 4, “Theory of Operations.”	This board set replaces the RealityEngine and VGX/VGXT graphics board set for the Single Tower and Crimson systems. This board set features up to 50 percent more GE processing power.
Geometry Engine® (GE10—P/N 030-0325-*xxx*) Note: The VTX uses a cost-reduced version of the GE10 board, known as the GE10V (P/N 030-0363-*xxx*).	The GE10 processes commands and data from the host and is the first stage in the graphics pipeline.	This board replaces the GE8 in the RealityEngine board set. The GE10 has 12 GE processors compared to 8 GE processors in the GE8 board.
Display Generator (DG2—P/N 030-0223-*xxx*)	The DG2 receives digital data from the Raster Memory and processes it to produce an analog signal for display.	This board is identical to the board used in the RealityEngine graphics.

Table 2-1 (continued) The New CHALLENGE/Onyx System Components

Product/Board Name	Description	Comments/Comparison
Raster Memory (RM4—P / N 030-0337-*xxx*)	The RM4 scans and converts triangle data into pixel data.	This board is identical to the board used in the RealityEngine graphics. However, the RE^2 / VTX board set does not require an RM4T board to terminate the triangle bus as in the Reality Engine. Termination takes place on the backplane in the CHALLENGE / Onyx systems.
Video Filter (EF7) board	This board supplies signal noise suppression between the graphics boards and I / O panel. This board attaches directly to the I / O panel.	See Figure 2-6.

Table 2-1 (continued) The New CHALLENGE / Onyx System Components

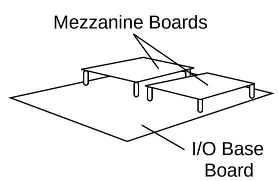


Figure 2-1 Interface modules (mezzanine boards)

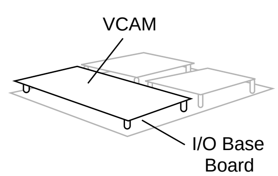


Figure 2-2 VME channel adapter module (VCAM, P / N 030-0243-*xxx*)

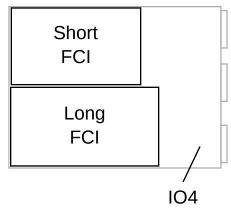


Figure 2-3 Flat Cable Interface modules (standard and short)

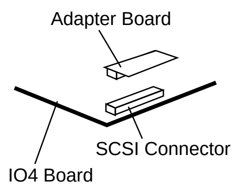


Figure 2-4 SCSI channel adapter boards

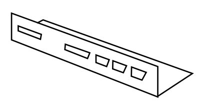


Figure 2-5 IO4 Filter

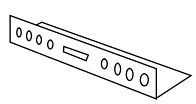


Figure 2-6 Video filter (EF7)

2.2 Controls, Connectors, and Indicators

Figure 2-7, Figure 2-8, and Figure 2-9 show the locations of the standard controls, connectors, and indicators for the CHALLENGE / Onyx deskside systems. Table 2-2, Table 2-3, and Table 2-4describe each item.

Item	Description
Power receptacle	This socket is an IEC320-C20 and accepts an IEC 320-C19 connector.
Main circuit breaker	This circuit breaker switch controls the main power supply to the chassis and protects the system from electrical damage. The circuit breaker is 25 amps for both 110 and 220 VAC operation.
System status / controller panel	This panel provides a display of current system operating conditions, such as temperature, power, and internal hardware status. If the system crashes, the system controller will record the events leading up to the failure. You can then retrieve these error messages for analysis. See the *CHALLENGE/Onyx Diagnostic Roadmap* (Document No. 108-7045-*xxx*) for a complete description.
Fault	The amber LED lights briefly when power is applied to the System Controller. This LED remains lit until the System Controller successfully initializes and a series of power-on tests have completed.
Power on	This green LED glows when the system power switch is on and the DC power levels are normal.
OFF / ON / MGR and system key	This three-position switch and the system key enable the user to bootup the system, reset the system, and perform system administrator tasks. See the *CHALLENGE/Onyx Diagnostic Roadmap* (Document No. 108-7045-*xxx*) for a complete description.

Table 2-2 System Controls, Connectors, and Indicators

Note: The key is the same for all system; however, the customer should make copies and keep them in a safe place. The system cannot boot without the key. In addition, to prevent possible tampering, the customer should not leave the system key in the lock during normal operation.

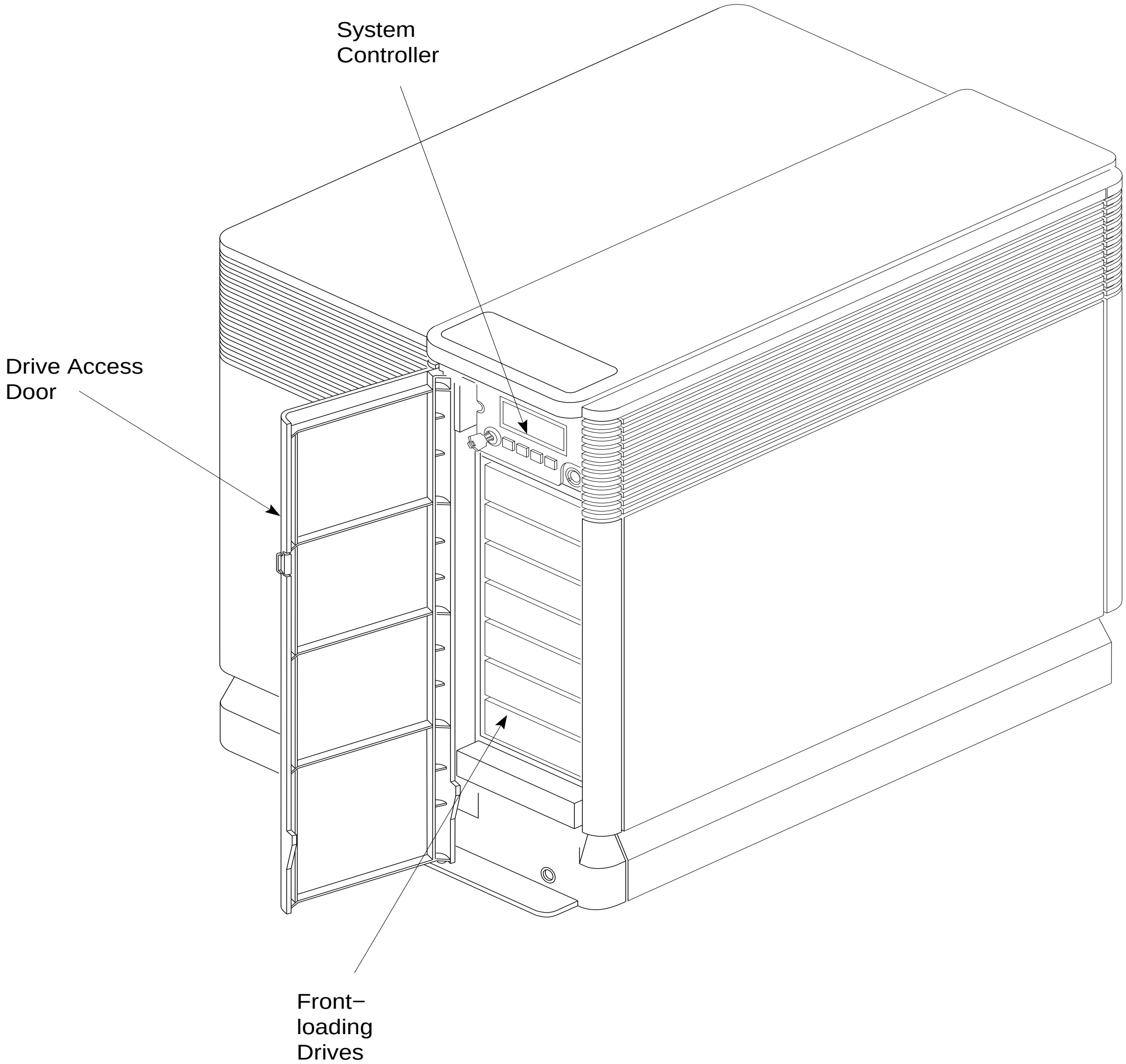


Figure 2-7 Front View of CHALLENGE/Onyx System with Drive Door Open

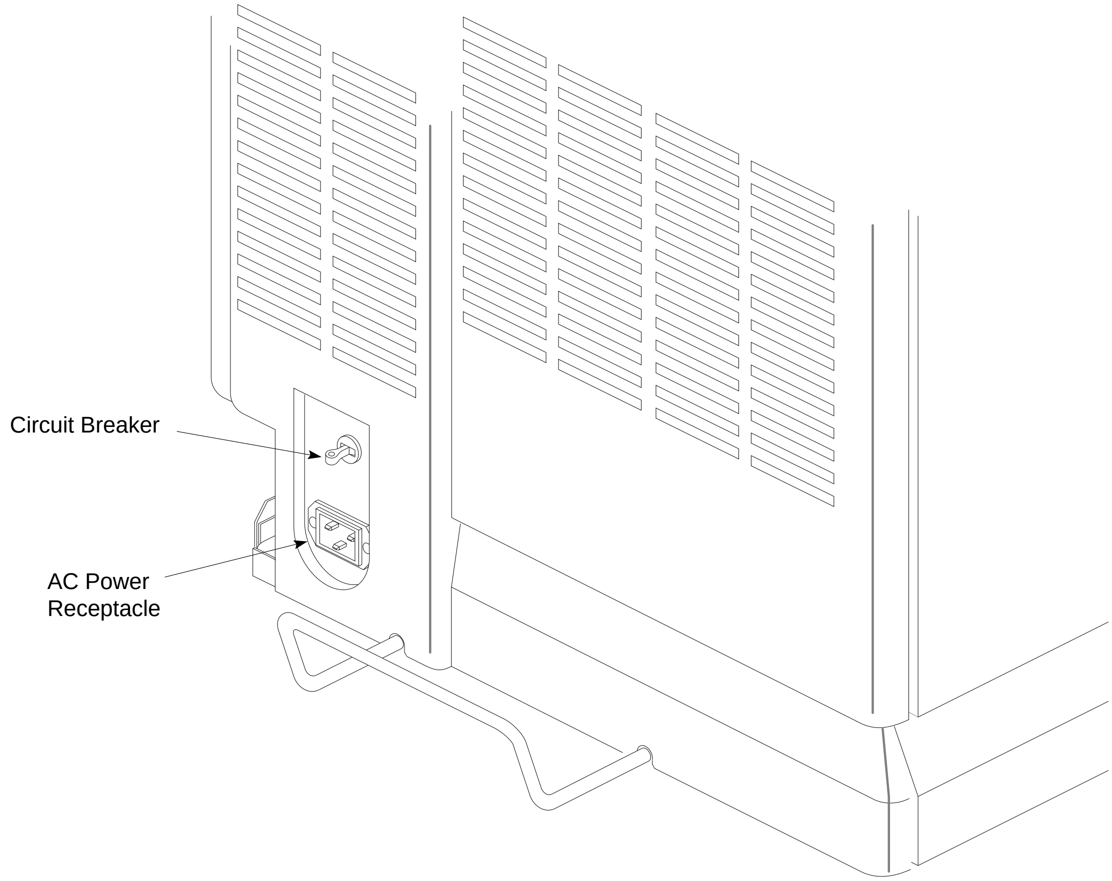


Figure 2-8 Rear View of CHALLENGE / Onyx Deskside System Chassis

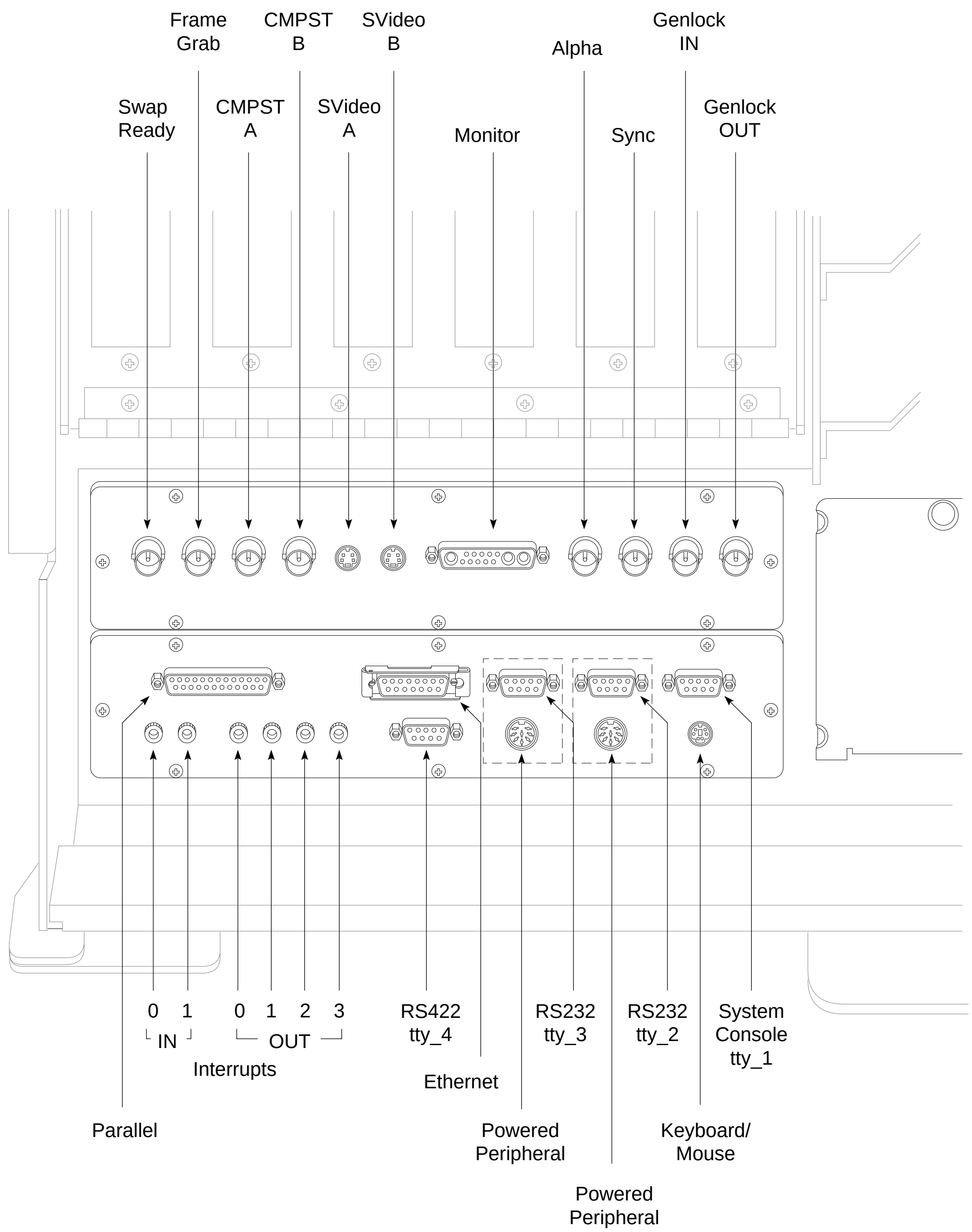


Figure 2-9 Main I/O and Graphics I/O Panels

Item	Description
Keyboard / Mouse Connector	This 6-pin minicircular dual inline (DIN) connector accepts the standard Silicon Graphics keyboard cable in Onyx systems.
Parallel Port	This is a 25-pin D-sub Centronics-compatible connector.
Ethernet	This 15-pin D-sub port provides a standard Ethernet connection. See note in Section 2.2.1, “I / O Filter Boards.”
RS-232	A combination of 9-pin D-sub and 8-pin circular DIN connectors provides this serial interface.
RS-422	This is a 9-pin connector.
0, 1 IN (Interrupt In)	This connector is used in multiple-system configurations to receive CPU interrupts from other CHALLENGE / Onyx deskside systems.
0, 1, 2, 3 OUT (Interrupt Out)	This connector is used in multiple-system configurations to send an interrupt to other CHALLENGE / Onyx systems.

Table 2-3 I / O Panel Connectors

Caution: *Never remove the keyboard cable while the system is on*. You may blow fuses on the main I / O panel.

2.2.1 I/O Filter Boards

The I / O filter boards provide the secondary I / O panels that mount on the I / O door (see Figure 2-10). The filter boards connect to additional IO4 boards (if available) on a CHALLENGE server system. The CHALLENGE deskside system may have up to three IO4 boards. A system can therefore have up to two I / O filter boards and one main I / O panel board. The I / O filter board does not have a keyboard / mouse connection. Only the main I / O panel provides this connection.

2.2.2 Interrupt Connectors

The interrupt connectors 0, 1 IN and O, 1, 2, 3 OUT provide the capability to transmit and receive CPU interrupts to and from other CHALLENGE / Onyx systems. A single system can generate an interrupt to a maximum of four different systems. The following sections illustrate two possible examples for their use by customer-supplied application programs.

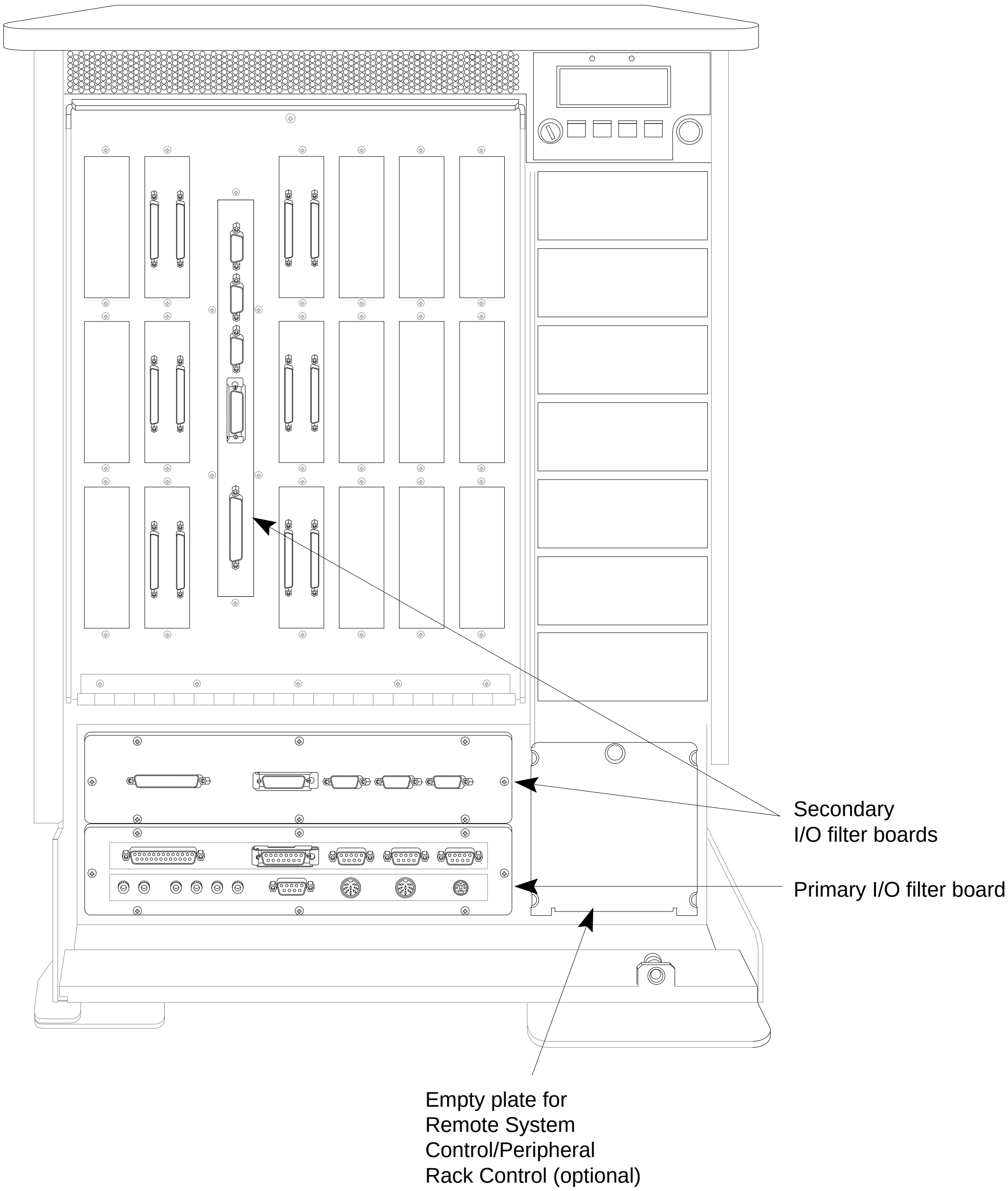


Figure 2-10 Server System with Multiple I/O Panels

2.2.2.1 Heartbeat Interrupts

In this scenario, the customer uses the interrupts as a *heartbeat* transmitter, involving two systems working in tandem in a master/slave configuration. In this situation, the master computer sends continuous interrupts or heartbeats to a slave system to indicate normal, *healthy* operation. If, for some reason, the master computer goes down and fails to transmit an interrupt to the slave system, the slave system can automatically take control of the operation.

2.2.2.2 Master Orchestrator

In another scenario, complex simulation programs may require that several computers be orchestrated to provide a comprehensive, yet cohesive, series of displays—for example, a multiple-scene flight simulation program. In this situation, different computers provide different environment, terrain, and situation scenery. A master orchestrating computer generates timed interrupts to the other systems to help signal and control the overall updating of frames and the changing of displayed events.

Connector	Function
S-VIDEO	Separate video. These two electrically separate output channels enable you to connect an S-video recorder on one port and an S-video monitor on the other port. The channels are interchangeable.
13W3	This output connector equals and replaces the RGB BNC connectors on earlier Silicon Graphics workstations. The 13W3 provides RGB out and logic sense for the monitor.
SYNC	This output connector provides an external sync signal for non-Silicon Graphic monitors, as required.
GEN IN	This input connector allows the system to line-lock to an external video source.
GEN OUT	This output connector enables the master sync source to loop through the system to other equipment.
ALPHA	This connector provides output for external transparent or color blending renderings.
CMPST A CMPST B	CMPST A and B provide a composite video output signal for a recording device and monitor. The channels are equal and interchangeable.
FRAME GRAB	This input connector provides acquisition control.
SWAP READY	This input connector enables multiple systems to be slaved together to provide synchronous frame display.

Table 2-4 Onyx Graphics I/O Panel Connectors

2.3 CHALLENGE/Onyx Deskside System Slot Designations

Table 2-5 and Table 2-6 and Figure 2-11 and Figure 2-12 describe the slot locations for the CHALLENGE/Onyx deskside system configurations.

Slot Number	Description
1	MC3
2	IP19 CPU

Table 2-5 Onyx Graphics Configuration

Slot Number	Description
3	IO4 base board (Note: An IO4 must reside in slot 3.)
4	VCAM board (Note: The VCAM mezzanine board connects to both the IO4 and the backplane.)
5	VME
6	VME
7	VME
8	GE10 (Geometry Engine) board
9	DG2 (Display Graphics) board
10	Third or fourth RM4 (Raster Manager) board
11	Second RM4 (Raster Manager) board
12	Third or fourth RM4 (Raster Manager) board
13	First RM4 (Raster Manager) board

Table 2-5 Onyx Graphics Configuration

Caution: Due to less air flow coming into slot 1 and because of the heat generated by the IP19 board, the cooler-operating MC3 *must* be in the first slot.

Note: The VCAM mezzanine board connects to both the IO4 board and the backplane.

Slot Number	Description
1	First MC3
2	First CPU
3	Second or third CPU or second or third MC3 or second or third IO4 (See note below.)
4	Second or third CPU or second or third MC3 or second or third IO4 (See note below.)
5	IO4 Board (Note: An IO4 board must reside in slot 5.)
6	VCAM Board
7	VME
8	VME
9	VME
10	VME
11	VME

Table 2-6 CHALLENGE Server Configuration Slot Designations

Caution: Owing to less air flow coming into slot 1 and because of the heat generated by the IP19 board, the cooler-operating MC3 must be in the first slot.

Note: The server system can have up to three CPU boards or three MC3 boards or three IO4 boards. See Chapter 3, "Configurations and Components," for a list of legal server configurations. In addition, an IO4 board *must* reside in slot 5.

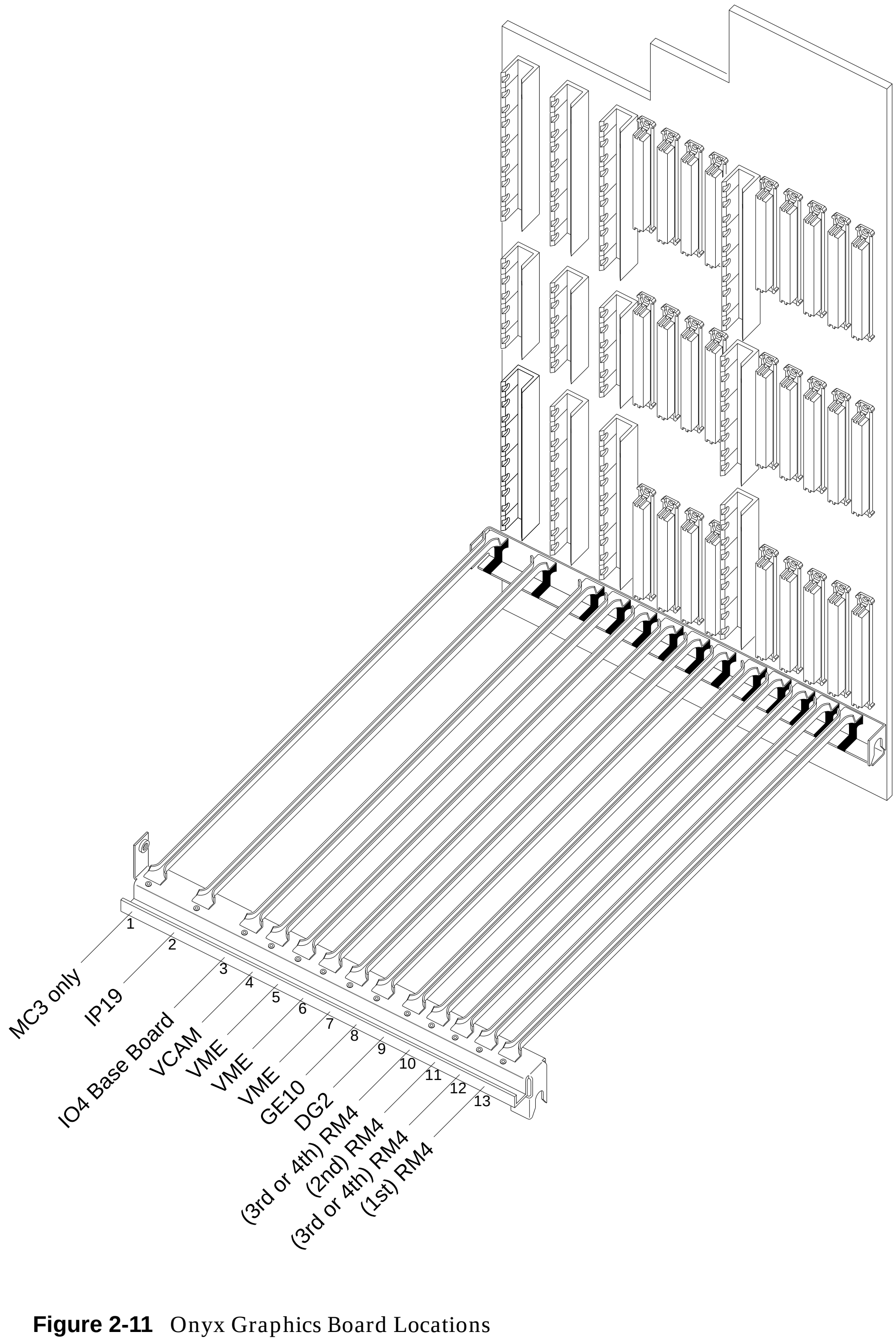


Figure 2-11 Onyx Graphics Board Locations

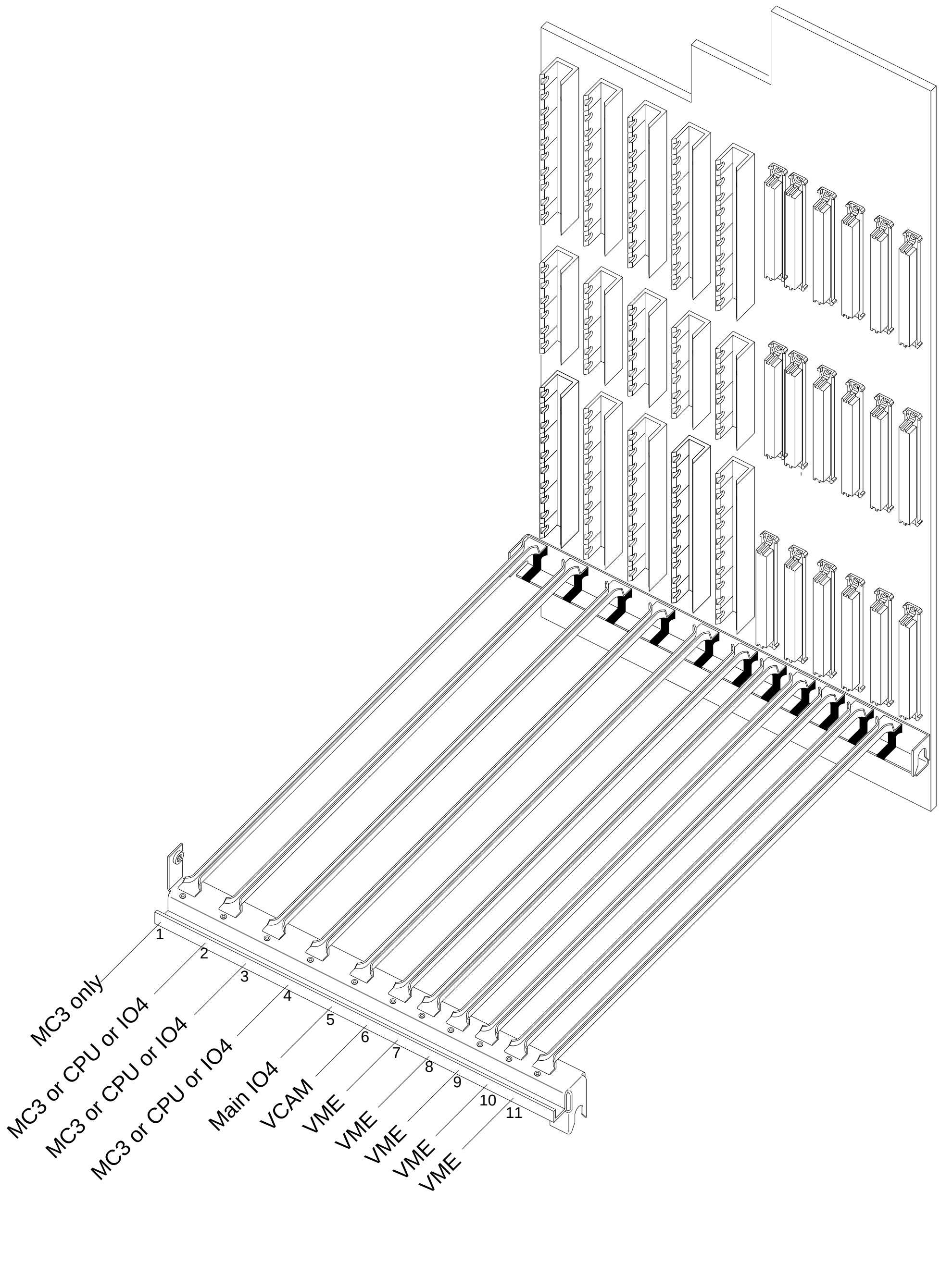


Figure 2-12 CHALLENGE Server Board Locations

2.4 Backplanes

The CHALLENGE server system uses an 11-slot backplane to provide interconnection and power to the boards in the system. The Onyx graphics system uses a 13-slot backplane. Figure 2-13 and Figure 2-14 provide illustrations of the graphics and server backplanes.

2.4.1 Graphics Backplane

The backplane provides two types of board connectors:

- Slots 1 through 3 on the graphics configuration, which connect to the Everest bus, are 1.6 inches wide and use a male 560-pin Futurebus+™ Metral connector.
- Slots 4 through 7 and 9 through 13 on the graphics configuration are 0.8 inches wide and use three 96-pin DIN connectors. Slot 8 uses a Futurebus+ Metral connector.

  Note: Slots 4 through 7 on the graphics backplane connect to the VMEbus, and slots 8 through 13 connect to the graphics bus.

Figure 2-13 illustrates the Onyx graphics backplane. Note the power board connections (505, 512, and System Controller). The power boards convert the 48 DC volts from the offline switching (OLS) power supply to the required DC voltages for the boards. See the description in Chapter 4, “Theory of Operations,” for more information on power board operation.

The graphics backplane employs two 505 boards, one 512 board, and one System Controller board. The 505 board provides 5 volts for use by the boards. The 512 provides both 5 volts and 12 volts. The 12 volts supply power to the drives, VME, and graphics boards.

Note: The System Controller board is also known as the E Power board.

The System Controller board provides 1.5 VDC for the Everest bus and also provides power for the system controller. This board can plug only in the rightmost slot because the connectors are different than the other power boards.

Table 2-7 describes additional backplane connectors and jumpers.

Connector or Jumper	Description
JTAG	This 25-pin connector is for factory use only, not for field or customer use. This connector provides an output connector for a logic analyzer.
H1, GRD1, H2	Do not change the setting of these jumpers. These headers are used by the factory to configure the system clock.

Table 2-7 Graphics and Server Backplane Connectors and Jumpers

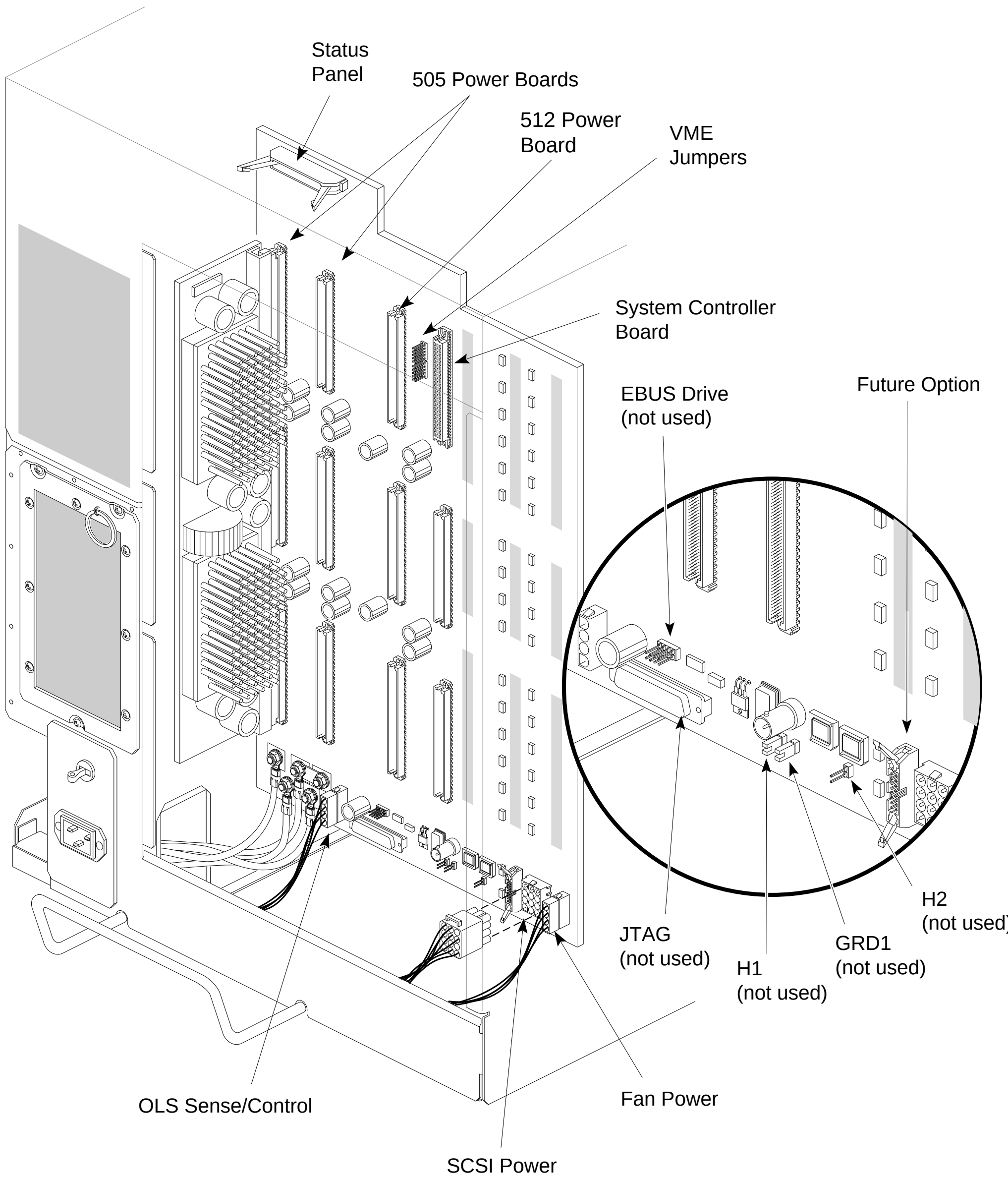


Figure 2-13 Onyx Graphics Backplane

2.4.2 Server Backplane

The backplane provides two types of board connectors:

- slots 1 through 5 on the server configuration which connect to the Everest bus, are 1.6 inches wide and use a male 560-pin metral connector

- slots 6 through 11 on the server configuration, which connect to the VME bus, are 0.8 inches wide and use three 96-pin DIN connectors

Figure 2-14 illustrates the CHALLENGE server backplane. Note the power board connections (505, 512, and System Controller). The power boards convert the 48 DC volts from the offline switching (OLS) power supply to the required DC voltages for the boards. See the description in Chapter 4, “Theory of Operations,” for more information on power board operation.

The server backplane employs one 505 board, one 512 board, and one System Controller board. The 505 board provides 5 volts for use by the boards. The 512 provides both 5 volts and 12 volts. The 12 volts supply power to the drives, VME, and graphics boards.

The System Controller board provides 1.5 VDC for the Everest bus and also provides power for the system controller. This board can plug only in the rightmost slot because the connectors are different than the other power boards.

Table 2-7 describes additional backplane connectors and jumpers.

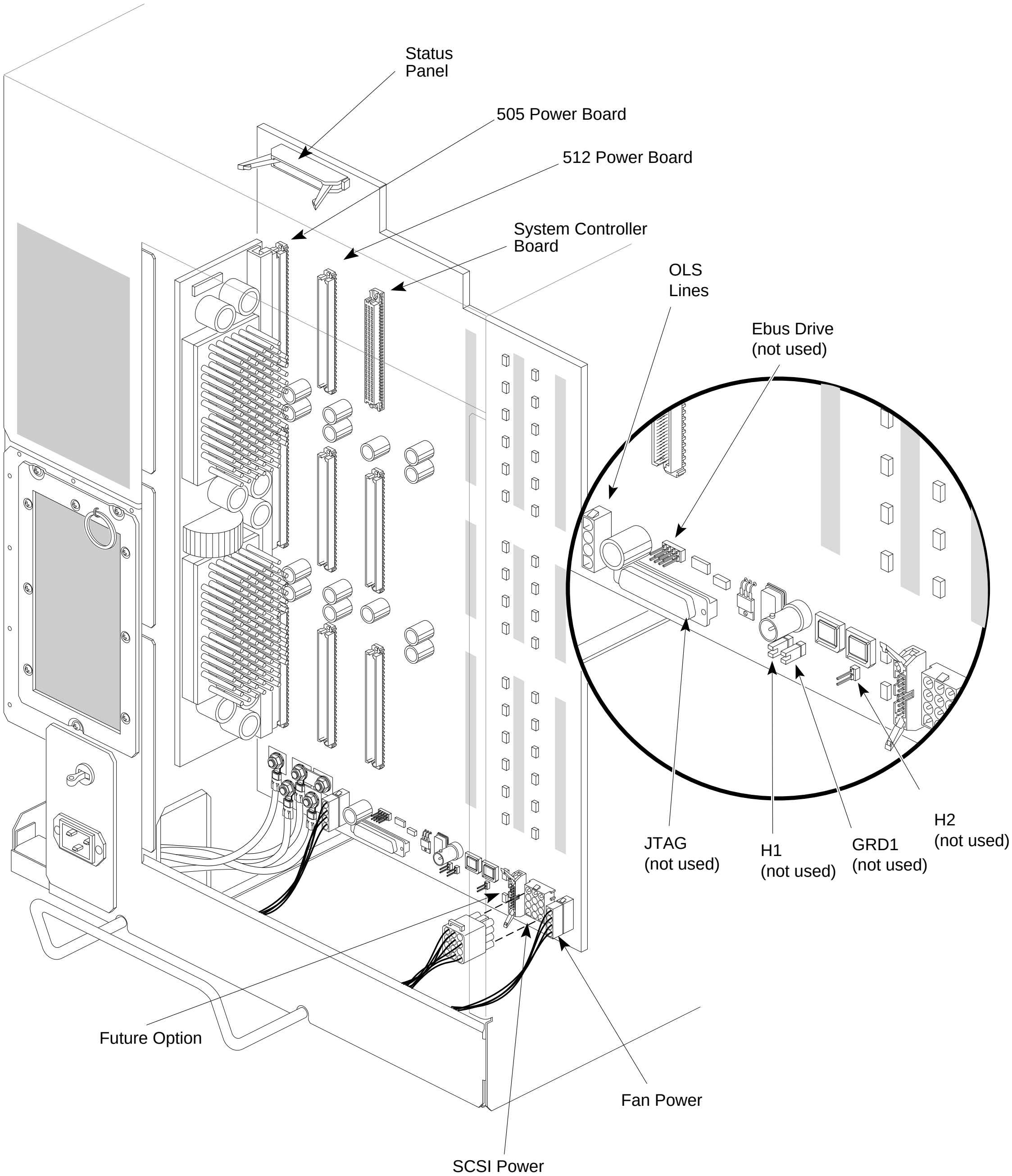


Figure 2-14 CHALLENGE Server Backplane Connectors and Jumpers

Chapter 3

Configurations and Components

This chapter describes the available system versions and the major components (field-replaceable units) for the CHALLENGE (server) and Onyx (graphics) system configurations. Both configurations are available in 110 and 220 VAC versions.

3.1 CHALLENGE Deskside Server System Configurations

The 11-slot server system comes in the following base configuration:

- one IP19 CPU
- one MC3 memory board
- one IO4 board

  Note: The IO4 board also comes standard with a VCAM (VME channel adapter module) mezzanine board that interfaces the Ebus to the VMEbus.

- a set of power boards
- five available VME slots

3.1.1 Legal Server Configurations

The CHALLENGE deskside supports multiple IP19, IO4, and MC3 boards. The following are the legal deskside server configurations:

- 3 IP19s, 1 IO4, and 1 MC3
- 3 IO4, 1 IP19, and 1 MC3
- 2 IP19, 2 MC3, and 1 IO4
- 2 MC3, 2 IO4, and 1 IP19
- 2 IO4, 2 IP19, and 1 MC3

Note: The IP19 board can contain two or four R4400 processors.

Caution: The deskside server system can physically hold up to three MC3 boards; however, this is not legal configuration. See Section 5.15.5, "Avoiding Three MC3 Board Configurations," in Chapter 5, "Installation," for more information.

3.1.2 Power Boards

The server system comes standard with a set of four power boards that plug into the backplane. The power boards convert the 48 volts from the OLS and provide the required DC voltages for the system. The CHALLENGE deskside system includes these power boards (see also Figure 2-14 in Chapter 2, "Chassis Tour"):

- one 505 board
- one 512 board
- one System Controller board

Note: For a functional description of the power boards and OLS, see Chapter 4, "Theory of Operations."

3.2 Onyx Graphics Workstation Configurations

The 13-slot graphics workstation has the following base configuration:

- one IP19 CPU board
- one MC3 memory board
- one IO4 board

  Note: The IO4 board also comes standard with a VCAM (VME channel adapter module) mezzanine board. This board interfaces the Everest system bus to the VMEbus.

- the RealityEngine^2 (RE^2) or VTX graphics board set
- a set of power boards
- three available VME slots

Note: The Onyx system can house only one IP19, one MC3, one IO4, and one graphics board set.

3.2.1 RealityEngine^2 Graphics Board Set

The Onyx deskside system supports one RE^2 board set in the following configurations:

- 5 span
- 10 span
- 20 span

Caution: The 20-span configuration requires 220 VAC power. The 5- and 10-span systems use 110 VAC in the United States and Canada. See Section 3.2.4, "Graphics Power Configurations," for more information.

In addition, the standard RE^2 graphics configuration comes with a multisync 21-inch monitor.

3.2.2 VTX Graphics Board Set

The Onyx deskside system supports one 5-span (only) VTX board set. The VTX configuration also uses the standard 19-inch Silicon Graphics monitor.

Note: For a list of differences between the RE^2 and VTX graphics board sets, see Chapter 4, "Theory of Operations."

3.2.3 Power Boards

The standard graphics system comes with a set of four power boards that plug into the backplane. The power boards convert the 48 volts from the OLS and provide the required DC voltages for the system. The Onyx deskside system includes these power boards (see also Figure 2-13 in Chapter 2, "Chassis Tour"):

- two 505 boards
- one 512 board
- one System Controller board

Note: For a functional description of the power boards and OLS, see Chapter 4, "Theory of Operations."

3.2.4 Graphics Power Configurations

The following represents the maximum graphics system configuration that can safely use a 110-VAC power source:

- RealityEngine^2 graphics with two RM4 boards
- two GB of main memory (if available)
- one IP19 board with four R4400 processors
- seven internal hard disks
- three VME boards

3.3 CHALLENGE/Onyx Main Components

This section provides field-replaceable units (FRUs) and part numbers for the CHALLENGE / Onyx deskside systems (see Table 3-1, Table 3-2, and Table 3-3). See Chapter 5, “Installation,” for drawing of many of the following components:

Part Number	Description
013-0511-xxx	Video filter PCB (GFX)
030-0263-xxx	505 power board
030-0264-xxx	VME power board
030-0265-xxx	Ebus power board
030-0310-xxx	Graphics backplane
030-0314-xxx	Server backplane
030-0240-xxx	IO4 board
030-0243-xxx	VCAM board
030-0245-xxx	MC3 board
030-0249-xxx	IP19 (2 CPUs)
030-0250-xxx	IP19 (4 CPUs)
030-0256-xxx	16 MB SIMMs
030-0257-xxx	64 MB SIMMs
030-0304-xxx	SCSI differential module
030-0305-xxx	SCSI single-ended
030-0312-xxx	S mezz (93B) board
030-0284-xxx	VS2
030-0325-xxx	GE10 board
030-0363-xxx	GE10V board
030-0223-xxx	DG2
030-0337-xxx	RM4

Table 3-1 CHALLENGE / Onyx Boards

Part Number	Description
018-0291-xxx	Video analog cable assembly
018-0292-xxx	Status panel cable assembly

Table 3-2 CHALLENGE / Onyx Cable Assemblies

Part Number	Description
018-0294-xxx	Three-drive SCSI cable assembly
018-0331-xxx	Secondary I/O cable assembly
018-0333-xxx	General I/O cable assembly
015-0113-xxx	Blower power harness assembly
015-0114-xxx	Disk power harness assembly

Table 3-2 (continued) CHALLENGE/Onyx Cable Assemblies

Part Number	Description
013-0500-xxx	Blower module
013-0508-xxx	Chassis power assembly
013-0509-xxx	Fan assembly
013-0510-xxx	SCSI bulkhead
013-0513-xxx	OLS assembly
013-0515-xxx	AC power inlet
013-0652-xxx	General I/O assembly
041-0025-xxx	Status panel
041-0042-xxx	2.0 GB drive

Table 3-3 CHALLENGE/Onyx Miscellaneous Parts

Chapter 4

Theory of Operations

This chapter provides a block diagram description of the CHALLENGE / Onyx system. A functional overview of the RealityEngine^2 (RE^2) and VTX graphics board set is also provided.

4.1 Overall Functional Description

Figure 4-1 shows a simplified block diagram of the CHALLENGE / Onyx bus and system architecture. Each board that composes the board set, as well as the optional interface modules, VCAM, and SCSI channel configuration boards is described in detail in the following sections.

4.1.1 System Board Set

The base CHALLENGE / Onyx system configuration includes these boards:

- an IP19 CPU board
- an MC3 memory board
- an IO4 system I / O board

Both the Onyx graphics and the CHALLENGE server configurations of the chassis are shipped with a version of the system board set. Additionally, a number of optional (mezzanine) boards may be attached to the IO4 board.

The principal features of the system board set are:

- two or four R4400 microprocessors per CPU board
- 1.2 GB per second, 256-bit bus
- 48-bit address bus
- RealityEngine^2 / VTX graphics subsystem support
- up to two GB of interleaved RAM
- dual SCSI-2 channels for each IO4 board
- 8- and 16-bit SCSI II compatibility

- Additional Flat Cable Interface (FCI), VMEbus, and SCSI ports available on optional mezzanine boards

4.1.2 Main System Bus

The main set of buses in the CHALLENGE/Onyx system architecture is the Everest address and data buses, Ebus for short. The Ebus replaces the old standard MP bus in the Silicon Graphics POWER Series™ systems such as the Single Tower and POWER Center™ (Predator). The Ebus provides a 256-bit data bus and a 40-bit address bus that can sustain a bandwidth of 1.2 GB per second. This is 20 times greater than the bandwidth of the old MP bus.

Note: The Ebus may be referred to as the POWERpath-2 system bus in other documents.

The 256-bit data bus provides the data transfer capability to support a large number of high-performance RISC CPUs. The 40-bit address bus is also wide enough to support 16 GB of contiguous memory in addition to an 8 GB I/O address space.

4.1.3 Ibus

The 64-bit Ibus (also known as the HIO bus) is the main internal bus of the I/O subsystem and interfaces to the high-power Ebus through a group of bus adapters. (See Section 4.4.1.1, “Bus Architecture,” for more information.) The Ibus has a bandwidth of 320 MB per second that can sufficiently support a graphics subsystem, a VME64 bus, and as many as eight SCSI channels operating simultaneously.

4.1.4 VMEbus

Another major bus in the CHALLENGE/Onyx architecture is the 64-bit VMEbus. The VMEbus interfaces with the Ebus through the VCAM board, which mounts on the IO4. Additional VMEbuses may be added to the CHALLENGE/Onyx rackmount system through an optional card cage.

The VME interface supports all protocols defined in Revision C of the VME specification plus the A64 and D64 modes defined in Revision D. The D64 mode allows DMA bandwidths of up to 60 MB.

4.1.5 System Controller

The system controller assembly consists of a PCB and LCD screen. The PCB contains a battery-backed microprocessor that communicates directly with the boot-master CPU board through a polled serial line. For a complete discussion on the operation of the System Controller, see the *CHALLENGE/Onyx Diagnostic Roadmap*, Document No. 108-7045-*xxx*.

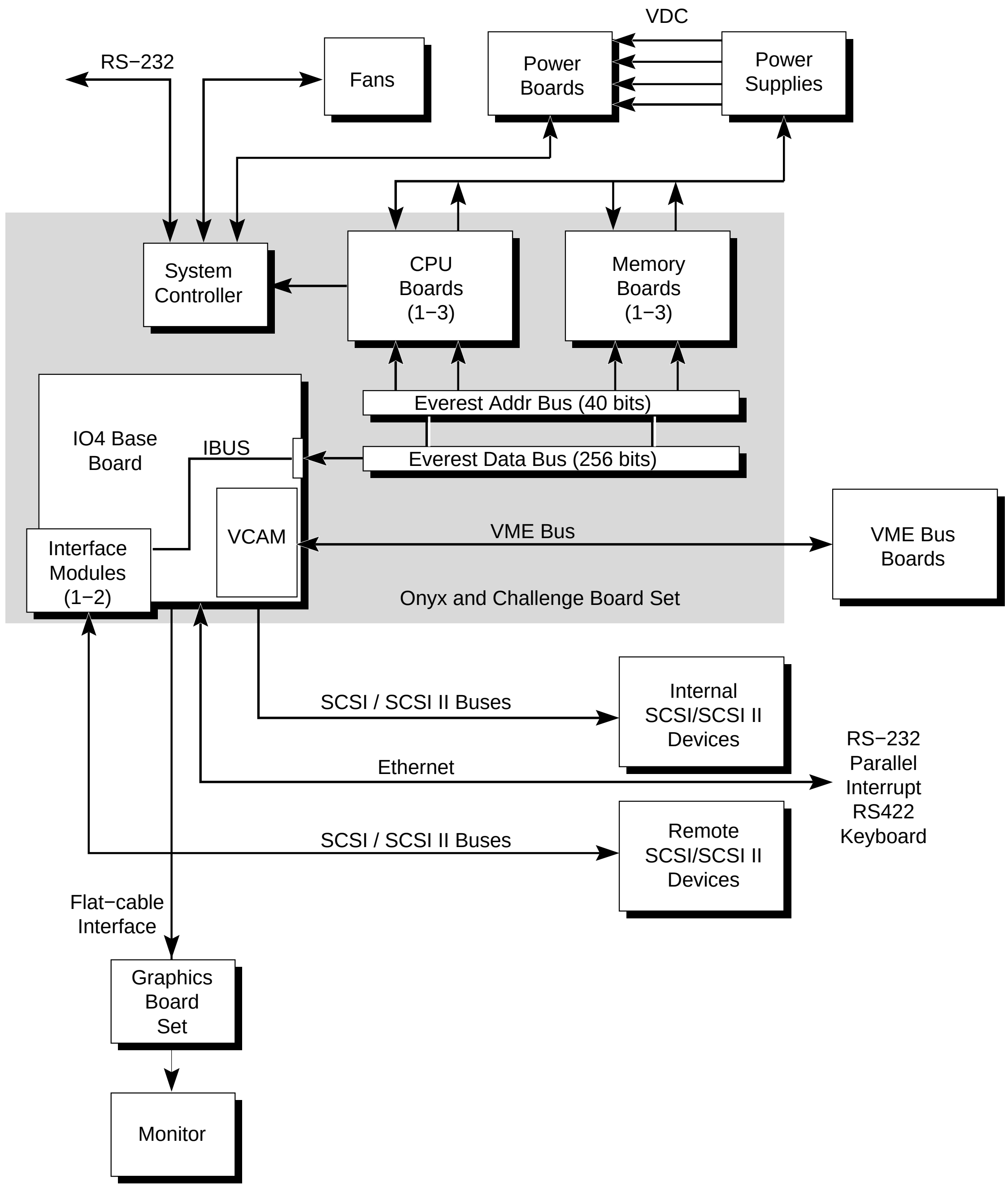


Figure 4-1 CHALLENGE / Onyx Functional Block Diagram

4.2 IP19 CPU Board

The IP19 is a multiprocessor CPU board that can support two or four R4400 microprocessors. The board logic is divided so that each of the microprocessor has its own dedicated supporting logic. This processor *slicing* allows each microprocessor to run cache-independent 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 4-2 for a functional block diagram illustrating the CPU board.

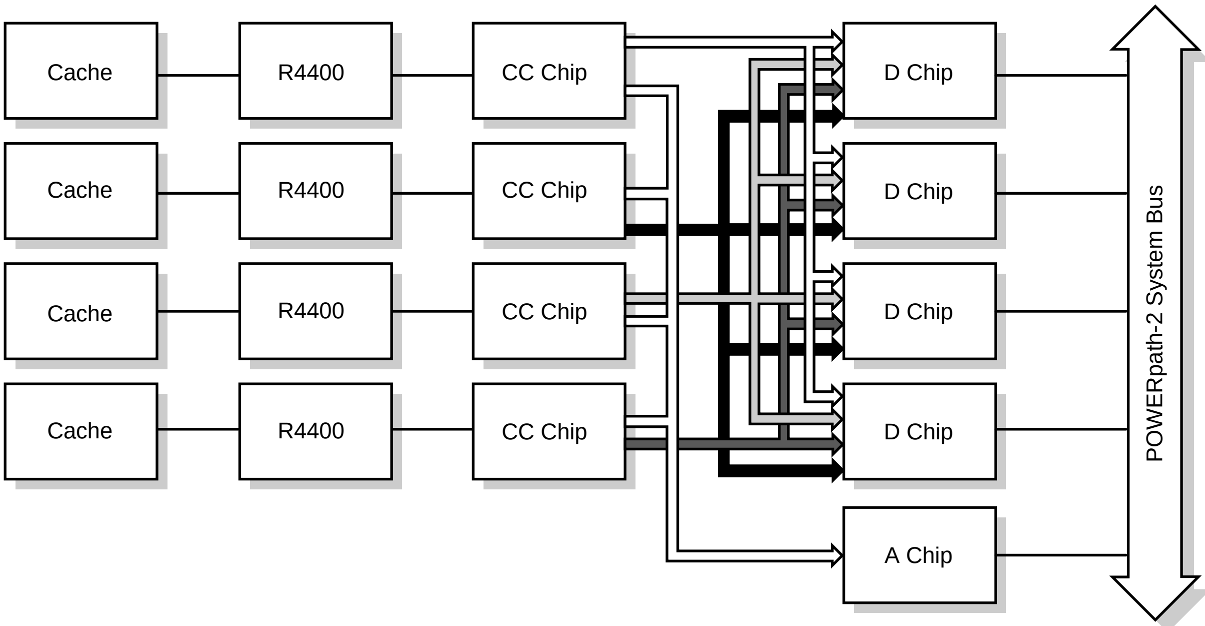


Figure 4-2 CPU Board Functional Block Diagram

4.2.1 CPU Features

Here are some of the key features of the MIPS R4400,which is the main processor in the CHALLENGE / Onyx systems:

- true 64-bit microprocessor with 64-bit integer and floating-point operations, registers, and virtual addresses
- 50 MHz external clock frequency and 100-MHz internal clock frequency (at initial product shipment)
- on-IC memory management unit (MMU)
- 5-volt or 3.3-volt power supply
- 36-bit physical address than can access up to 64 GB of physical memory
- 64-bit cache-coherent system interface
- on-IC 16 KB instruction cache and 16 KB data cache with 128-bit secondary cache interface that can support a secondary cache size of either 1 or 4 MB
- 64-bit virtual address

4.2.2 Processor Subsystem

As shown in Figure 4-2, each CPU has it own secondary cache and a cache controller, the CC device. Each CPU is also connected to the Ebus through the address path (A) ASIC and four data path (D) ASICs.

4.2.2.1 Cache Controller (CC)

The cache controller implements a duplicate set of secondary cache tags that handle and arbitrate cache requests on the Ebus. The CC arbitrates requests by giving read-request operations a higher priority than cache-write requests. Pending bus access requests are then buffered and queued until the current operation is complete.

4.2.2.2 Address Path (A) ASIC

The A ASIC services the address requests of all the processors on the CPU board. Like the CC, the A ASIC gives higher priority to read requests to minimize the read-wait or read-latency period. It also supports piggyback read requests from different processors, allowing several processors to share the same read requests and response cycles on the bus. This helps optimize overall performance for tightly coupled microprocessing programs. Even though the A ASIC may service up to four processors, each processor still has its own dedicated path to the bus.

4.2.2.3 Data Path (D) ASIC

The D ASIC provides a bit-sliced data path that narrows the 256-bit Ebus data to a 64-bit bus to match the size of the R4000 series interface bus. Each processor has its own 64-bit path dedicated for transfers to the system bus. Again, there is no contention between processors sharing the same CPU board. The data path between the CC and D ASICs is bidirectional. To minimize read latency, the default direction for this bus is toward the processor.

4.3 MC3 Memory Board

The MC3 memory board is arranged so that its SIMMs are separated into two DRAM array leaves (leaf 0 and leaf 1). Each array leaf has four banks of four SIMMs each. The system supports 16 and 64 MB SIMM sizes and allows a maximum capacity of 2 GB per MC3 board.

Note: Earlier versions of the MC3 (P / N 030-0245-007 and below) supported a maximum of 1 GB of system memory owing to problems with the MA ASIC. Newer versions of the MC3 (P / N 030-0245-008 and above) will support up to 2 GB of memory.

Two types of interleaving are supported: on-board interleaving between array leaves of equal memory size on the same board and interleaving between two or more memory boards having the same total memory capacity. Figure 4-3 is a functional block diagram of the MC3 board.

4.3.1 Interleaving

Interleaving, a technique for organizing memory into leaves, increases the sustainable memory bandwidth. For example, using two overlapped memory accesses, operating on two memory leaves, effectively doubles the memory bandwidth attainable without interleaving. (A single memory leaf can start to process a new read request every 200 nanoseconds; the Ebus can deliver a new request every 100 nanoseconds.) Each leaf can independently process a memory request for a processor.

Each memory board supports two-way interleaving, and each leaf can transfer an entire cache block, which is the unit of interleaving. Two memory boards support up to four-way memory interleaving; four memory boards support up to eight-way interleaving.

Note: If a memory problem occurs, this could seriously affect the interleave factor for the system. For example, if the system is set up for two-way interleaving and a problem occurs with one of the SIMMs, the system could default to one-way interleaving because the memory link is broken.

4.3.2 Memory Board Structure

The key memory board components are (see Figure 4-3)

- one address control ASIC (the MA IC)
- four data control ASICs (the MD ICs)
- custom SIMMs

The MA ASIC is a gate array that provides the interface between the memory array and the system address lines, or address path. The MA ASIC includes bus arbitration and acknowledge logic, decode logic, and two interleaved DRAM controllers. Each DRAM controller generates multiplexed memory address lines and control lines to control two banks of DRAM SIMMs. In addition, the MA IC generates and receives signals that allow it to control the MD ASICs.

The four MD ASICs provide error detection and correction and data buffering for the transfer of data between the 576-bit-wide memory array and the 264-bit-wide D path, including ECC bits. The MD ASICs perform no action on their own, except notifying the MA ASIC when they detect an error. The four MD ASICs are identical; each drives one quarter of the bus.

The memory array consists of one to eight banks of 144 four-bit-wide DRAMs of either 16 MB or 64 MB. Groups of 36 memory ICs, together with their associated address buffers, are mounted on 200-pin SIMMs. Each SIMM provides 144 bits of data. A complete memory bank consists of four identical SIMMs.

A minimum configuration of 64 MB uses four SIMMs. A maximum configuration uses 32 SIMMs. Normally at least two memory banks are populated. For maximum performance, the two banks must be located on different memory leaves; all memory banks must have the same number of populated leaves. If half the Ebus-rated performance is sufficient, a system can be configured with a single memory bank.

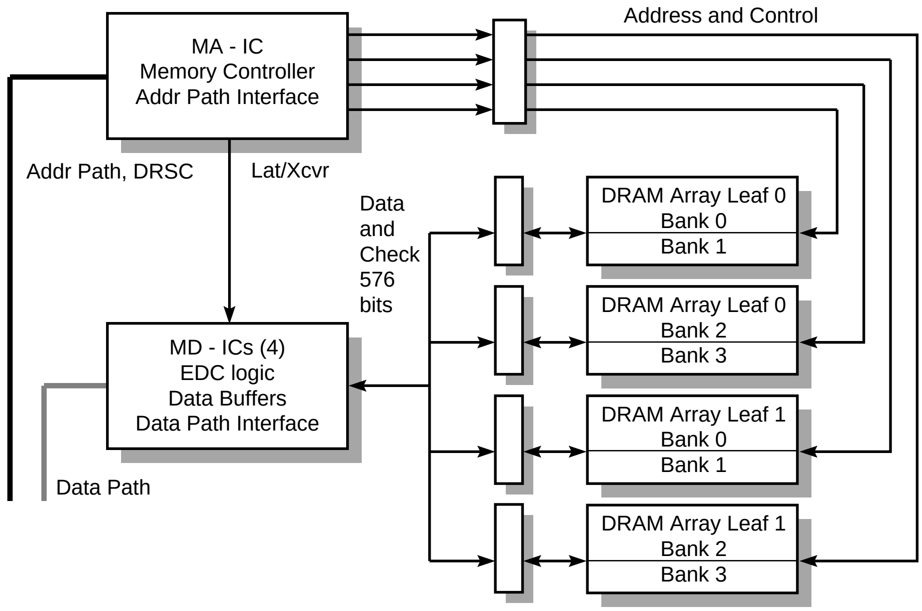


Figure 4-3 MC3 Memory Board Functional Block Diagram

4.4 I/O Subsystem

This section details the operation of the IO4 subsystem. The CHALLENGE/Onyx I/O subsystem consists of an IO4 base board and a set of optional I/O mezzanine boards that mount directly onto the IO4 board.

4.4.1 IO4 Board

The IO4 board is the heart of the I/O subsystem. The IO4 board supplies the system with a basic set of I/O controllers and system boot and configuration devices. This base set include:

- three RS-232 ports
- one RS-422 port
- one parallel port
- one Ethernet controller
- a second-level boot EPROM
- an NVRAM that stores system configuration information
- two Ibus connections

In addition, the IO4 board provides these interfaces:

- two Flat Cable Interconnects (FCIs)

- two SCSI-2 cable connections
- two Ibus connections

See Figure 4-4 for a functional block diagram of the IO4 board.

4.4.1.1 Bus Architecture

Communication with the VME and SCSI buses, the installed graphics boards set(s), and the Ethernet takes place through the Ibus. A set of interface control devices, an I address (IA) and I data (ID), interfaces the Ibus to the Ebus, the main system bus. The ID ASICs latch the data, and the IA ASIC clocks the data from each ID to the Flat Cable Interface (FCI).

Two FCI controllers (or F controllers) handle the data transfers to and from an internal graphics board set (if installed) and any VMEbus boards. The SCSI-2 (S) controller serves as an interface to the various SCSI-2 buses. The Everest peripheral controller (EPC) device manages the data movement to and from the Ethernet, a parallel port, and various types of on-board PROMs and RAM.The EPC communicates with the second-level boot PROM, the system configuration NVRAM, and the timer through the peripheral bus, or Pbus. The Pbus is a 16-bit general-purpose bus that is designed for components using external DMA controllers or PIO.

4.4.1.2 S Controller ASIC

The S controller is an ASIC that contains two SCSI-2 controller ICs and the logic to interface with the Ibus. The S controller provides two fast and wide 16-bit SCSI-2 controllers that are configurable as either single-ended or differential. See Section 4.4.2.4, “SCSI Channel Adapter Boards,” for more information.

4.4.1.3 F Controller ASIC

The F controller acts as an interface between the Ibus and the Flat Cable Interfaces (FCIs). This device is primarily composed of FIFO registers and sychronizers that provide protocol conversion and buffer transactions in both directions and translate 34-bit I/O addresses into 40-bit system addresses.

Two configurations of the F controller are used on the IO4 board; the difference between them is the instruction set they contain. One version is programmed with a set of instructions designed to communicate with the GFXCC (for graphics), the other version has instructions designed for the VMECC. All communication with the CC ICs is done over the FCI, where the F controller is always the slave.

Both versions of the F controller ASICs have I/O error-detection and handling capabilities. Data errors that occur on either the Ibus or the Ebus are recorded by the F controller and sent to the VMECC or GFXCC (the CC ICs must report the error to the appropriate CPU and log any specific information about the operation in progress). FCI errors are recorded in the error status register. This register provides the status of the first error that occurred, as well as the cause of the most recent FCI reset.

4.4.1.4 EPC

The Everest peripheral controller (EPC) supports the basic peripheral ICs and interfaces required for system boot and operation. The EPC manages the data movement to and from the Ethernet, a parallel port, and various types of on-board PROMs and RAM. The EPC consists of the following components:

- a SEEQ EDLC Ethernet controller and buffer
- a real-time clock with battery-backed RAM
- one MB of EPROM, a small serial EEPROM
- a SCSI-channel buffer
- a DMA engine
- three Zilog 85230 DUARTs

Note: One of the Zilog ICs supports the mouse and keyboard. The other two drive the four serial ports.

Two additional devices are connected to the EPC IC: a Western Digital SCSI-1 interface IC for use with single-ended SCSI devices and static RAM for use as buffer memory. The EPC also supports a parallel port.

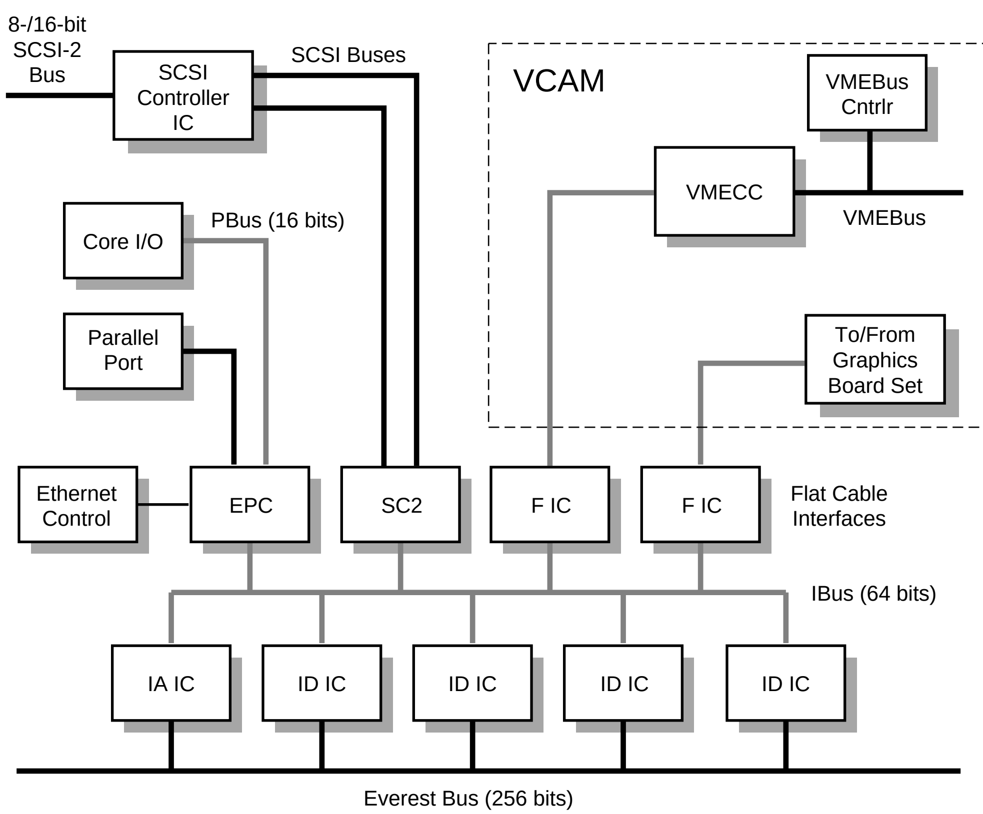


Figure 4-4 IO4 Base Board Functional Block Diagram

4.4.2 Mezzanine Boards

Other principal components of the I/O subsystem are mezzanine boards. The mezzanine boards mount directly onto the IO4 *base* board through a set of standoffs. The available mezzanine boards consist of these types:

- a VCAM board
- an S mezz board that provides three additional SCSI channels
- two versions of the FCI interface board
- two SCSI channel adapter boards

The mezzanine boards provide the IO4 board with a variety of additional bus interfaces and/or serial ports. The mezzanine boards mount directly to the IO4 board. Brief descriptions of the available mezzanine boards follow.

4.4.2.1 VMEbus Channel Adapter Module (VCAM) Board

The VCAM board comes standard with the system and mounts on the rear of the IO4 base board through a set of standoffs. The VCAM board provides the interface between the Ebus and the VMEbus and manages the signal level conversion between the two buses. The VCAM also provides a pass-through connection that ties the graphics subsystem to the Ebus.

The VCAM can operate as either a master or a slave. It supports DMA-to-memory transactions on the Ebus and programmed I/O operations from the system bus to addresses on the VMEbus. In addition, the VCAM provides virtual address translation capability and a DMA engine that increases the performance of non-DMA VME boards.

4.4.2.2 SCSI Mezzanine Boards

The SCSI (S mezz) board duplicates the SC2 IC and SCSI control logic found on the IO4 base board and provides three additional SCSI channels. Two of the channels are differential only; the third is configurable as single-ended or differential. The IO4 base board can house up to two S mezz boards and provide up to eight SCSI channels. In this maximum SCSI channel configuration, four channels are reserved for differential operation only. The other four channels can be configured as either single-ended or differential. This board secures to the IO4 board through standoffs.

4.4.2.3 F Mezzanine Boards

The F mezzanine (F mezz) boards duplicate the F controller (see Section 4.4.1.3, "F Controller ASIC") and control logic found on the IO4 board. The two FCI boards are designated F mezz and F mezz (short). The only differences are that the F mezz board is slightly longer and has an additional connector. This connector allows it to pick up the FCI channel normally covered by the VCAM. The long F mezz board is used only in systems having multiple IO4 boards and on those boards that do not have the VCAM mounted. The short version of the F mezz is designed to mount on the IO4 board along with the VCAM. The long F mezz provides two additional interfaces to the FCI. The short version has one less interface.

4.4.2.4 SCSI Channel Adapter Boards

There are two versions of the SCSI channel adapter board, differential and single-ended. The differential board is color coded red. The single-ended board is color coded green. The adapters insert directly into the SCSI connectors at the forward edge of the IO4 board.

4.5 System Power

The CHALLENGE / Onyx systems are powered through an offline switcher (OLS) and a set of specialized power boards. The following sections describe these components in detail.

4.5.1 Offline Switcher (OLS) Power Supply

The deskside chassis supports a 1900-watt OLS that accepts 110 or 220 VAC without jumper modifications. The OLS converts the input voltage to 48 VDC and distributes the regulated voltage to a set of backplane power boards. The power boards then take the 48 VDC and converts it to 5 and 12 VDC.

The rackmount chassis supports a maximum of three 1900-watt OLSs to provide power for the system's multiple card cage and backplane architecture.

In the rackmount configuration, the OLSs convert the 220 or 400 VAC input to 48 VDC at 37 amps and distribute the regulated voltage to the chassis midplane. Additional power boards supply the DC voltages required by the Everest and VMEbuses. The on-board regulators and power boards allow board-level voltages to be generated for only the populated card cage slots.

4.5.2 Power Boards

Power boards are DC-to-DC converters that take the 48 volts from the offline switcher and step it down to levels appropriate for the buses, circuit boards, and SCSI drives. The power boards connect to the CHALLENGE / Onyx backplane. Three types of power boards are used in the CHALLENGE / Onyx deskside system:

- The System Controller board supplies +1.5 VDC at 30 amps for use by the Ebus. This board also provides power for the microprocessor in the System Controller.
- The 505 power board generates +5 VDC at 80 amps for use by the boards.
- The 512 power board generates +5 VDC at 40 amps and +12 VDC at 17 amps for the VMEbus.

4.6 RealityEngine^2 and VTX Graphics Subsystems

Unless otherwise indicated, the following sections apply to both the RE^2 and the VTX configurations.

The RealityEngine^2 (RE^2) and VTX are the graphics boards sets in the Onyx deskside and rackmount systems. The RE^2 and VTX graphics subsystems comprise three board types: the Geometry Engine (GE10), the Display Generator (DG2), and the Raster Memory (RM4).

The principal features of the RealityEngine^2 and VTX graphics board sets are

- greater texel storage capacity (4 MB versus 256 KB in PowerVision™)
- greater texturing and antialiasing capabilities
- more color and greater depth and spatial resolution
- RGB and simultaneous low-resolution composite video out
- supports most video standards, such as PAL and NTSC
- built-in genlocking
- greater z-buffering capability (32 bits versus 24 bits in PowerVision)
- supports full-scene antialiasing (1K x 1K)
- higher pixel processing power
- separate 12-bit color maps for multiple windows

4.6.1 Comparing the RealityEngine, RealityEngine^2, and VTX Graphics Subsystems

The RE^2 provides greater performance than the RealityEngine graphics as a result of enhanced GE processing hardware and the expanded bandwidth of the Everest bus. The VTX (a 5-span-only configuration) is a cost-reduced version of the RE^2.

Major similarities between these board sets include the following:

- All three graphic subsystems use the DG2 (Display Generator) board.
- All three graphic subsystems use the RM4 (Raster Memory) board.

For a list of differences among these subsystems, see Table 4-1.

Feature	VTX	RealityEngine^2	RealityEngine
Number of RM4 boards and number of spans supported	1 RM4 board (5 span only)	1, 2, or 4 RM4 boards (5, 10, or 20 span)	1, 2, or 4 RM4 boards (5, 10, or 20 span)
Monitor size and maximum resolution supported	19-inch (1280 x 1024 resolution)	21-inch (1600 x 1200 resolution)	21-inch (1600 x1200 resolution)
Geometry Engine board used and number of GE processors	GE10V with 6 GE processors	GE10 with 12 GE processors	GE8 with 8 GE processors

Table 4-1 Differences Among VTX, RealityEngine^2, and RealityEngine Subsystems

Feature	VTX	RealityEngine^2	RealityEngine
High-definition television (HDTV) support	No	Yes	Yes
RM4T board required	No	No	Yes
Frontplane used	DI4	DI1 for Onyx rackmount and DI3 for Onyx deskside	DI1, DI2, DI3, depending on system
Supported systems	Onyx deskside and rackmount	Onyx deskside and rackmount	POWER Series systems including — POWER Center (Predator) — SkyWriter — Single Tower — Crimson
Number of heads or pipes supported	1 only	1 on Onyx deskside and 1 to 3 on Onyx rackmount	1 on all supported systems. SkyWriter supports up to two heads.

Table 4-1 Differences Among VTX, RealityEngine^2, and RealityEngine Subsystems

Note: The RealityEngine uses an RM4T (Raster Memory terminator) board to terminate the triangle bus. The triangle bus is terminated through the backplane for the RE^2 and VTX graphics.

4.6.2 Overall Functional Description

The primary board in the subsystem is the GE10. The GE10 interfaces with the host system through a Flat Cable Interface (FCI) connection that ties to the VCAM mezz board on the IO4 base board (see Figure 4-5). The FCI connection is embedded in the backplane of the system.

An F controller (see Section 4.4.1.3, “F Controller ASIC”) on the IO4 base board provides a Flat Cable Interface to the VCAM board. Graphics data routes from the VCAM to the backplane to the GE10.

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. Figure 4-5 shows a block diagram of the RealityEngine^2 and VTX board set.

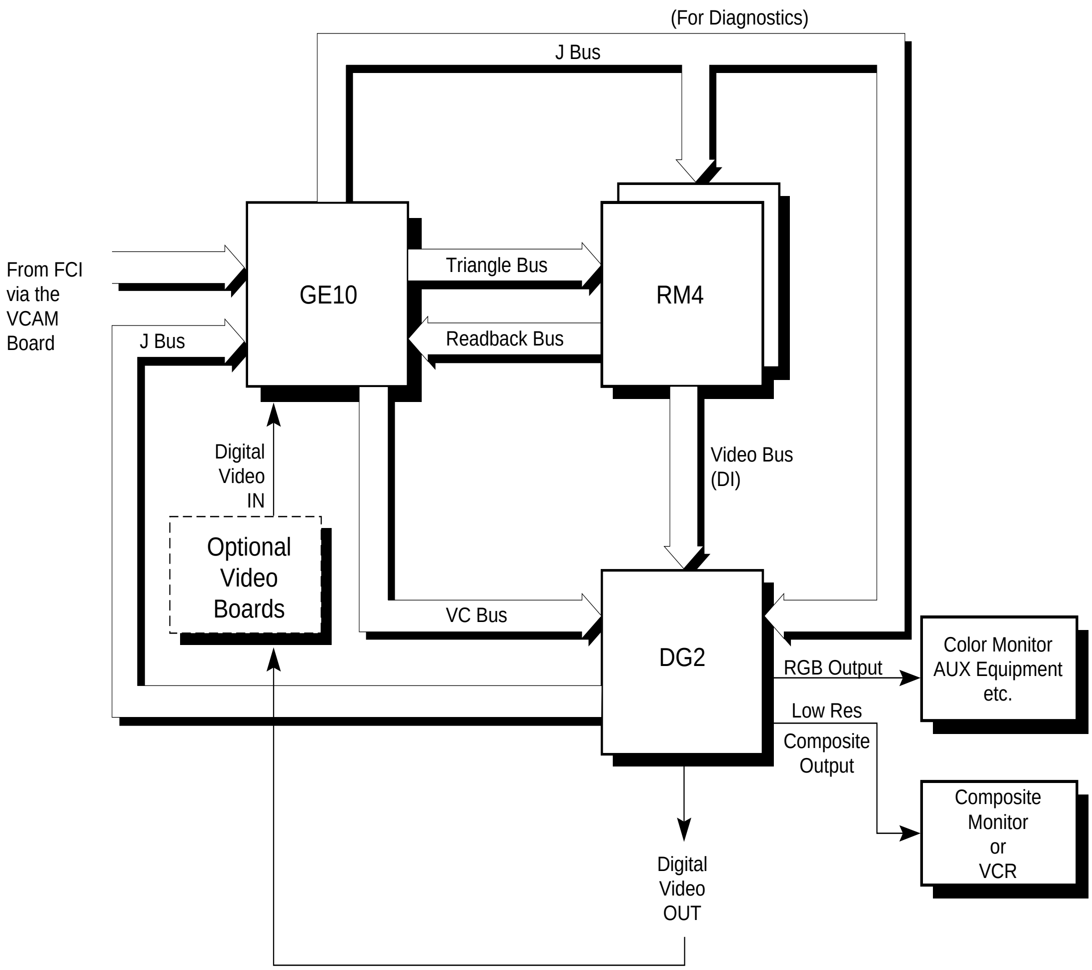


Figure 4-5 RealityEngine² and VTX Graphics Subsystem Functional Block Diagram

The RealityEngine² and VTX board sets use application-specific integrated circuits (ASICs) and parallel processing to reduce the amount of required hardware. This reduction can be seen when the RealityEngine² and VTX are compared to their predecessor, PowerVision. The RealityEngine² and VTX have three standard boards; PowerVision requires a minimum of four boards.

Note: The GE10 performs the functions of the GE6 and GM3 (geometry manager) board of the PowerVision system.

4.6.3 Geometry Engine (GE10) Board

The Geometry Engine (GE10) board processes graphics library (GL) commands and data from the system CPU board and is the first stage of the graphics pipeline. Figure 4-6 shows a block diagram of the GE10.

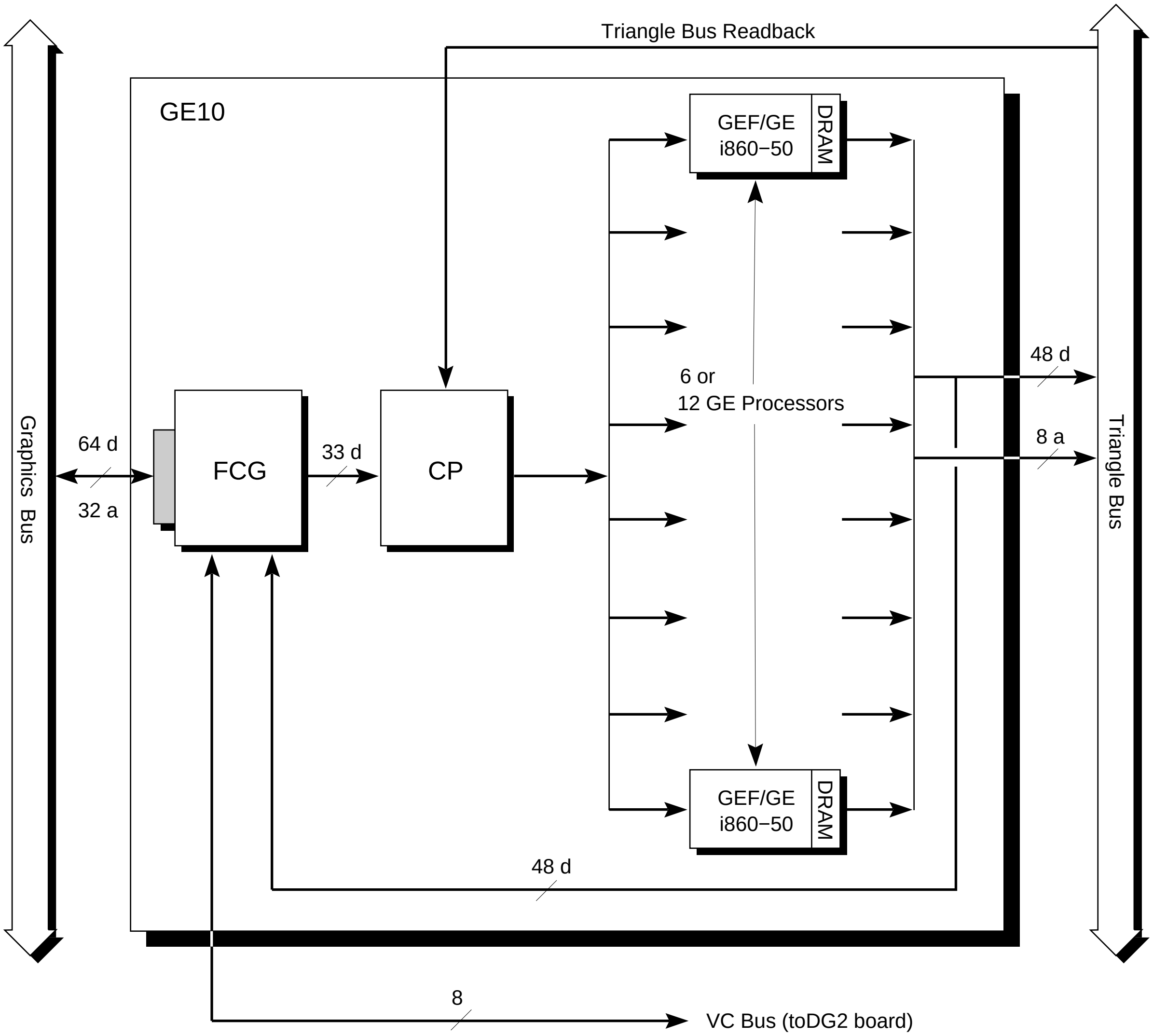


Figure 4-6 Geometry Engine Functional Block Diagram

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 Flat Cable Interface through 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 GE10 (RE^2 version) has 12 GE processors. The GE10V (VTX version) has six GE processors.The GE processors consist of a floating-point microprocessor, the Intel™ i860XP, a 64-bit-wide DRAM, which stores both code and instructions, and the Geometry Engine FIFO (GEF) ASIC (see Figure 4-7). The Intel microprocessor can perform 100 million floating-point operations per second (MFLOPS).

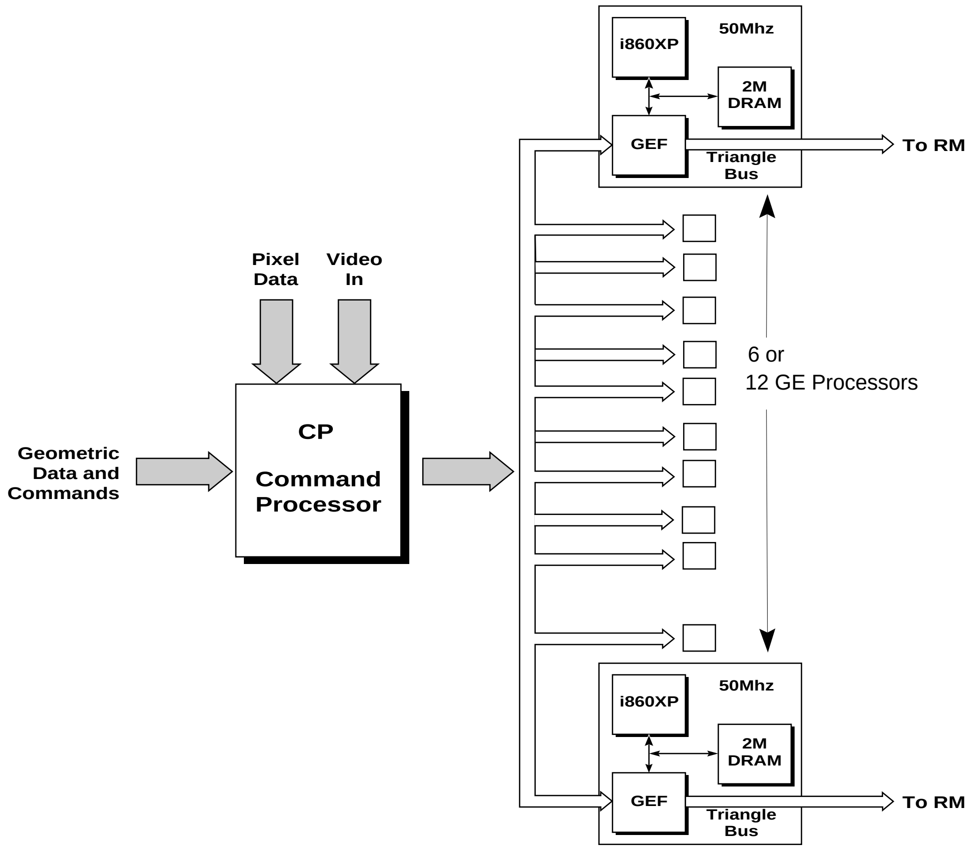


Figure 4-7 GE Processor Block Diagram

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

4.6.4 Raster Memory (RM4) Board

The Raster Memory (RM4) boards scan and convert 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. The frame buffer is a rectangular array of image memory processors.The graphics subsystem displays images by projecting continuous spans onto the screen. Following the transfer to the frame buffer, the RM4 hands off control of the graphics subsystem to the display generator (DG2). The RM4 board is shown in Figure 4-8.

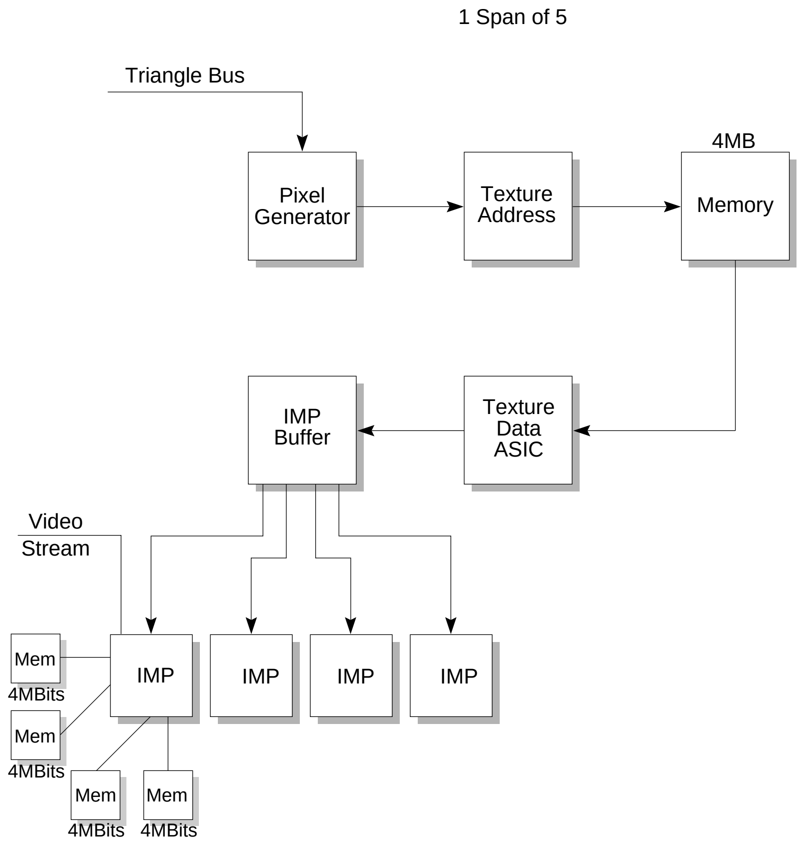


Figure 4-8 Raster Memory (RM4) Board Block Diagram

The RE^2 board set can have up to four RM4 boards per pipeline. The cost-reduced VTX supports one RM4 board. As more RM4 boards are added, the spans are interleaved, providing higher resolution and display quality.

Note: A 10-span system has 10 pixel generators, 160 image engines and increased memory. A 20-span system has 20 pixel generators, 320 image engines, and even greater memory.

To differentiate the boards, the RM4s receive a 2-bit identity field from the video bus front plane, the DI1. This field identifies which of four addresses a board occupies.

4.6.5 Display Generator Subsystem (DG2)

The DG2 board receives digital frame buffer pixel data from the RM4 board over the video bus. The DG2 then 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 4-9 for a functional block diagram of the DG2 board).

4.6.5.1 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.

4.6.5.2 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

4.6.5.3 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.

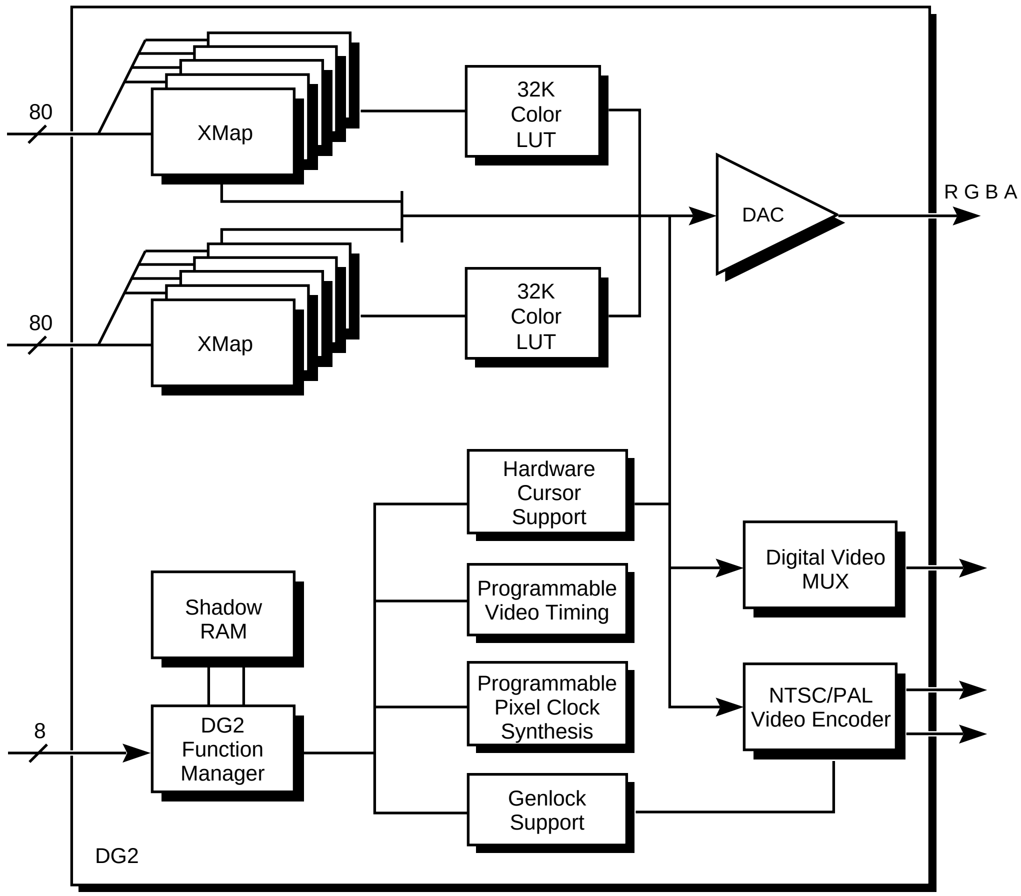


Figure 4-9 Display Generator (DG2) Block Diagram

4.7 Storage Devices

SCSI front-loading devices (FLDs) require no additional cabling at installation; however, each device should be checked to ensure that it has a valid ID select number. The location of the ID select switch varies according to the make of drive being installed.

The internal SCSI buses terminate on the SCSI backplane, which is part of the drive bulkhead assembly (see Chapter 2, “Chassis Tour,” for more information). If remote SCSI drives are to be connected to the internal SCSI bus, remove the cable from the SCSI channel the cable, remove the bus terminator, and attach a SCSI cable of the correct length between the remote drives and the CHALLENGE / Onyx system I / O panel. Ensure that the bus is correctly terminated at the last remote device.

Note: The maximum allowable length for single-ended SCSI cabling is 19.6 feet (6 meters), and the maximum allowable length for differential SCSI cabling is 81 feet (25 meters).

These guidelines also apply to systems having additional SCSI channels owing to the installation of one of the optional mezzanine cards.

4.8 SCSI Support

The CHALLENGE / Onyx products support many types of SCSI protocols, resulting in a wide variety of SCSI channel configurations. This document 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.

4.8.1 Supported SCSI Protocols for CHALLENGE/Onyx

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 depend on one another. For example, a 16-bit SCSI peripheral typically transfers more data at a faster rate than an 8-bit SCSI peripheral.

4.8.2 SCSI Bus Bandwidth

An 8-bit bus provides up to eight SCSI IDs; a 16-bit bus provides up to 16 SCSI IDs. Because 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.

4.8.3 SCSI Bus Type

A SCSI bus type is either single-ended or differential. Differential buses use circuitry to obtain higher signal levels in a bus than normally possible with single-ended buses, as shown in Figure 4-10. Higher signal levels support longer cable lengths and more devices on a bus. Single-ended and differential SCSI peripherals use different integrated circuitry and cannot be mixed on a bus.

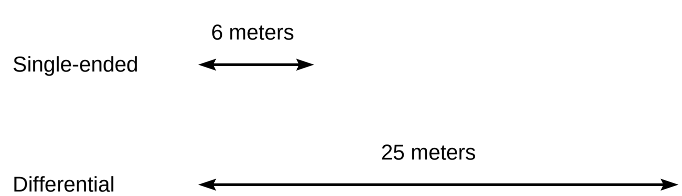


Figure 4-10 Maximum SCSI Bus Length Based on Bus Type

4.8.4 SCSI Data Transfer Rate

Data transfer rates are either slow or fast, measured in megatransfers per second. Megatransfers are the millions of 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 depend on the bus bandwidth. See Figure 4-11.

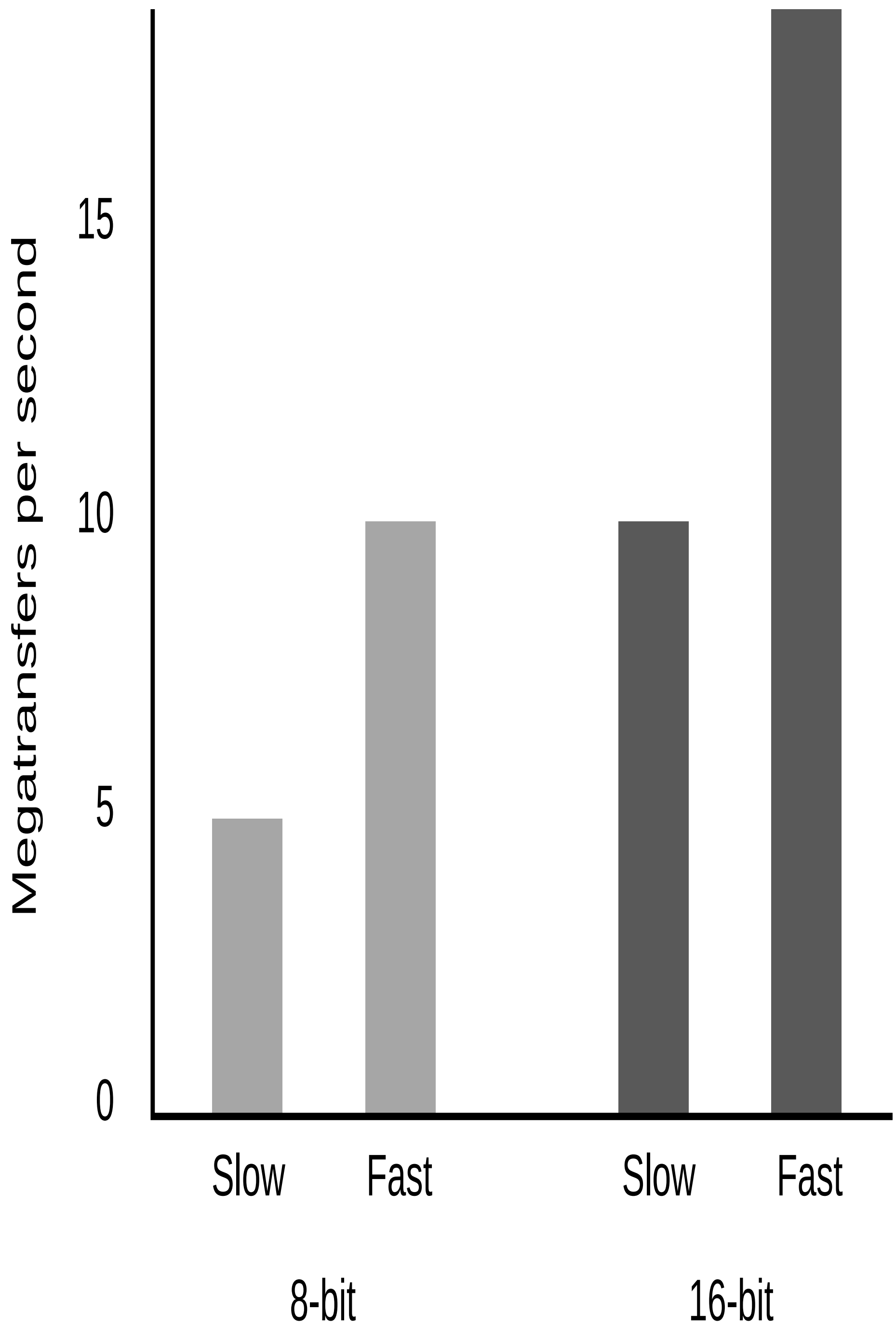


Figure 4-11 SCSI Bus Data Transfer Rates

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.

4.8.5 SCSI Configuration Guidelines

These guidelines reflect the dependencies between SCSI bus bandwidths, types, and data transfer rates. Follow these guidelines to minimize inconsistent or inoperable SCSI buses:

- Install 8-bit and 16-bit devices on separate buses.
- Install single-ended and differential devices on separate buses.
- When calculating SCSI bus length, include all cable-length inside devices, components, and chassis.

4.9 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 Section 4.9.1, "SCSI Channel Component and Descriptions" for a description of the typical components in an Everest SCSI bus and Figure 4-20 for an overview of the default chassis SCSI implementations for the deskside chassis.

4.9.1 SCSI Channel Component and Descriptions

This section describes the various SCSI channel components.

Note: The SCSI component drawings are not to scale.

An IO4 board (see Figure 4-12) provides SCSI bus signals for up to eight SCSI buses. SCSI buses 0 and 1 are available directly on the IO4 board. Buses 2 through 4 require a mezzanine board attached to the lower mezzanine connector on the IO4 board, and buses 5 through 7 require a second mezzanine board attached to the upper mezzanine connector.

IO4 boards support all SCSI protocols and use an adapter board to select the desired protocol for each bus. Several IO4 boards may reside in a system.

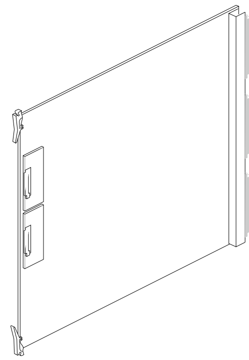


Figure 4-12 IO4 Board

A SCSI mezzanine board (see Figure 4-13) attaches to an IO4 board, up to two mezzanine boards for each IO4 board. Each SCSI mezzanine board supports three 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.

The first mezzanine board provides SCSI buses 2 through 4, with bus 2 on the outer center connector. The second mezzanine board provides SCSI buses 5 through 7, with bus 5 on the outer center connector.

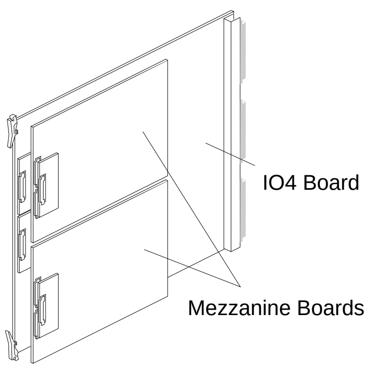


Figure 4-13 SCSI Mezzanine Board

A channel adapter board (see Figure 4-14) 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.

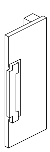


Figure 4-14 Channel Adapter Board

A SCSI bulkhead (see Figure 4-15) 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.The bulkhead also provides connectors at the end of the channels for termination.Several different SCSI bulkheads exist based on the chassis involved.

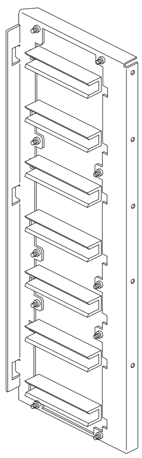


Figure 4-15 SCSI Bulkhead (deskside version shown)

A 50-pin drive adapter board (see Figure 4-16) selects one of the two possible SCSI channels delivered to each drive bay. A drive adapter board resides on a drive sled and provides a 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.

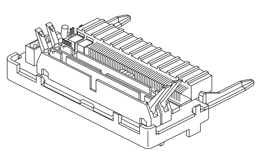


Figure 4-16 Drive Adapter Board, 50 pin

A 68-pin drive adapter board (see Figure 4-17) selects one of the two possible SCSI channels delivered to each drive bay. A drive adapter board resides on a drive sled and provides a 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.

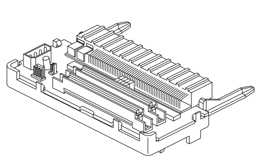


Figure 4-17 Drive Adapter Board, 68 pin

A SCSI device (see Figure 4-18) is a media retrieval mechanism that uses the SCSI interface.

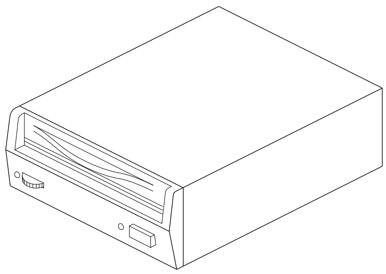


Figure 4-18 SCSI Device (CD player shown)

A SCSI terminator (see Figure 4-19) resides at the end of a SCSI channel and terminates the signals. A SCSI channel will not work unless the signals are properly terminated.

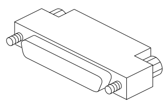


Figure 4-19 SCSI Terminator

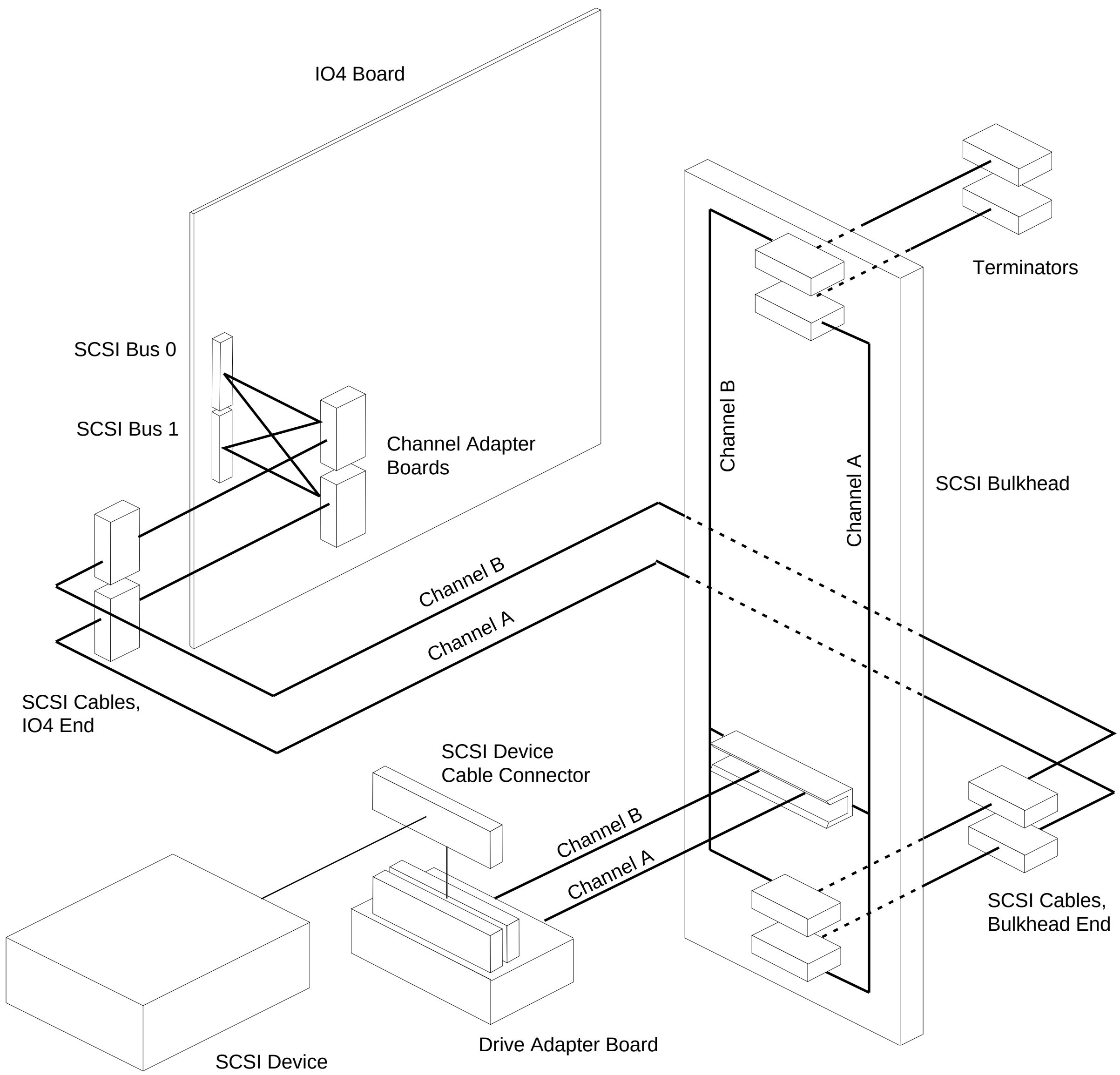


Figure 4-20 Deskside Internal SCSI Channel Components

4.10 New Addressing Scheme for Drives

An IO4 board can have up to eight SCSI bus interfaces or channels (see Figure 4-21). Compare this with the IO3, the predecessor to the IO4, which has only two channels (or SCSI bus interfaces). In addition, the new, wider SCSI pin connector on the chassis now has 68 pins that enable connectivity with up to 15 devices per channel.

Due to this expanded connectivity, the IRIX and PROM monitor drive-addressing scheme has been modified to accommodate the increased number of drives and channels.

4.10.1 Addressing Drives Using the PROM

The previous PROM drive addressing format remains basically in place, for example, *dksc(a,b,c),* where *a* represents the SCSI bus number, *b* refers to the drive number, and *c* refers to the drive's partition number. The *dksc* designation is the monitor's name for SCSI.

Note: The PROM can address only the master IO4 board in a system. In a deskside system, the master IO4 resides in either slot 3 (Onyx) or slot 5 (CHALLENGE). In a rackmount system, the master IO4 resides in slot 15. If you need to address a drive connected to another IO4 board, you must do so under IRIX.

4.10.2 Addressing Drives under IRIX

Under IRIX, the addressing scheme has changed as shown in the following new format, */dev/dsk/dksSSSdDsP,* where */dev/dsk* references the IRIX file directory of the drives and *dks* designates SCSI. The *SSS* designator represents the slot number of the IO4 board and / or the SCSI bus number (see Note below), *dD* refers to the drive number, and *sP* refers to the drive's partition number.

Note: If you are addressing a drive on the master IO4 board system, you need to specify *only* the applicable SCSI bus number. If you are addressing a drive on another IO4 board, you must specify both the slot number of the board and the applicable SCSI bus number.

For example, if you are addressing a drive connected to an IO4 board in slot 4 and SCSI bus number 5 (on a deskside system), the *SSS* number would be 45.

With the earlier IO3 boards, the software required only single digits to differentiate drives; however, with the IO4 and new version of the software, the SCSI bus or *SSS* number can contain up to three digits. If *SSS* is a two- or three-digit number, the first one or two digits identify the IO4 board, by the Ebus slot number. The final digit identifies which of the eight possible SCSI buses (0 through 7) on the IO4 board is used. See Figure 4-21 to see how the buses are physically laid out on the IO4 board.

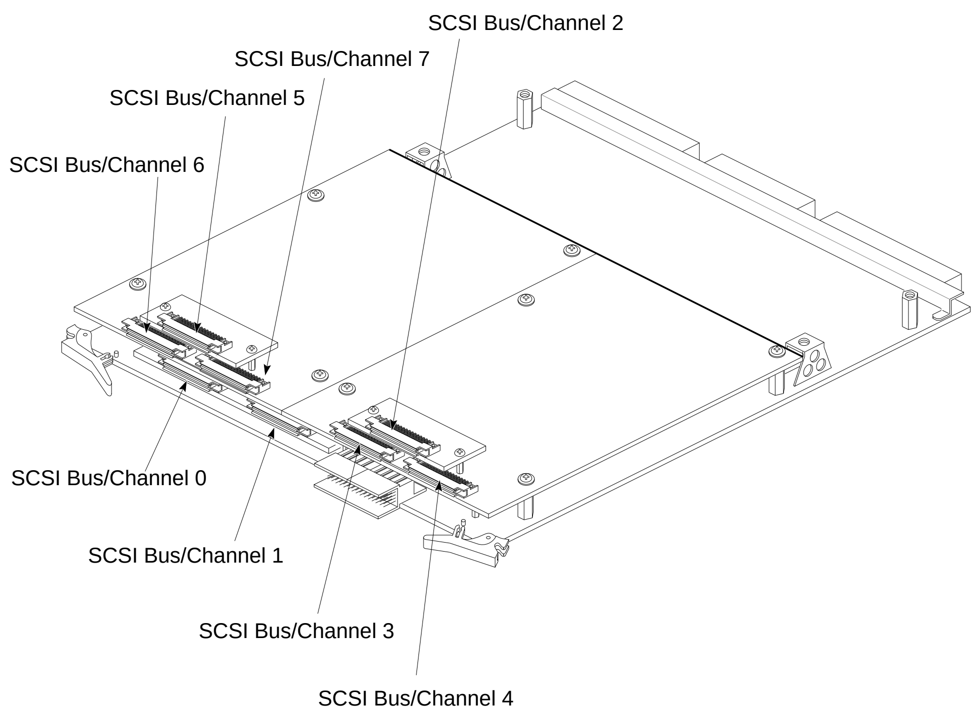


Figure 4-21 SCSI Channels or Bus Interfaces on an IO4 Board with Two Mezzanine Boards

4.10.3 Forming the Drive Address

The software drive identification number uses the same form as in the addressing scheme described earlier. Insert the IO4 board slot number and / or the SCSI bus number, followed by the drive number and partition number as required.

4.10.3.1 PROM Addressing

Assume that you want to address partition 0 on SCSI drive (number 6). This drive connects to SCSI bus number 6. You can also assume that the IO4 resides in slot number 15 in a rackmount system.

The PROM drive address is *dksc(6,6,0).*

4.10.3.2 IRIX Addressing

Assume that you want to address partition 0 on SCSI drive (number 6). This drive connects to SCSI bus number 6. You can also assume that the IO4 resides in slot number 14.

The IRIX drive address is */dev/dsk/dks146d6s0.*

4.10.3.3 Using the New Address

You must know this new drive addressing and identification method to run the disk maintenance programs such as *fx* and *MAKEDEV*. For information on running these programs, see the system administration documents for your computer.

Chapter 5

Installation

5.1 Overview

This chapter describes how to unpack, cable, and configure the CHALLENGE / Onyx deskside system. This chapter also contains removal and replacement procedures for field-replaceable units (FRUs).

5.2 Safety

Read these safety statements carefully before you install or remove any part of the system.

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) and Silicon Graphics–trained personnel only. This equipment uses electrical power internally that is hazardous if the equipment is improperly assembled or disassembled.**

Caution: This equipment is extremely sensitive to damage from electrostatic discharge (ESD) caused by the buildup of electrical potential on clothing and other materials.

Follow these ESD preventive measures:

- Attach a ground strap to your wrist when connecting / disconnecting boards or 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 until they are needed in the antistatic bags.
- Place the boards only of an antistatic mat. Do not place boards on top of an antistatic bag unless the outside of the bag also has antistatic protection.
- Remove a board from its antistatic bag only when you are properly grounded to the chassis ground with a ground strap.
- If you are servicing a system or installing a hardware upgrade, do not disconnect the power cord from the wall socket *and* the chassis. You will lose the system ground and could damage the equipment as a result.

- Do not use an ohmmeter on the boards.

Caution: Sixteen fuses are installed on the SCSI backplane. To protect against fire, replace only with a Cooper Industries, Bussman Div., P/N MCR-5, rated 125 V, 5 A fuse.

Caution: There is a danger of explosion if the lithium battery-powered integrated circuit on the IO4 and system controller board is incorrectly replaced. Replace only with a Dallas Semiconductor, P/N DS1397. Discard used part according to manufacturer's instructions.

5.3 Unpacking

Read this section for information on how to unpack the deskside system.

Warning: **Be careful when unpacking and moving the CHALLENGE/Onyx deskside 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.**

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

Follow these procedures to unpack the box.

Note: The CHALLENGE/Onyx deskside shipping crate is the same as the one used for the Single Tower and Crimson systems.

1. Lift up the cardboard box to expose the top of the system, then remove the bottom cardboard skirt.
2. Locate the two wooden ramps supplied with the packing material.
3. Place one end of the wooden ramp on the platform of the system. Place the other end on the ground.
4. Position one person in the front of the system and another in back, then roll the system down the ramp. Make sure the casters maintain contact with the platform until the system rolls to ground level.

Warning: **The deskside chassis weighs 160 lbs (72.57 Kg). Take care when rolling it system down the ramp.**

5.4 Graphics System Installation

Before beginning the installation procedure, verify that the installation site meets the space, power, and environmental guidelines found in the *CHALLENGE/Onyx Site Preparation Guide* (P / N 108-7040-*xxx*).

5.4.1 Graphics System Installation Summary

See Table 5-1 for a quick installation checklist for the Onyx deskside system.

Tasks	Location in Manual
1. Read the safety precautions.	See Section 5.2, “Safety.”
2. Unpack the system.	See Section 5.3, “Unpacking.”
3. Connect the monitor.	See Section 5.4.3, “Monitor Cabling.”
4. Connect the keyboard and mouse.	See Section 5.4.4, “Keyboard and Mouse Cabling.”
5. Power up the system and verify normal operation.	See Section 5.6, “Powering Up and Verifying Operation.”
6. Load the front-loading devices.	See Section 5.7, “Loading the Front-loading Devices (FLDs) into the System.”
7. Connect the printer.	See Section 5.8.1, “Printer Cabling.”
8. Connect the modem (optional).	See Section 5.8.2, “Modem Cabling.”
9. Connect to Ethernet drop.	See Section 5.9, “Connecting the System to Ethernet.”
10. Configure the graphics hardware.	See Section 5.10, “Configuring the Onyx Graphics System.”
11. Load the software.	See Section 5.11, “Software Installation.”

Table 5-1 Quick Onyx Deskside System Installation Checklist

5.4.2 System Board Installation

All boards ordered with the system should have been installed at the factory. You do not need to install any boards into the system unless you are upgrading the chassis.

5.4.3 Monitor Cabling

The RE^2 graphics workstation configuration ships with a 21-inch (1600 x 1200 pixel) color monitor (see Figure 5-1). The VTX graphics system uses a 19-inch monitor with either BNC or 13W3 connectors. See Figure 5-2 and Figure 5-3 for connection information.

Note: For additional information regarding monitor operation, see the monitor's user's guide.

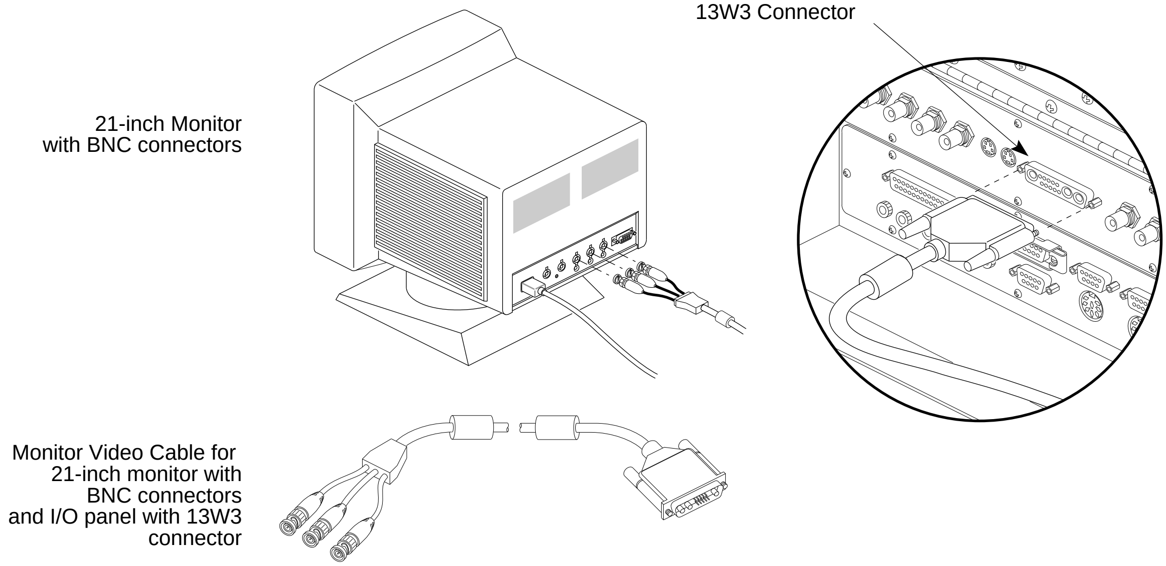


Figure 5-1 Connecting a 21-inch Monitor

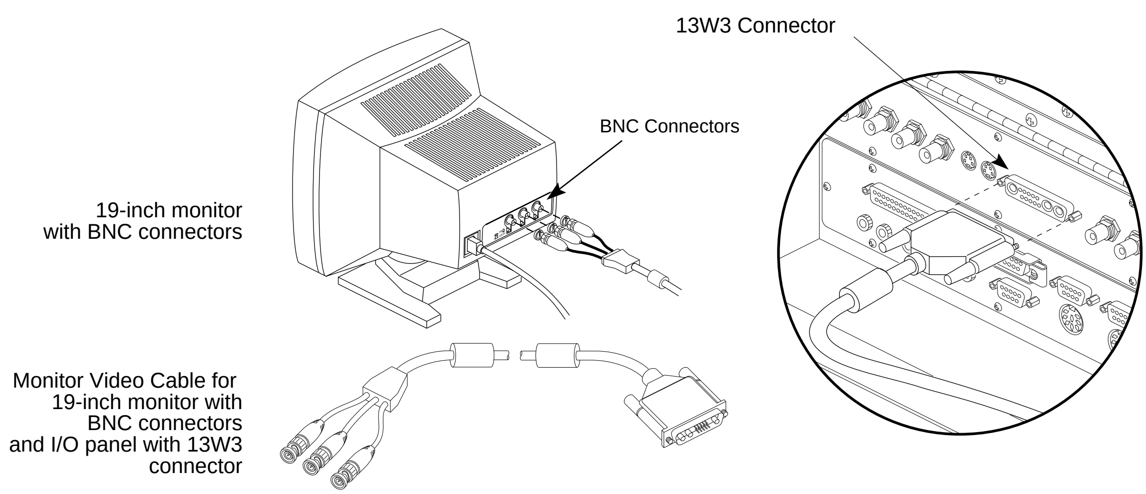


Figure 5-2 Installing a 19-inch Monitor with BNC Connectors

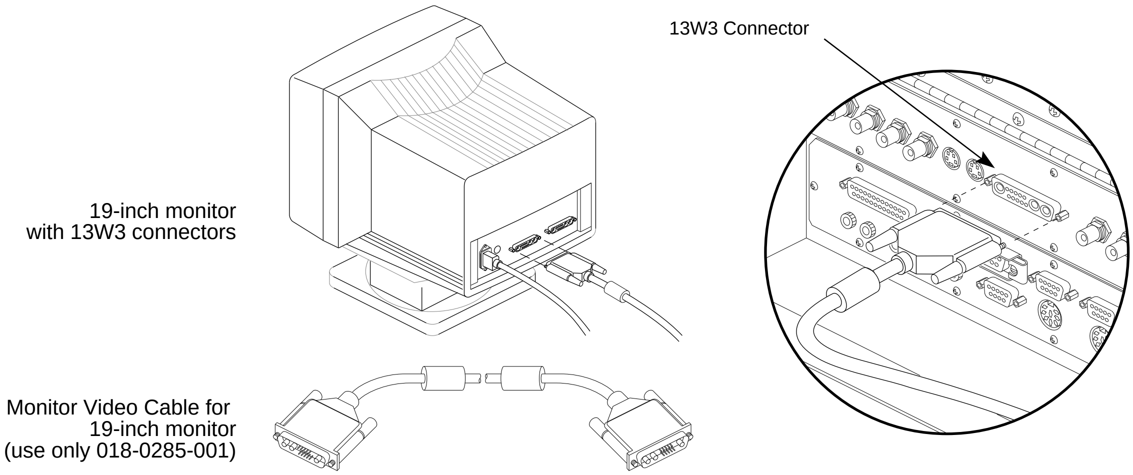


Figure 5-3 Installing a 19-inch Monitor with 13W3 Connectors

5.4.4 Keyboard and Mouse Cabling

The Onyx deskside system ships with a standard 101-key international keyboard. The keyboard has two identical plug receptacles, located in the upper right and left corners. These receptacles will accept the 6-pin connectors from either the keyboard cable or the mouse. Attach the keyboard as shown in Figure 5-4.

Note: After you install the keyboard and mouse, go to Section 5.6, "Powering Up and Verifying Operation."

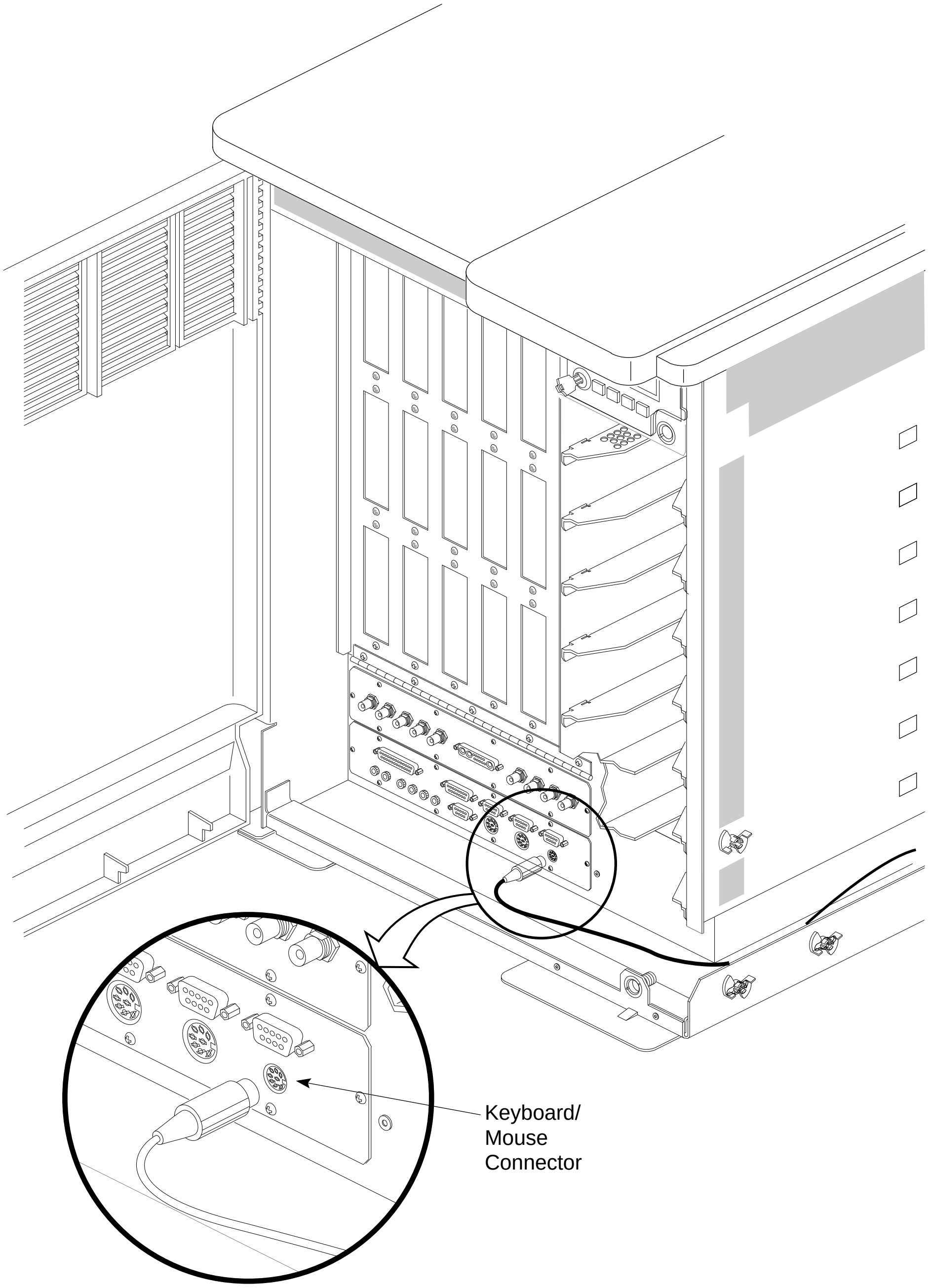


Figure 5-4 Keyboard Cabling

5.5 Server Installation

Before beginning the installation procedure, verify that the installation site meets the space, power, and environmental guidelines found in the *CHALLENGE/Onyx Site Preparation Guide* (P / N 108-7040-*xxx*).

5.5.1 Server System Installation Summary

See Table 5-2 for a quick installation checklist for the CHALLENGE deskside system.

Tasks	Location in Manual
1. Read the safety precautions.	See Section 5.2, “Safety.”
2. Unpack the system.	See Section 5.3, “Unpacking.”
3. Connect the monitor.	See Section 5.4.3, “Monitor Cabling.”
4. Connect the keyboard and mouse.	See Section 5.4.4, “Keyboard and Mouse Cabling.”
5. Power up the system and verify normal operation.	See Section 5.6, “Powering Up and Verifying Operation.”
6. Load the front-loading devices.	See Section 5.7, “Loading the Front-loading Devices (FLDs) into the System.”
7. Connect the printer.	See Section 5.8.1, “Printer Cabling.”
8. Connect the modem (optional).	See Section 5.8.2, “Modem Cabling.”
9. Connect to Ethernet.	See Section 5.9, “Connecting the System to Ethernet.”
10. Load the software.	See Section 5.11, “Software Installation.”

Table 5-2 Quick CHALLENGE Deskside System Installation Checklist

5.5.2 Terminal and Keyboard Cabling

The CHALLENGE system server configuration requires a customer-supplied ASCII terminal and keyboard. The terminal is connected to the system using a null modem cable with a 9-pin connector. Attach the terminal as shown in Figure 5-5. Ensure that the terminal is set to the following parameters:

- 9600 baud, full duplex
- XON / XOFF handshaking
- 8 bits
- 1 stop bit

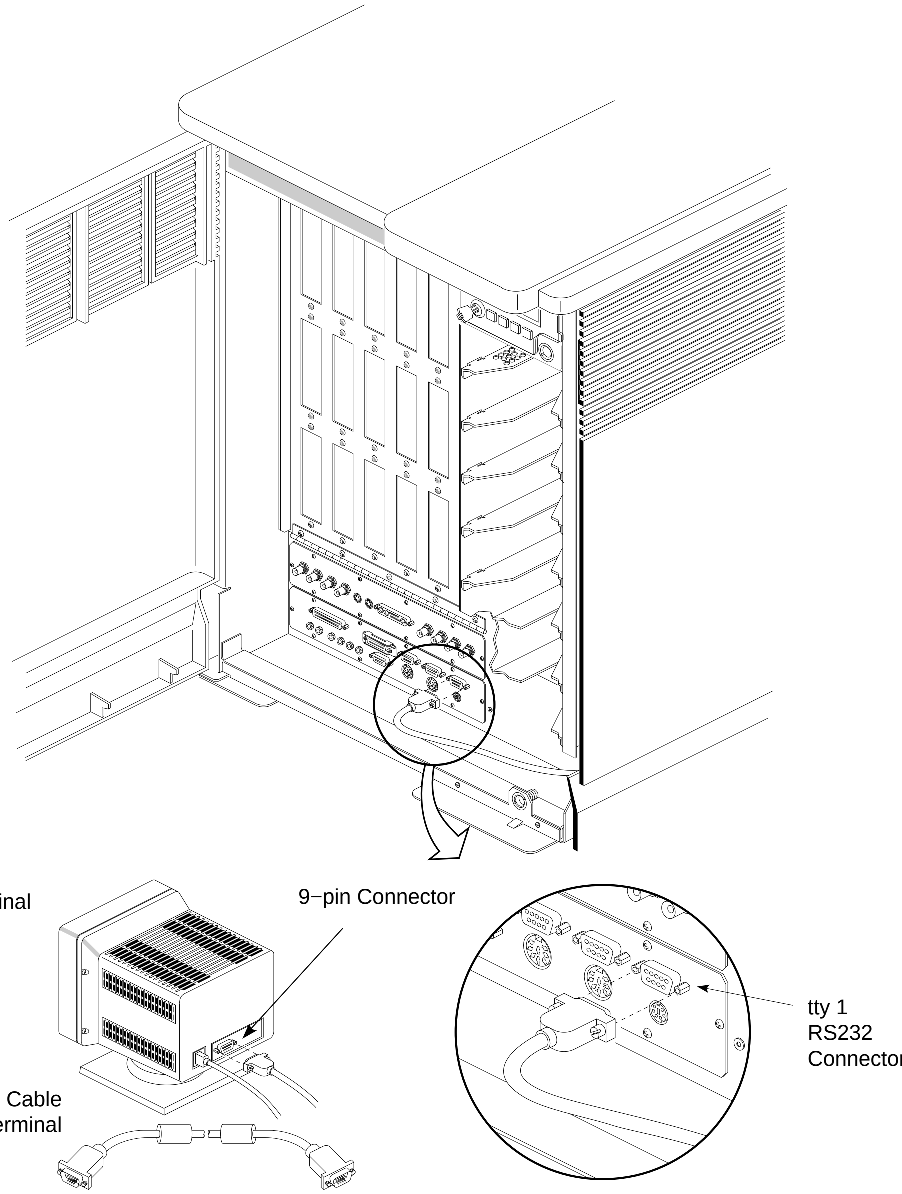


Figure 5-5 Connecting an ACSII Terminal

The keyboard has two identical plug receptacles, located in the upper right and left corners. These receptacles will accept the 6-pin minicircular connectors from either the keyboard cable or the mouse. Attach the keyboard as shown in Figure 5-4.

5.6 Powering Up and Verifying Operation

At this stage of the installation, you should have only the keyboard, mouse, and terminal or monitor connected. *Do not* connect additional devices to the chassis at this time. If something is wrong with the system, it will be easier to spot the possible problem, if additional devices are not connected. Follow these procedures to power up the system.

1. Turn on the main power switch on the back of the unit (see Figure 5-6).
2. Turn on the graphics monitor or ASCII terminal.
3. Turn the System Controller key switch to the On position (see Figure 5-7).
4. If desired, use the System Controller menu and display to watch the boot process status display by using the Menu function key.
5. When the power-on diagnostics have been completed, you will see this message on the monitor or terminal:

```
Starting up the system ...
To perform System Maintenance instead, press <Esc>
```

6. Type **hinv** to check and verify the hardware configuration of the system. You should get a display similar to the following:

```
4 100 MHZ IP19 Processors
CPU: MIPS R4000 Processor Chip Revision: 3.0
FPU: MIPS R4010 Floating Point Chip Revision: 0.0
Data cache size: 8 Kbytes
Instruction cache size: 8 Kbytes
Secondary unified instruction/data cache size: 1 Mbyte
Main memory size: 64 Mbytes, 1-way interleaved
I/O board, Ebus slot 11: IO4 revision 1
Integral IO4 serial ports: 4
VTX Graphics option installed
Integral Ethernet controller: et0, Ebus slot 11
Integral SCSI controller 1: Version WD33C95A
Integral SCSI controller 0: Version WD33C95A
Disk drive: unit 1 on SCSI controller 0
VME bus: adapter 0 mapped to adapter 45
VME bus: adapter 45
Integral IO4 parallel port: Ebus slot 11
```

Note: Some hardware options (such as a network board) may not be recognized by the PROM monitor. These options will not be listed by the *hinv* command. However, after you load and boot the operating system, the *hinv* command (executed at the IRIX prompt) should list *most* of the system hardware options.

Note: After you install the operating system, you can also type the following command at the IRIX prompt to obtain graphics hardware information:

```
/usr/gfx/gfxinfo
```

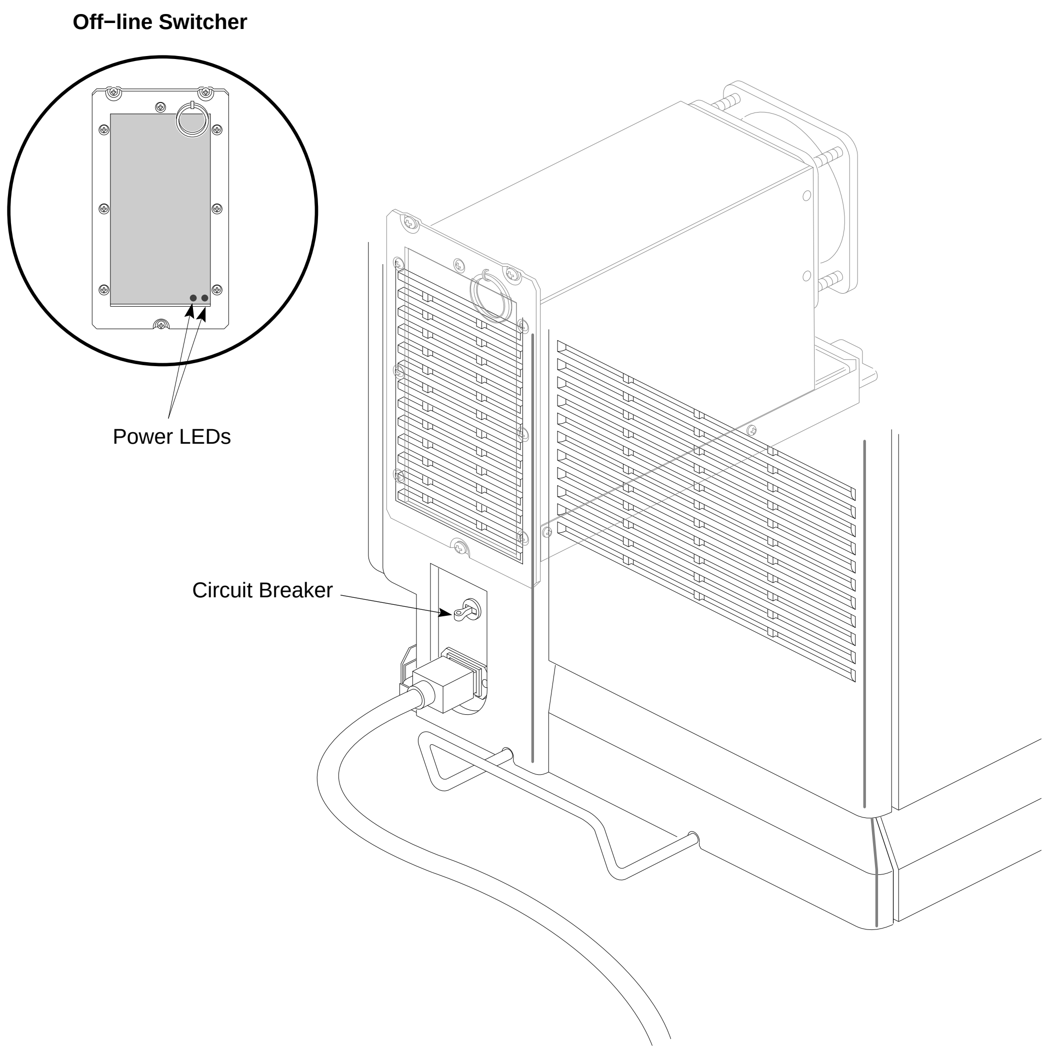


Figure 5-6 CHALLENGE / Onyx Main Power Switch

Note: When the rear plastic panel is removed and the offline switcher (OLS) is exposed, there are two power LEDs on the corner of the OLS. Both these LEDs should be *on* when the system is turned on.

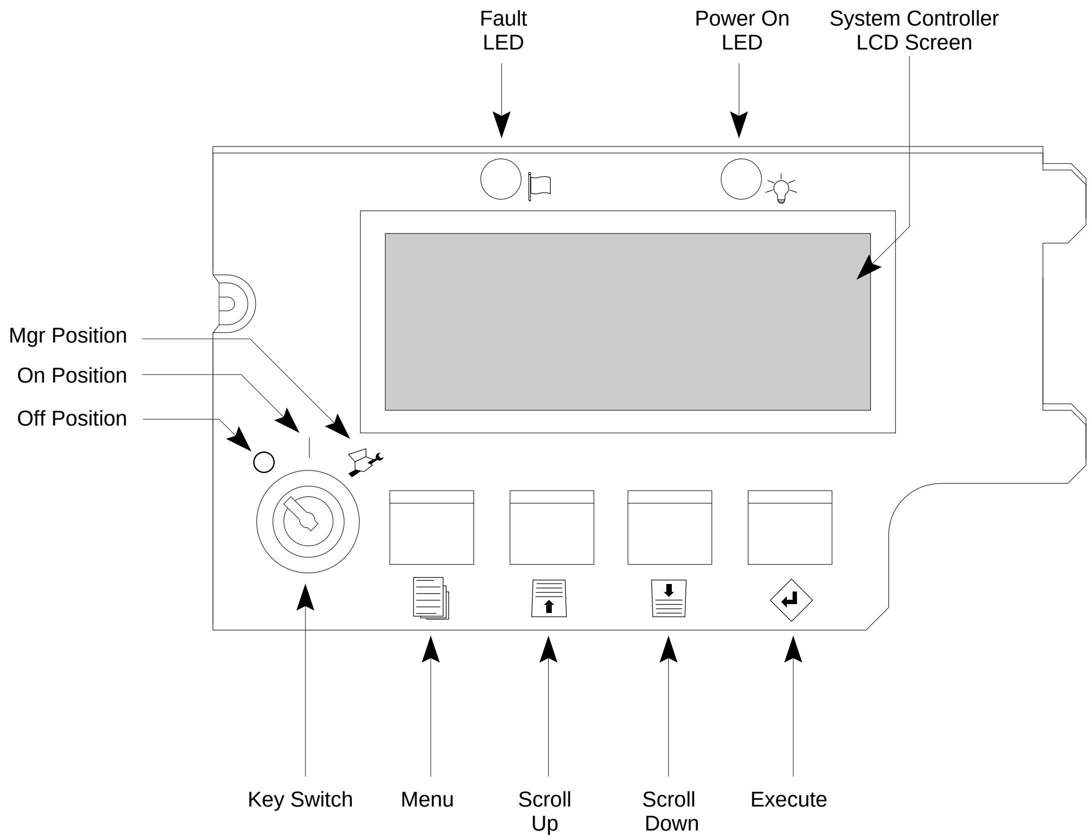


Figure 5-7 System Controller Status Panel

5.7 Loading the Front-loading Devices (FLDs) into the System

The CHALLENGE / Onyx FLDs use a sled assembly to mount into the drive bay; however, before installing a drive into a bay or slot, you need to determine the following:

- Is the drive differential or single-ended?
- Should the drive be set for channel A or B operation?

Note: Channel A is normally set up for single-ended devices, and channel B is normally set up for differential devices at the factory. If you plug a differential drive into the A channel or a single-ended drive into a B channel, you could render all the drives inoperable.

5.7.1 Installing a Front-loading Device

To install an FLD, follow these instructions:

1. Place the drive assembly into the desired slot. The slide lever should be pushed toward the left (in the unlocked position). Slide the drive module all the way into place.
2. Push the drive lever to the right so that drive module mounts into place. The drive should not come out if you pull on it (see Figure 5-8).

5.7.2 Loading the CD-ROM

Follow these instructions to load the CD-ROM into the drive:

1. Open the CD-ROM caddy by squeezing the two corner tabs together at the same time (see Figure 5-9).
2. Hold the CD-ROM diskette around the edges and place it into the caddy as shown in Figure 5-9.
3. Insert the caddy into the CD-ROM drive, arrow side first.

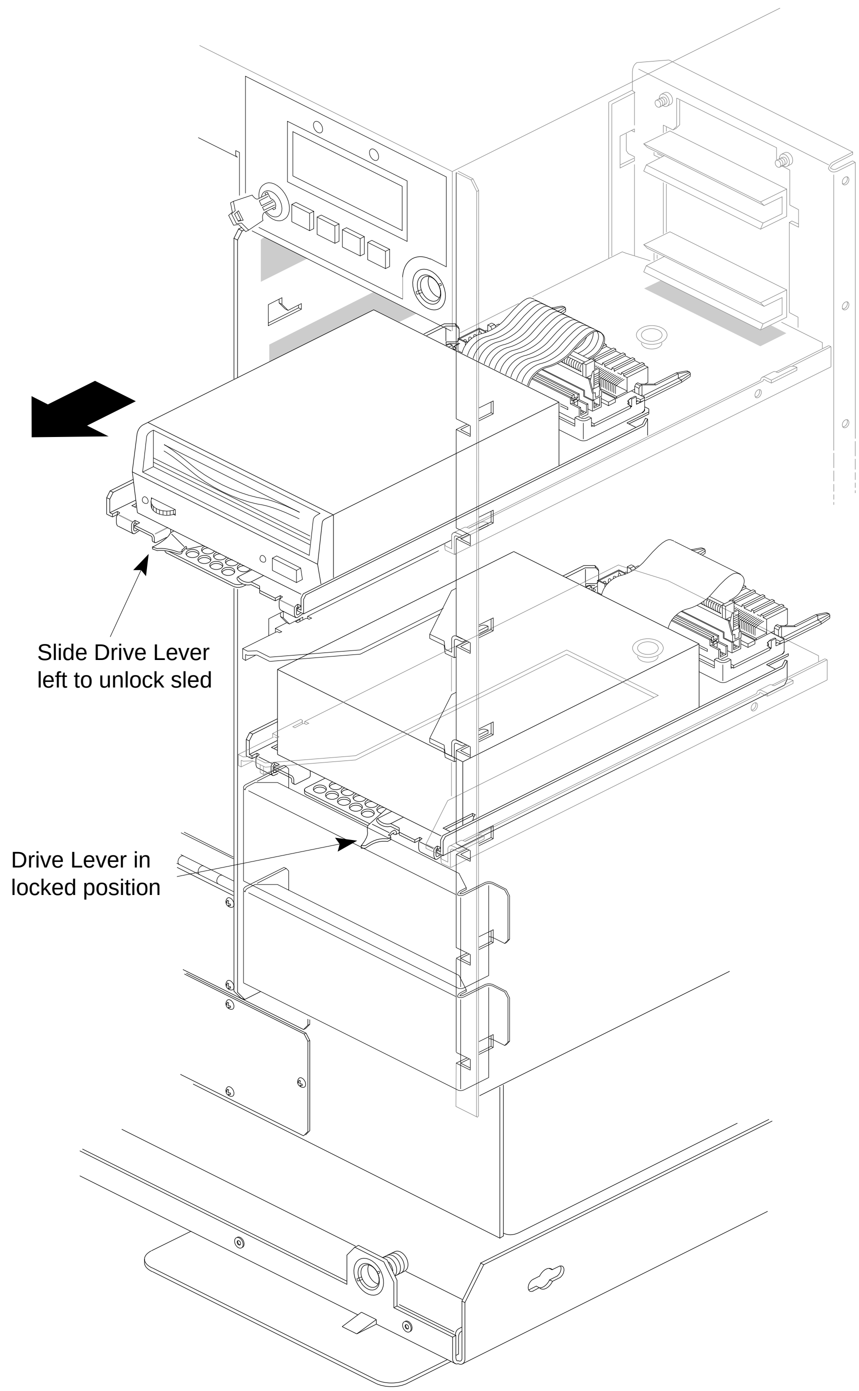


Figure 5-8 Installing a Drive

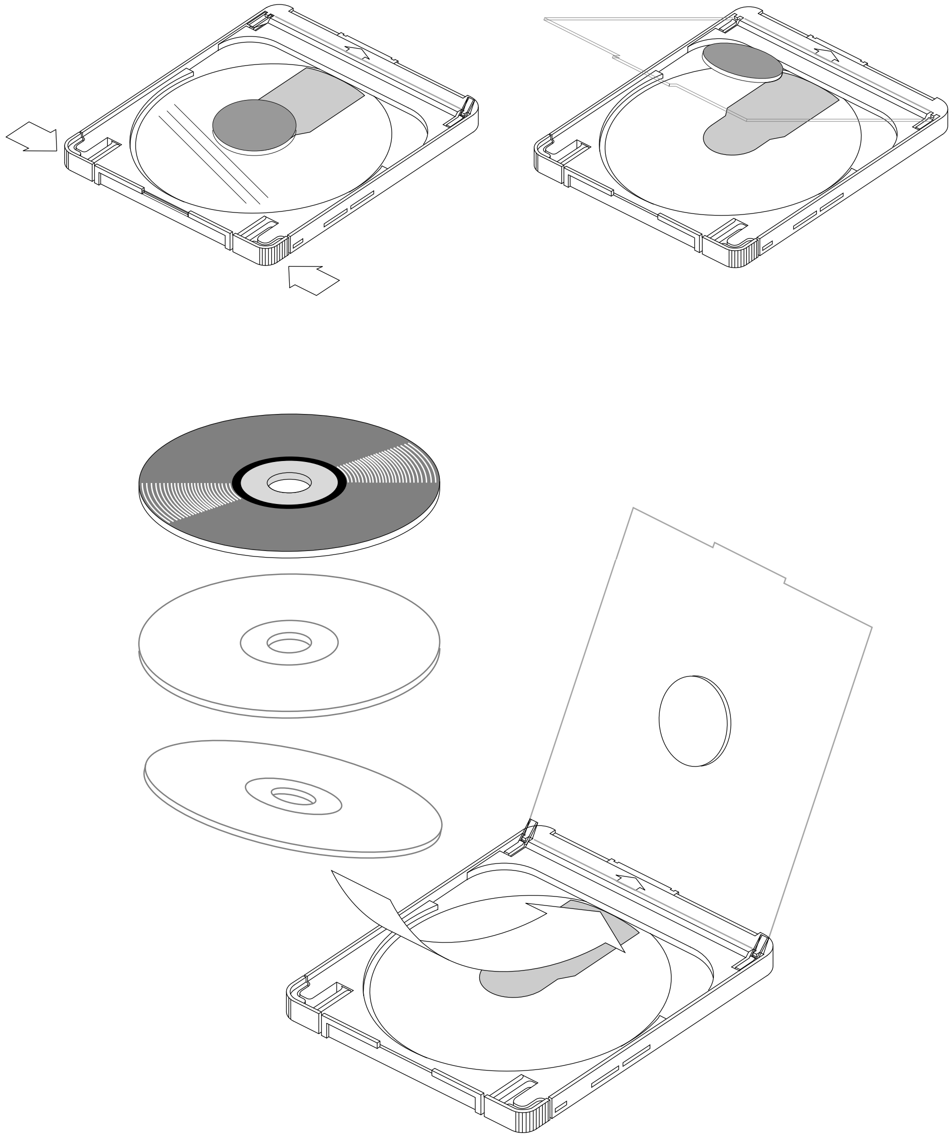


Figure 5-9 CD-ROM Installation

5.8 Optional Equipment

This section describes how to connect optional equipment such as a modem and a printer to the CHALLENGE/Onyx system.

5.8.1 Printer Cabling

The serial printer connection is a 9-pin serial port located on the CHALLENGE/Onyx system I/O panel. The parallel printer connection is a 25-pin Centronics-compatible port. Cable the printer using a printer or null modem cable, as shown in Figure 5-10 and Figure 5-11.

See Appendix B, “Cabling Local and Peripheral Devices,” for information on pin-outs.

Use the system manager’s “Printers” tool to configure the software to recognize the printer. Refer to the *IRIX Advanced Site and Server Administration Guide* for more information about printer configuration.

5.8.2 Modem Cabling

To attach a modem to the system, connect a modem cable to one of the 9-pin serial connectors on the I/O panel (see Figure 5-10). Note that this connection may require a 9-pin to 25-pin adapter cable. Be sure that the pin assignments on the cable match the pin assignments on the modem. See Appendix B, “Cabling Local and Peripheral Devices,” for information on pin-outs.

Note: This product requires the use of external shielded cables to comply with Part 15 of the FCC rules. Serial cables from different vendors may not be compatible.

Refer to the *IRIX Advanced Site and Server Administration Guide* for more information about modem configuration.

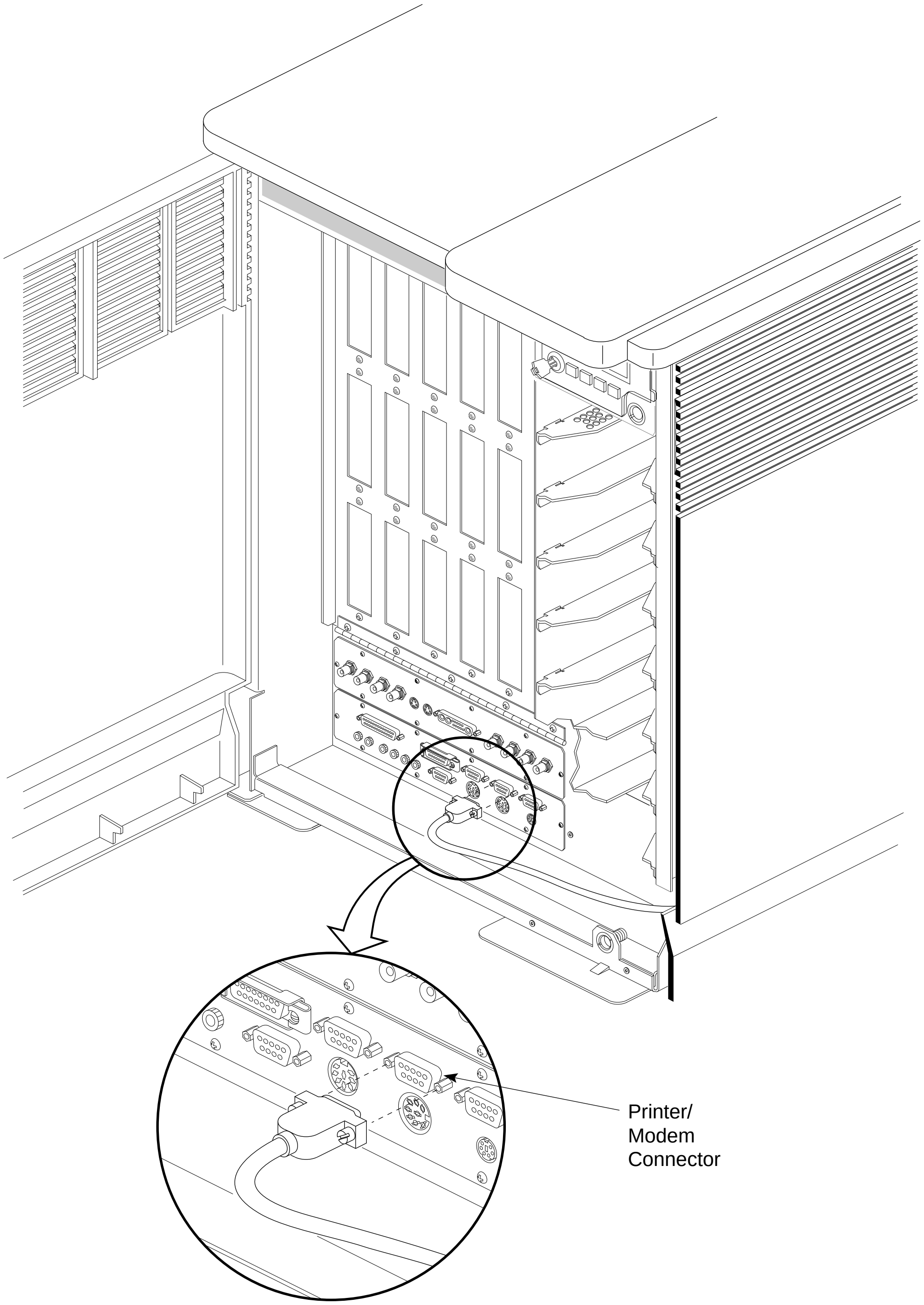


Figure 5-10 Connecting a Printer or Modem

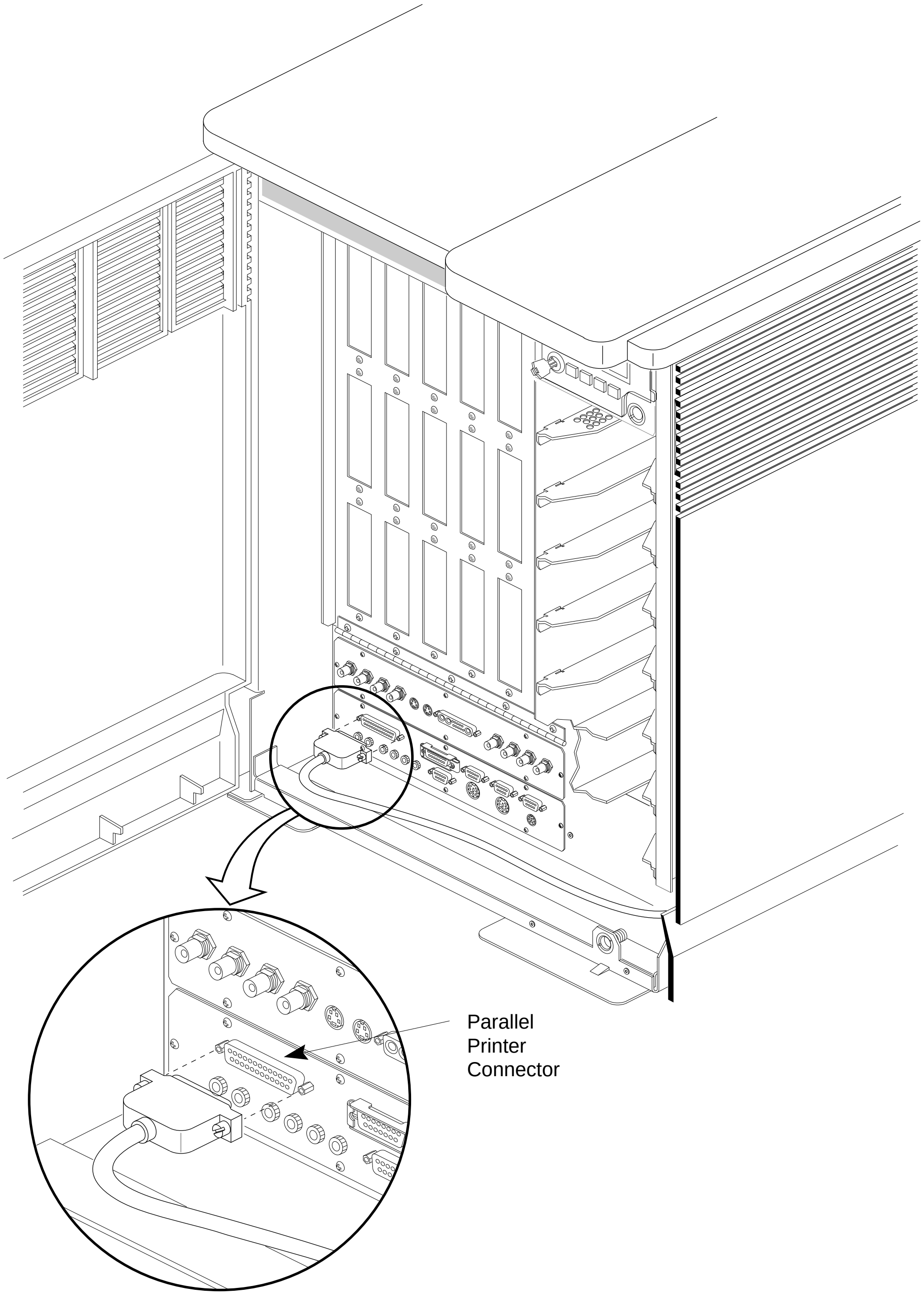


Figure 5-11 Connecting a Parallel Printer

5.9 Connecting the System to Ethernet

The CHALLENGE / Onyx system comes with a 15-pin AUI (attachment unit interface) Ethernet connector. If you have a CHALLENGE server system with multiple I / O panels, you can use multiple Ethernet drops. Follow these instructions to connect an Ethernet drop to your system.

1. Locate the Ethernet line, then route it to the rear of the chassis.
2. Run the Ethernet line into the cable trough on the side of the system nearest the disk drives.

   Note: If you do not know how to access this trough, see Section 5.16.8.

3. Plug the cable into the applicable connector (see Figure 5-12). Secure the 15-pin connection with a slide latch.

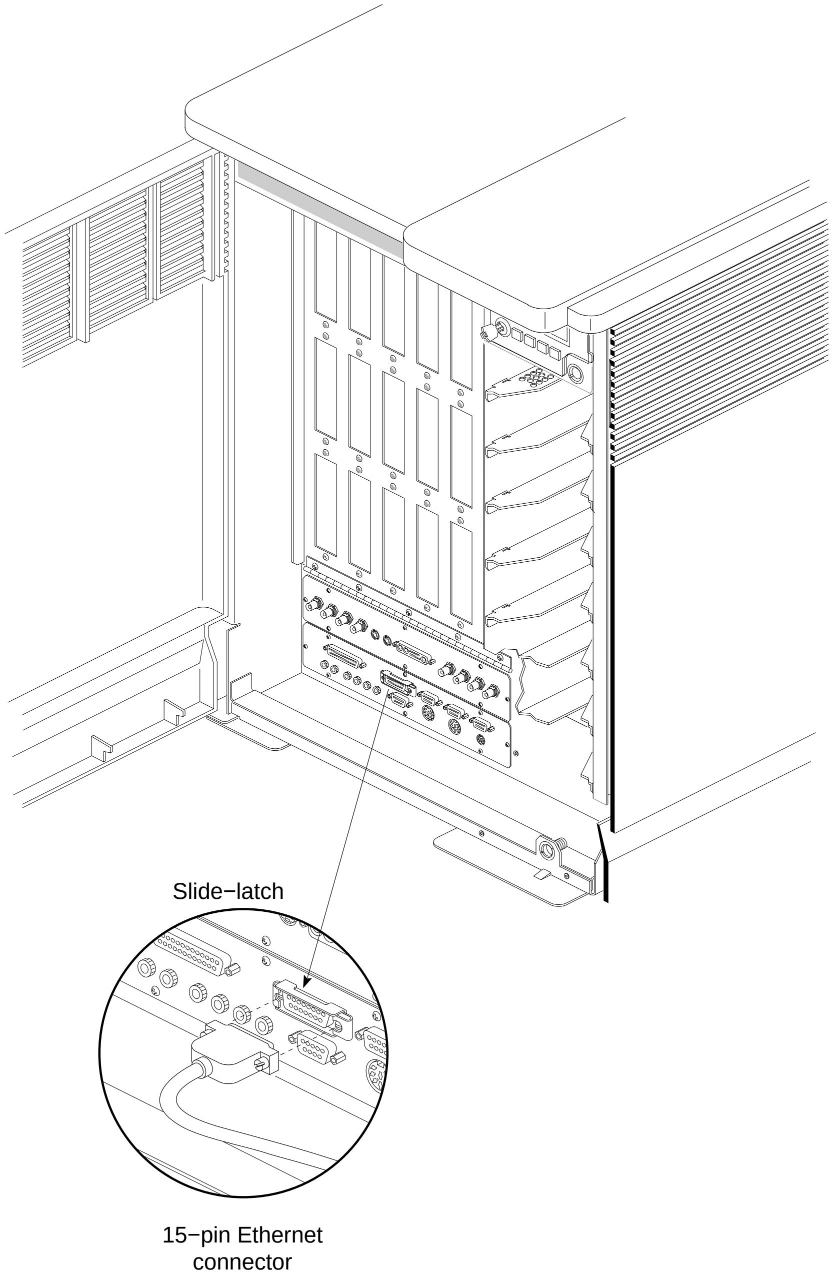


Figure 5-12 Ethernet Connection

5.10 Configuring the Onyx Graphics System

This section

- describes the controls and connectors for the 21-inch and 19-inch monitors

- shows how to connect additional video attachments to an Onyx system
- describes how to set and change the screen resolution.

5.10.1 The 21-inch Monitor Controls and Connectors

Figure 5-13 show the controls and connectors for the 21-inch monitor.

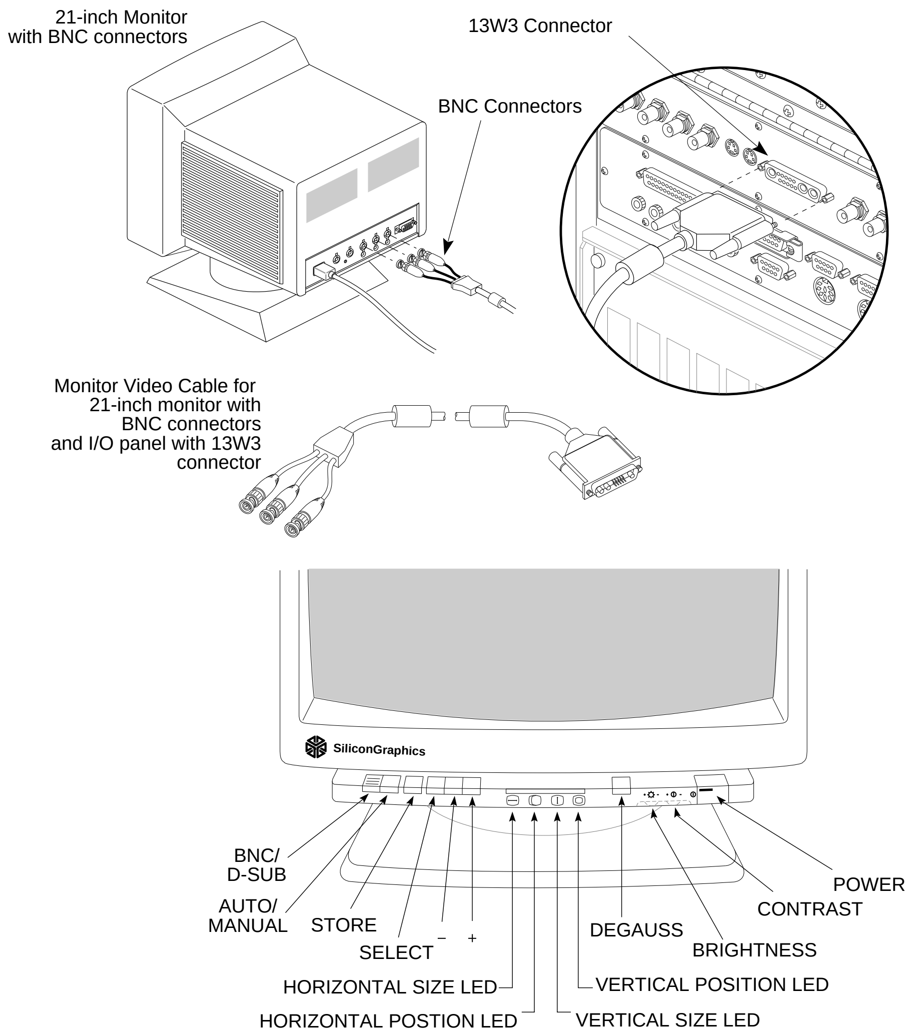


Figure 5-13 The 21-inch Monitor Controls and Connectors.

5.10.1.1 The 21-inch Monitor Controls

Table 5-3 and Table 5-4 describe the controls for the 21-inch color monitor.

Control	Description
BNC / D-SUB signal input selection switch	Selects BNC or 15-pin mini-D connectors.
Auto / manual selection switch	The Auto position selects one of the seven factory-preset viewing modes. Manual position allows display size and position to be changed using the Store, Selection, and Adjustment controls.
Store switch	When the Auto / Manual Selection switch is in the Auto position, pressing it steps through the preset viewing modes. When the Auto / Manual Selection switch in the Manual position, pressing it stores the displayed viewing mode. This mode is indicated when one of the adjustment LEDs light.
Selection switch	When the Auto / Manual Selection switch is in the Manual position, pressing it steps through the four available adjustments (horizontal size, horizontal position, vertical size, vertical position). When the adjustment is active, the corresponding amber LED is lit.
Adjustment button (–)	Pressing this button, with either the horizontal or vertical size adjustment selected, decreases screen size. When the horizontal position adjustment is selected, pressing this button shifts the screen position to the left. When the vertical position adjustment is selected, pressing this button shifts the screen down.
Degaussing switch	Press to manually degauss monitor (monitor will automatically degauss following power on).
Brightness control (sun icon)	Turn to adjust background brightness.
Contrast control (half moon icon)	Turn to adjust foreground brightness.
Power switch	Press on / press off switch. When power is on, the green LED in the switch is lit.
Three video signal termination switches (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 button (located on rear panel)	Release the button to manually adjust the incoming sync signal.

Table 5-3 The 21-inch Monitor Controls

Active (Lit) Adjustment Button	Minus (–)	Plus (+)
Horizontal Size	Decrease screen size	Increase screen size
Horizontal Position	Shift screen left	Shift screen right
Vertical Size	Decrease screen size	Increase screen size

Table 5-4 The 21-inch Monitor Viewing Mode Adjustments

Active (Lit) Adjustment Button	Minus (–)	Plus (+)
Vertical Position	Shift screen down	Shift screen up

Table 5-4 The 21-inch Monitor Viewing Mode Adjustments

5.10.1.2 Sync Adjustment

There is a push switch at the rear of the 21-inch monitor labeled “Sync Adjustment.” This switch is used only if the monitor experiences sync problems when it is first powered on.

Note: If the Sync Adjustment switch is in the out (on) position while the monitor is receiving one of the supported vertical sync signals, the screen will experience sync problems. Return the monitor to its preprogammed vertical sync values by pushing in the Sync Adjustment switch (to turn it off), pushing out the Auto / Manual switch (to select Auto), and pressing the Store switch (to recall the preset sync values).

If you want to modify the monitor to accept a vertical sync signal that is not one of the preset sync values listed in Table 5-5, perform the following steps:

1. Select the Manual mode with 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 button repeatedly until the displayed image is correct.

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

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

Video Mode	Horizontal Frequency	Vertical Frequency	Resolution
1. VGA350	31.5 kHz	70 Hz	640 x 350

Table 5-5 Preset Viewing Modes for 21-inch Monitor

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

Table 5-5 Preset Viewing Modes for 21-inch Monitor

5.10.2 The 19-inch Monitor Controls and Connectors

Figure 5-14 shows the controls and connectors for the 19-inch monitor, and Table 5-6 describes the controls.

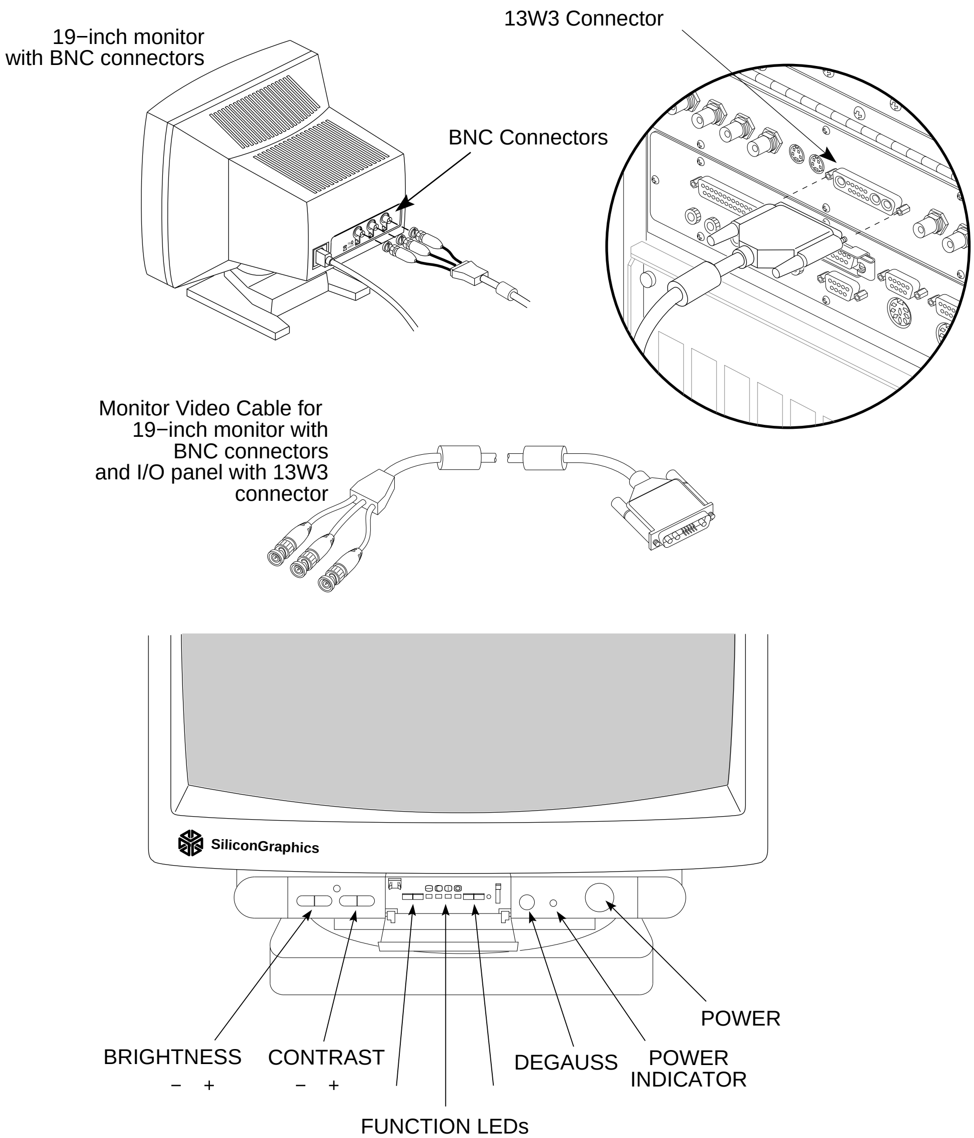


Figure 5-14 The 19-inch Monitor Controls and Indicators

Control	Description
Brightness control (sun icon)	Two buttons (+ 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.

Table 5-6 The 19-inch Monitor Controls

Control	Description
Contrast control (half moon icon)	Two buttons (+ 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.
Degaussing switch	Press to manually degauss monitor (monitor will automatically degauss following power on).
Power switch	Press on / press off switch.
	Note: The following controls are located behind the panel that is between the Degaussing switch and the Contrast control.
Select buttons	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. They are Horizontal Position, Horizontal Size, Vertical Position, and Vertical Size.
Adjustment buttons (+ and –)	Press these buttons to modify the selected function. Your adjustments are automatically saved in memory.
Memory Recall button	Press this button to restore all of the factory-preset viewing modes.
Mode Select switch	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. For normal operation with the VTX board set, leave the switch in position 1. If you decide to modify a viewing mode, select position 2 or 3 so that you do not overwrite the preset modes.

Table 5-6 (continued) The 19-inch Monitor Controls

5.10.3 Connecting Additional Video Attachments

Figure 5-15 illustrates a sample video setup using the VTX or RE² graphics hardware. The SVHS and CMPST A and CMPST B outputs enable you to view and record simultaneously.

The 13W3 connector uses either a 13W3-to-13W3 or a 13W3-to-BNC external cable, depending on the monitor connector. The VTX or RE² graphics hardware also provides a *swap ready* feature for visual simulation applications. If multiple systems are genlocked, the swap ready input enables the systems to swap display buffers simultaneously so that frame display renderings can occur synchronously.

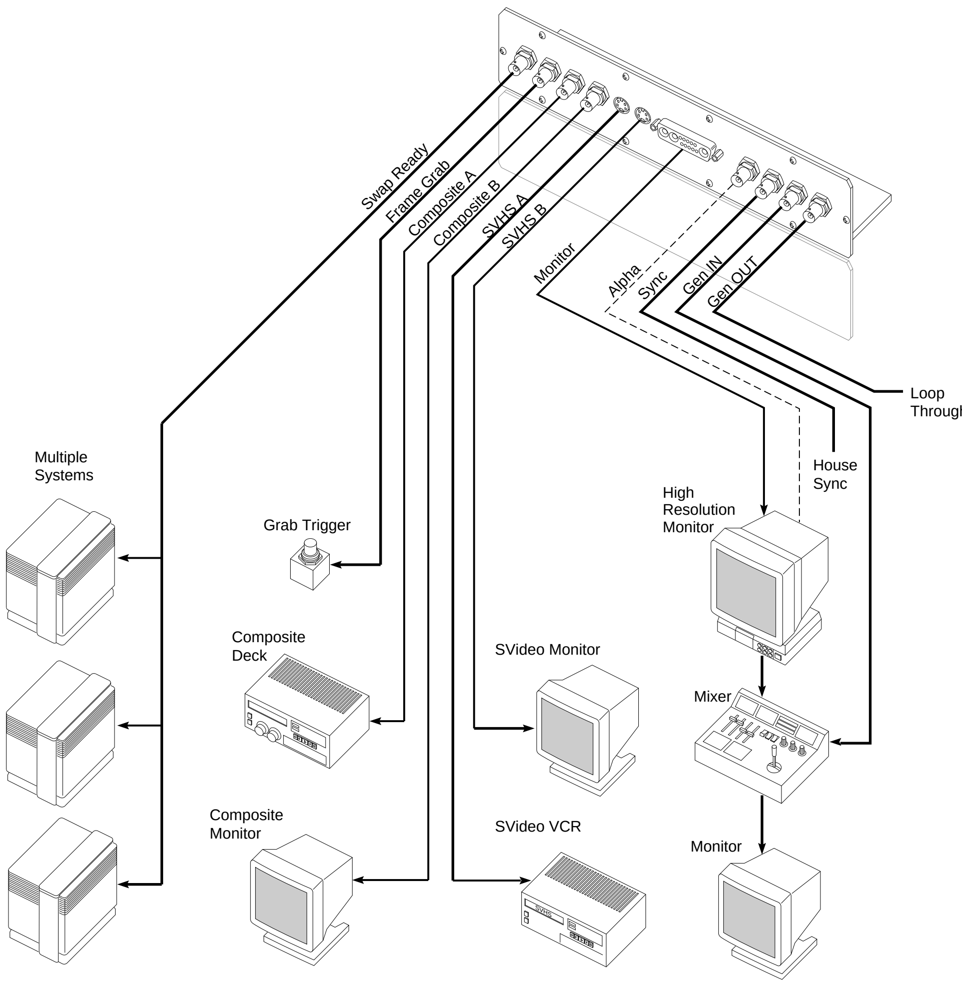


Figure 5-15 Sample Video Setup Using Onyx Graphics

5.10.4 Configuring the Monitor Resolution

The RE² and VTX configurations support a number of screen resolutions or video output formats (VOFs). See the release notes for the different possible settings.

Note: Only the RE^2 graphics (two and four RM4 board versions) support 1600 x 1200 resolution. This resolution is displayed only on the 21-inch monitor. For additional information regarding monitor operation, see the monitor's user's guide.

5.10.4.1 Checking the Monitor Resolution

Use the following command to determine the screen resolution:

```
/usr/gfx/gfxinfo
```

You should get a message similar to the following:

```
Graphics board 0 is "REV" graphics.
Unmanaged 0x0 1024x768
VTX Graphics Subsystem
6 GE (GE10 rev. 0x4)
1 RM board
Small pixel depth
10-bit RGB pixels
Not using VS2
```

Note: The second line indicates the screen resolution setting. The fifth line down also tells you how many RM4 boards are present.

5.10.4.2 Changing the Monitor Resolution

After you load IRIX, use the *setmon* command to change the resolution or video output format (VOF). This example shows you how to change the VOF to 1600 x 1200.

```
su
setenv DISPLAY :0
/usr/gfx/setmon -x 1600x1200_60
killall Xsgi
/usr/gfx/gfxinit -v
Xsgi &
```

Note: The *setmon* command loads the VOF value into EEPROM so that the system boots up in the specified display mode.

5.11 Software Installation

To install software on the system, see the *IRIS Software Installation Guide* (Document No. 007-1364-*xxx*) and the software release notes.

5.12 Configuring a SCSI Channel

All components from the start to the end of a SCSI channel must be set to the same protocol using one of several mechanical methods, such as selecting specific jumpers or connectors.

By selecting specific jumpers and connectors, many different SCSI devices can use the same basic mechanical design within several chassis.

To configure a SCSI channel, verify the type of SCSI protocol required, identify each component in the SCSI channel using the charts in Chapter 4, “Theory of Operations,” in Section 4.8, obtain any missing components, and configure all components to the desired protocol as shown in Section 5.12.1 through Section 5.12.5.

This section provides configuration procedures for the following SCSI channel components:

- IO4 and mezzanine boards
- channel adapter boards
- SCSI cables
- drive adapter boards

5.12.1 Configuring IO4 and SCSI Mezzanine Boards

IO4 boards and SCSI mezzanine boards require no other configuration 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 4-5 for the position of the bus connectors and Figure 5-16 for an illustration of the IO4 board.

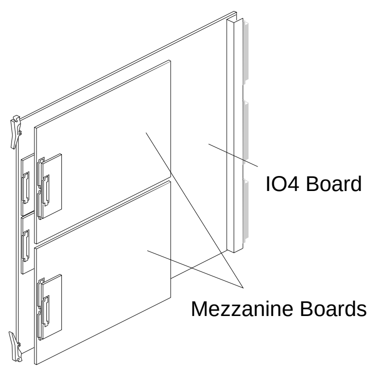


Figure 5-16 IO4 Board with Maximum SCSI Bus Configuration

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 tray.

SCSI mezzanine boards are shipped from the factory with both a single-ended and a 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.

5.12.2 Configuring Channel Adapter Boards

Channel adapter boards determine the protocol of a SCSI channel leaving an IO4 or SCSI mezzanine board. The two types of channel adapter boards are color coded to simplify identification, green for a single-ended protocol and red for a differential protocol.

Single-ended channel adapter boards also include jumpers for setting the data transfer rate of the channel, either slow or fast. The slow transfer rate is required for external SCSI channels. The fast data transfer rate is the normal setting for internal channels (see Figure 5-17 for details).

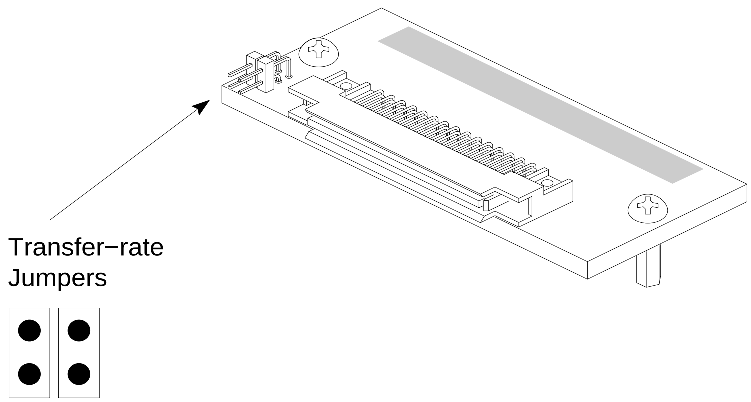


Figure 5-17 Setting Data Transfer Rate on a Channel Adapter Board

Note: If both jumpers are installed, this indicates a fast (10MB / sec) transfer rate; if both jumpers are off, this indicates a slow (5MB / sec) transfer rate. Slow is used when the SCSI channel is used externally. The jumpers can be installed vertically or horizontally.

5.12.3 Configuring SCSI Cables

Cables do not have any special jumpers or other methods of configuring a specific protocol; however, a cable must meet the electrical specifications and length limitations of the protocol.

Note: A cable sold for use with one SCSI configuration does not ensure that the cable is appropriate for other SCSI configurations. When in doubt, use a short cable.

5.12.4 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, part number as shown in Figure 5-18. For cables with 68-pin connectors, use a 68-pin drive adapter board, part number as shown in Figure 5-19.

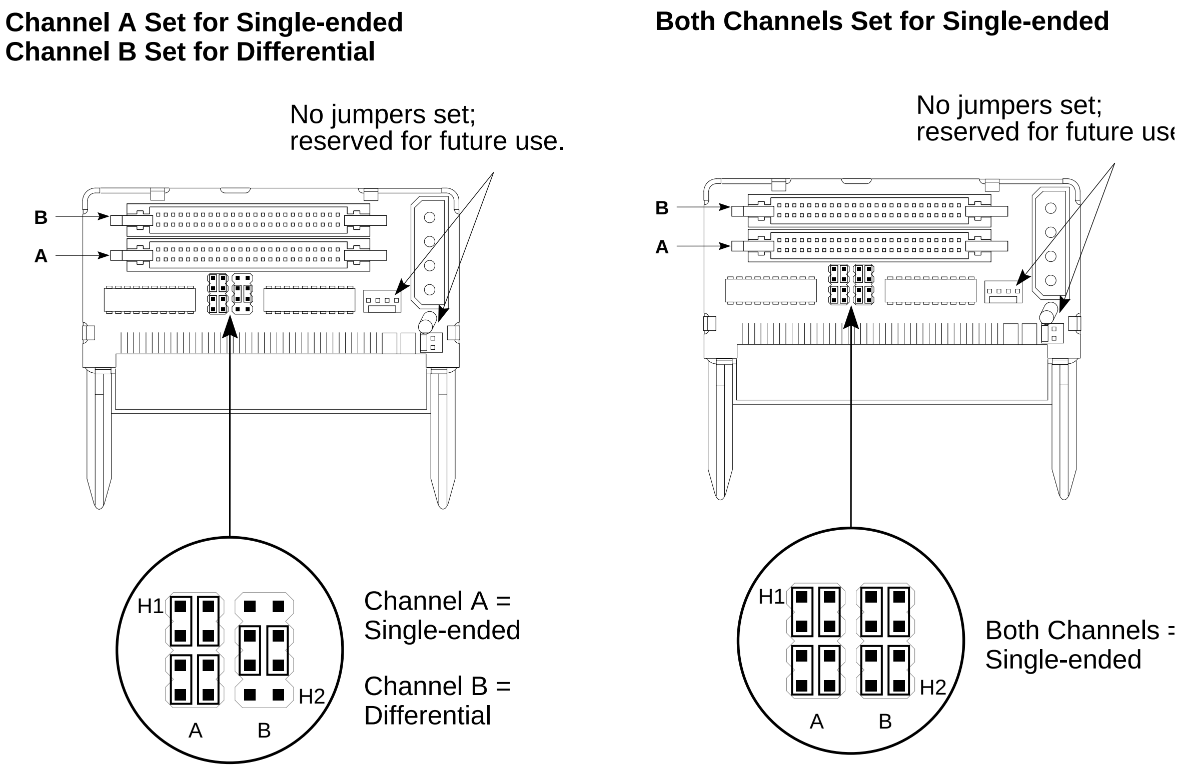


Figure 5-18 Setting SCSI Protocols on a 50-pin Drive Adapter Board

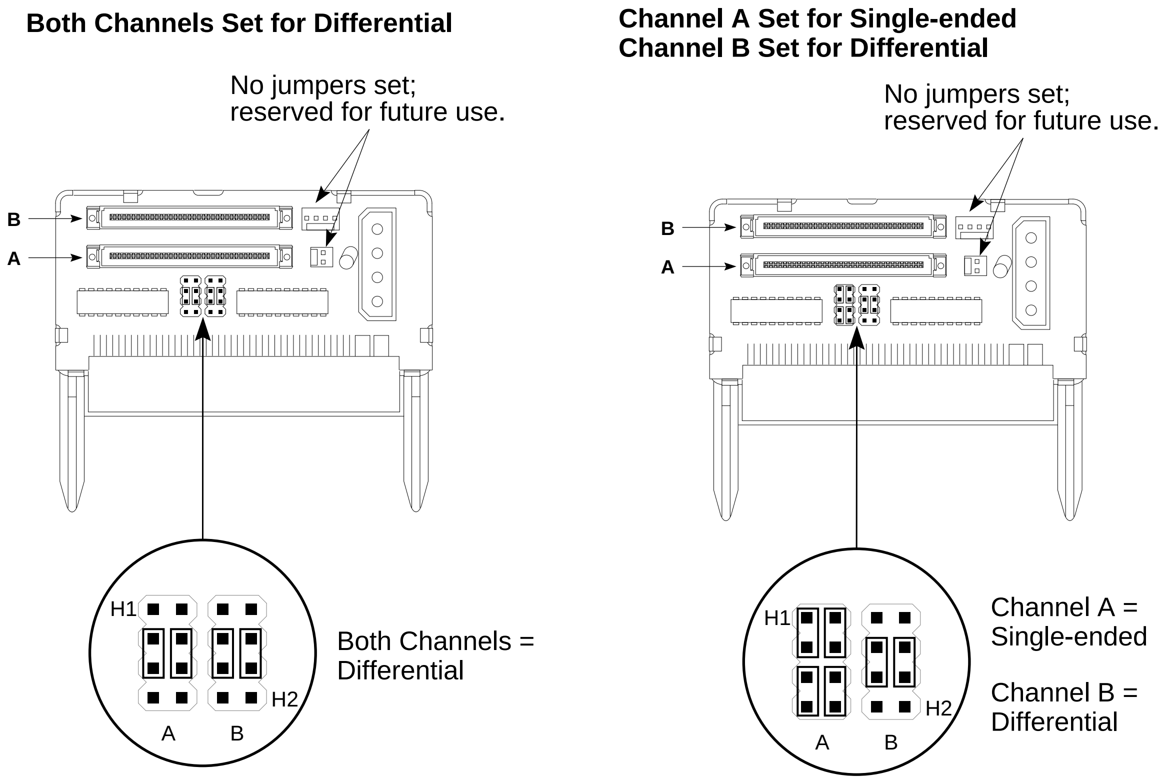


Figure 5-19 Setting SCSI Protocols on a 68-pin Drive Adapter Board

5.12.5 SCSI Channel Terminator

SCSI terminators must be matched to the protocol of the SCSI channel. There are two different terminators: one for a single-ended protocol and one for a differential protocol. These terminators are visually identical except for the manufacturing part numbers. See Table 5-7 and Figure 5-20.

Component	SGI Part Number	Distinguishing Marks
Single-ended terminator	9660008	AMP 869516-1 ACTIVE
Differential terminator	9660006	AMP 869515-1

Table 5-7 Identifying SCSI Channel Terminators

Caution: Never use a single-ended SCSI terminator on a differential channel. Connecting a single-ended terminator to a differential channel shorts power to ground.

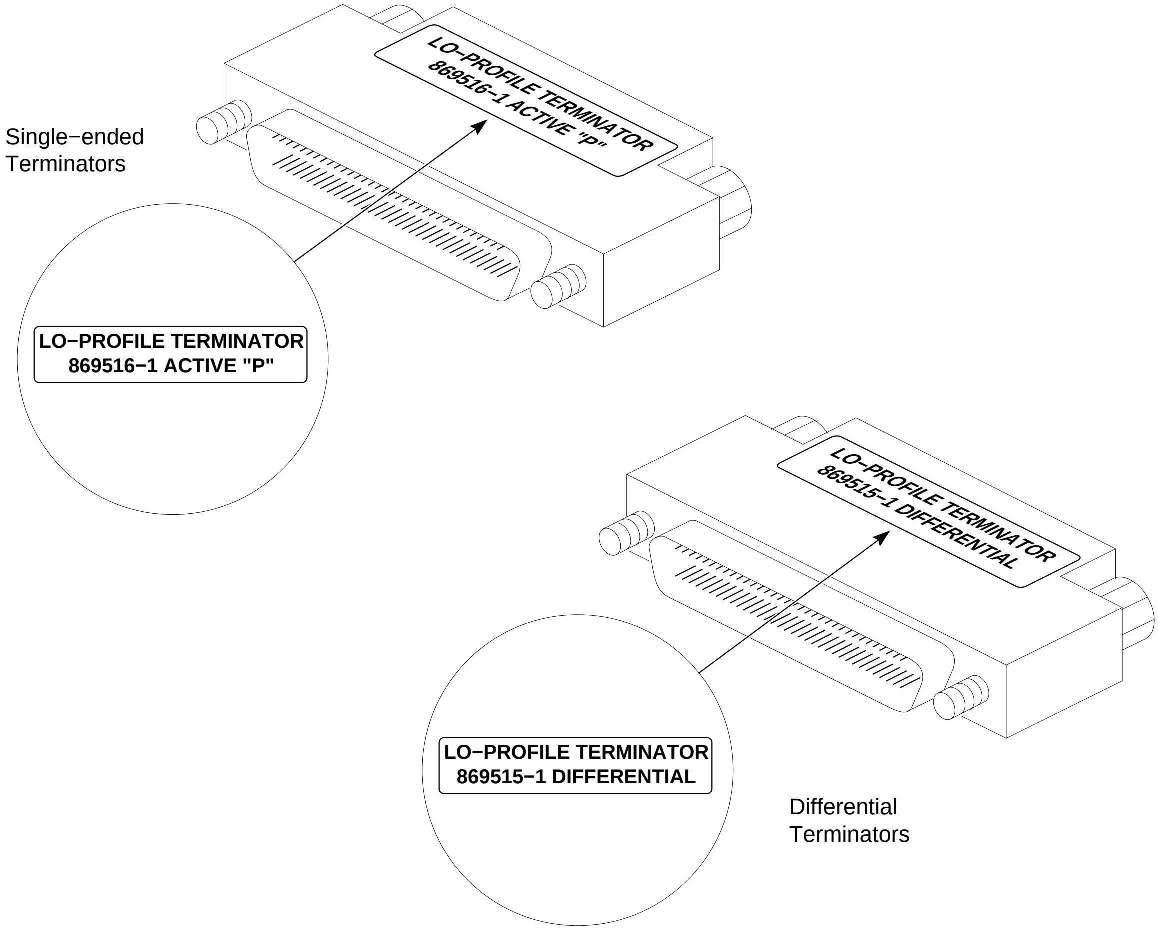


Figure 5-20 SCSI Terminator Labels

5.13 Labels on a SCSI Channel

To simplify SCSI channel identification, labels are on the I/O panel, connectors, cables, devices, SCSI boxes, and terminators. Depending on the component, a label may provide a

- channel number to identify the I/O board that provides the SCSI signal
- channel protocol to identify whether the channel is single-ended or differential
- bus number to identify the bus inside a SCSI box that supplies the SCSI channel

This section describes the SCSI channel labels for those individuals who need to determine the configuration of a SCSI channel or to modify the SCSI labels for a deskside chassis.

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 5.12, “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 5-19 through Figure 5-35 and for a description of deskside SCSI channel labels and their locations.

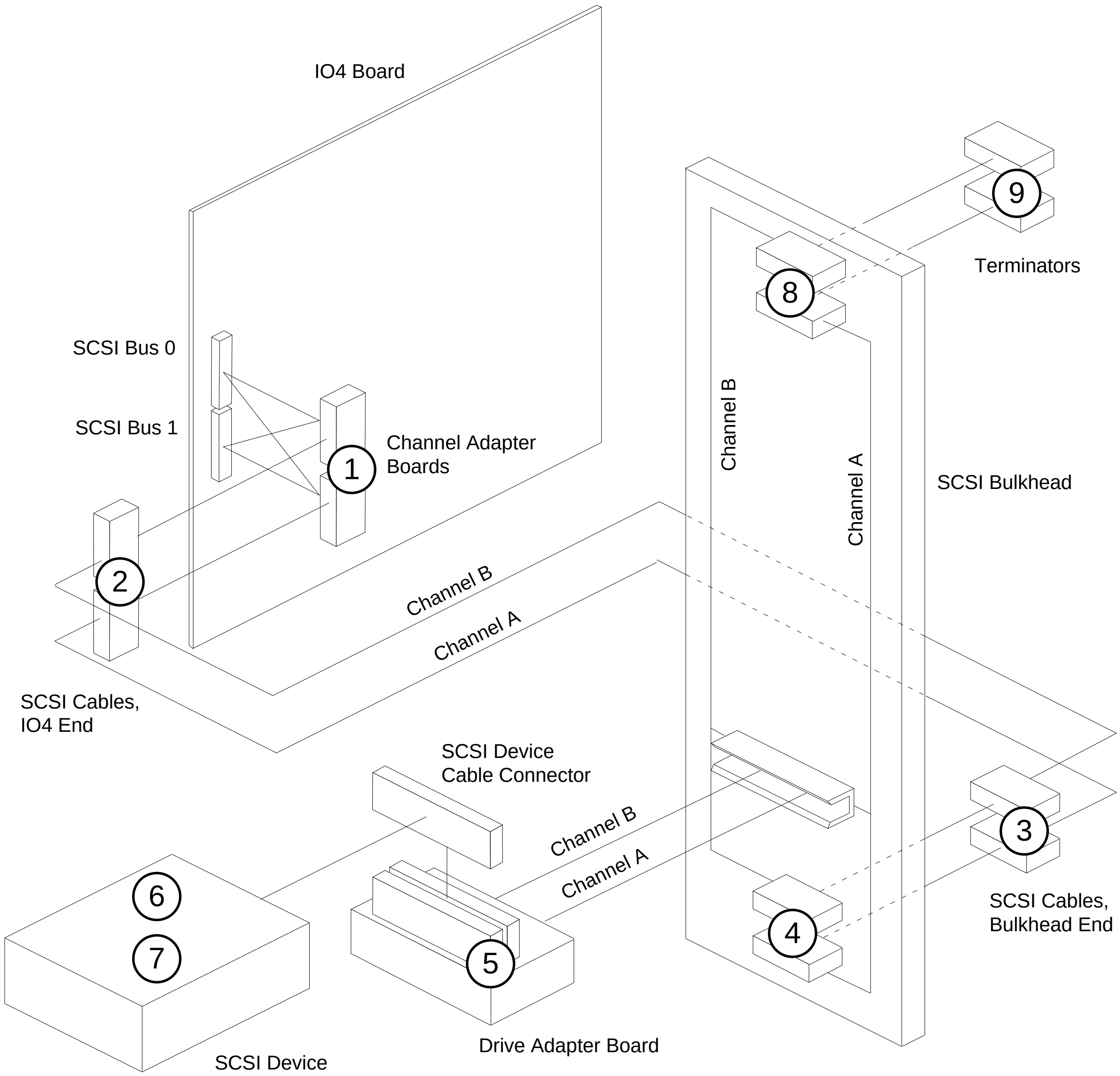


Figure 5-21 Deskside Internal SCSI Channel Label and Marking Locations

Key	Description	Procedure
1	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 (see Figure 5-22). Secondary SCSI boxes 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, bus 0 on an IO4 board in slot 13 gets the label DF SCSI 130. Place label on the flat face of the cable connector, aligning the bottom of the text along the outer long edge of the connector.

Table 5-8 Channel Adapter Board Label

Figure 5-22 Channel Adapter Board Label

Key	Description	Procedure
2	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 (see Figure 5-23.) Secondary SCSI boxes 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, bus 0 on an IO4 board in slot 13 gets the label DF SCSI 130. Place label on the flat face of the cable connector, aligning the bottom of the text along the inner long edge of the connector.

Table 5-9 SCSI Cable Label, Board End

Figure 5-23 SCSI Cable Label, Board End

Key	Description	Procedure
3	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 (see Figure 5-24). Secondary SCSI boxes 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, bus 0 on an IO4 board in slot 13 gets the label DF SCSI 130. Place label on the flat face of the cable connector, aligning the bottom of the text along the inner long edge of the connector.

Table 5-10 SCSI Cable Label, Bulkhead End

Figure 5-24 SCSI Cable Label, Bulkhead End

Key	Description	Procedure
4	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, the markings JIA_SCSI and JIB_SCSI are on the bulkhead next to the connectors. See Figure 5-25.	None required.

Table 5-11 Bulkhead SCSI Cable Connector Markings

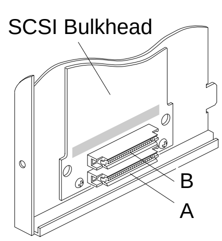


Figure 5-25 Bulkhead SCSI Cable Connector Markings

Key	Description	Procedure
5	On 50-pin adapter boards (see Figure 5-26), 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 5-12 Drive Adapter Board Markings for SCSI Channels A and B

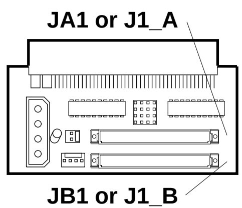


Figure 5-26 Drive Adapter Board Markings for SCSI Channels A and B

Key	Description	Procedure
6a	Identifies the SCSI channel (A or B) and the device ID number (1-15), part number 024-0632-xxx. See Figure 5-27.	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 5-13 SCSI Device Label for Devices with Large Front Bezels

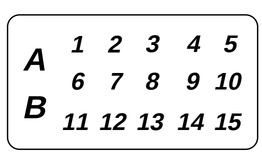


Figure 5-27 SCSI Device Label for Devices with Large Front Bezels

Key	Description	Procedure
6b	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 (see Figure 5-28). Secondary SCSI boxes are labeled from label set part numbers 024-0610-xxx (shown) through 024-0654-xxx.	Select label based on the slot and bus number of the I/O board. For example, bus 0 on an IO4 board in slot 13 gets the label DF SCSI 130. Place label on the flat face of the cable connector, aligning the bottom of the text along the inner long edge of the connector.

Table 5-14 SCSI Device Label for Devices with Restricted Space on the Front Bezel

Figure 5-28 SCSI Device Label for Devices with Restricted Space on the Front Bezel

Key	Description	Procedure
6c	Identifies the SCSI channel (A or B), part number 024-0671-xxx. See Figure 5-29.	Place label directly on the face of the drive, ensuring that it does not block any airflow. Indicate whether the device is configured for channel A or B.

Table 5-15 SCSI Device Label for Devices with Minimal Space on the Front Bezel

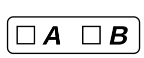


Figure 5-29 SCSI Device Label for Devices with Minimal Space on the Front Bezel

Key	Description	Procedure
7a	SCSI box label, part number 024-0655-xxx. See Figure 5-30.	Place label on the inner face of the drive door in the upper left corner. For each channel, indicate the channel protocol (SE for single-ended, DF for differential) and the SCSI bus number (0 or 1).

Table 5-16 SCSI Box Base Label

Figure 5-30 SCSI Box Base Label

Key	Description	Procedure
7b	Identifies SCSI protocol (SE or DF) and bus number (0-7). See Figure 5-31. SE SCSI 0 label is part number 024-0637-xxx; DF SCSI 1 label is part number 024-0640-xxx. Secondary SCSI boxes are labeled from label set part number s 024-0610-xxx (shown) through 024-0654-xxx.	Select label based on the slot and bus number of the I/O board. For example, bus 0 on an IO4 board in slot 13 gets the label DF SCSI 130. Place label on the flat face of the cable connector, aligning the bottom of the text along the inner long edge of the connector.

Table 5-17 SCSI Box Cover Label

Figure 5-31 SCSI Box Cover Label

Key	Description	Procedure
8	SCSI bulkhead (see Figure 5-32). 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, the markings JTA_SCSI and JTB_SCSI are on the bulkhead next to the connectors.	None required.

Table 5-18 Bulkhead Terminator Connector Markings

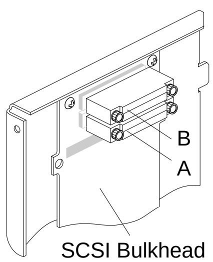


Figure 5-32 Bulkhead Terminator Connector Markings

Key	Description	Procedure
9	Identifies SCSI protocol (SE or DF) and bus number (0-7). See Figure 5-33. SE SCSI 0 label is part number 024-0637-xxx; DF SCSI 1 label is part number 024-0640-xxx.	Select label based on the slot and bus number of the I/O board. For example, bus 0 on an IO4 board in slot 13 gets the label DF SCSI 130. Place label on the flat face of the cable connector, aligning the bottom of the text along the inner long edge of the connector.

Table 5-19 SCSI Terminator Connector Label

Figure 5-33 SCSI Terminator Connector Label

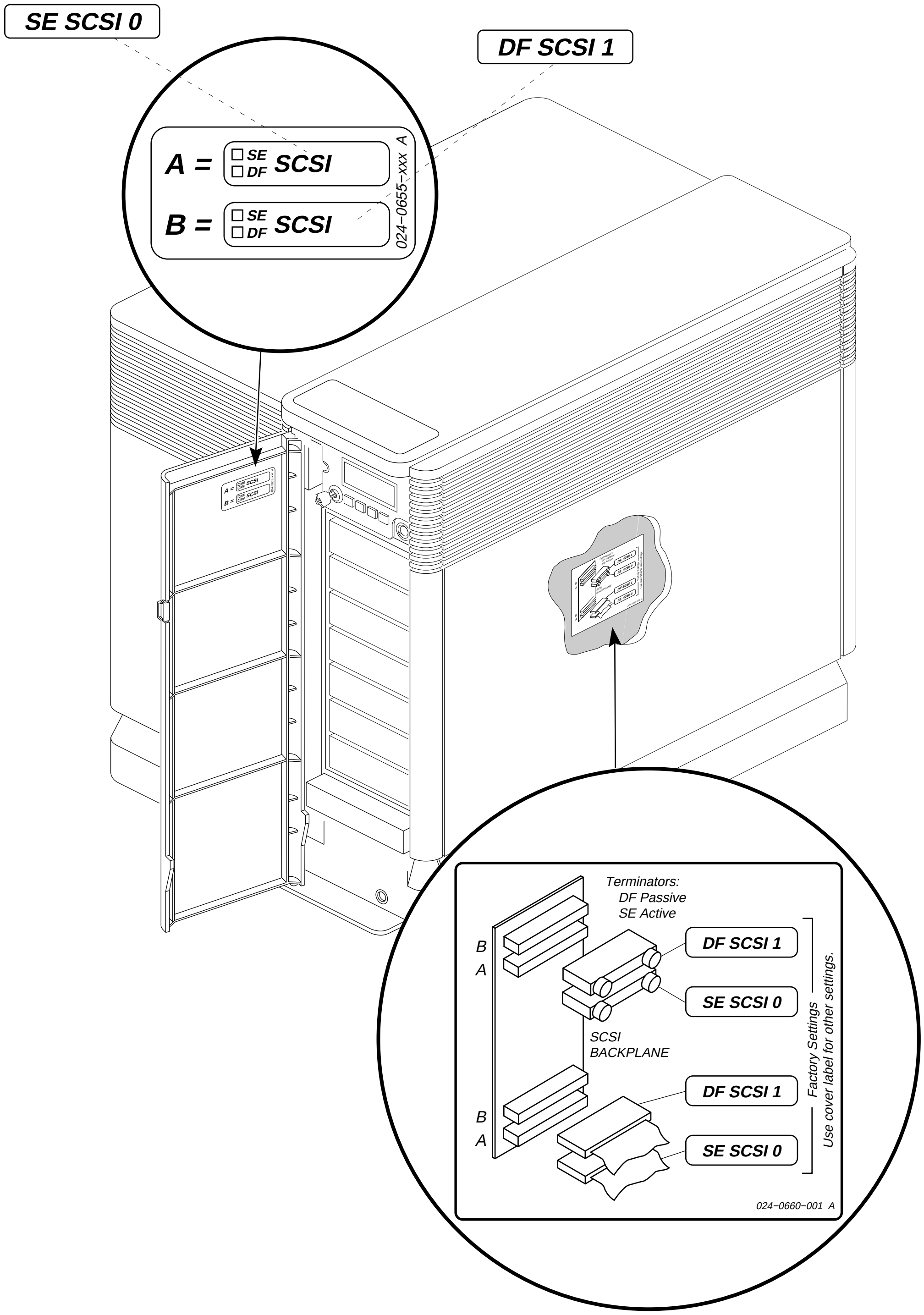


Figure 5-34 External SCSI Labeling of a Deskside Chassis

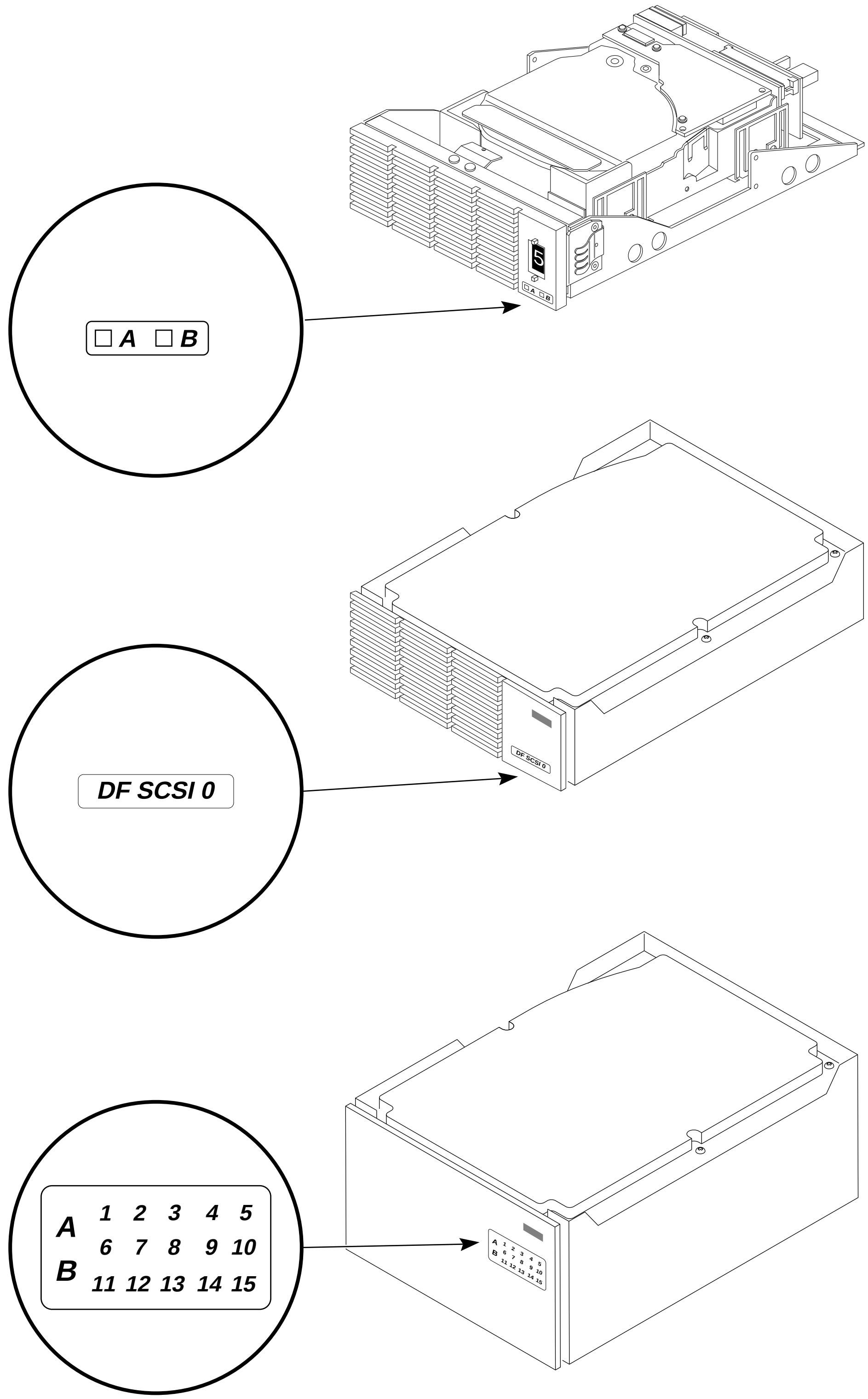


Figure 5-35 Location of SCSI Labels on Devices

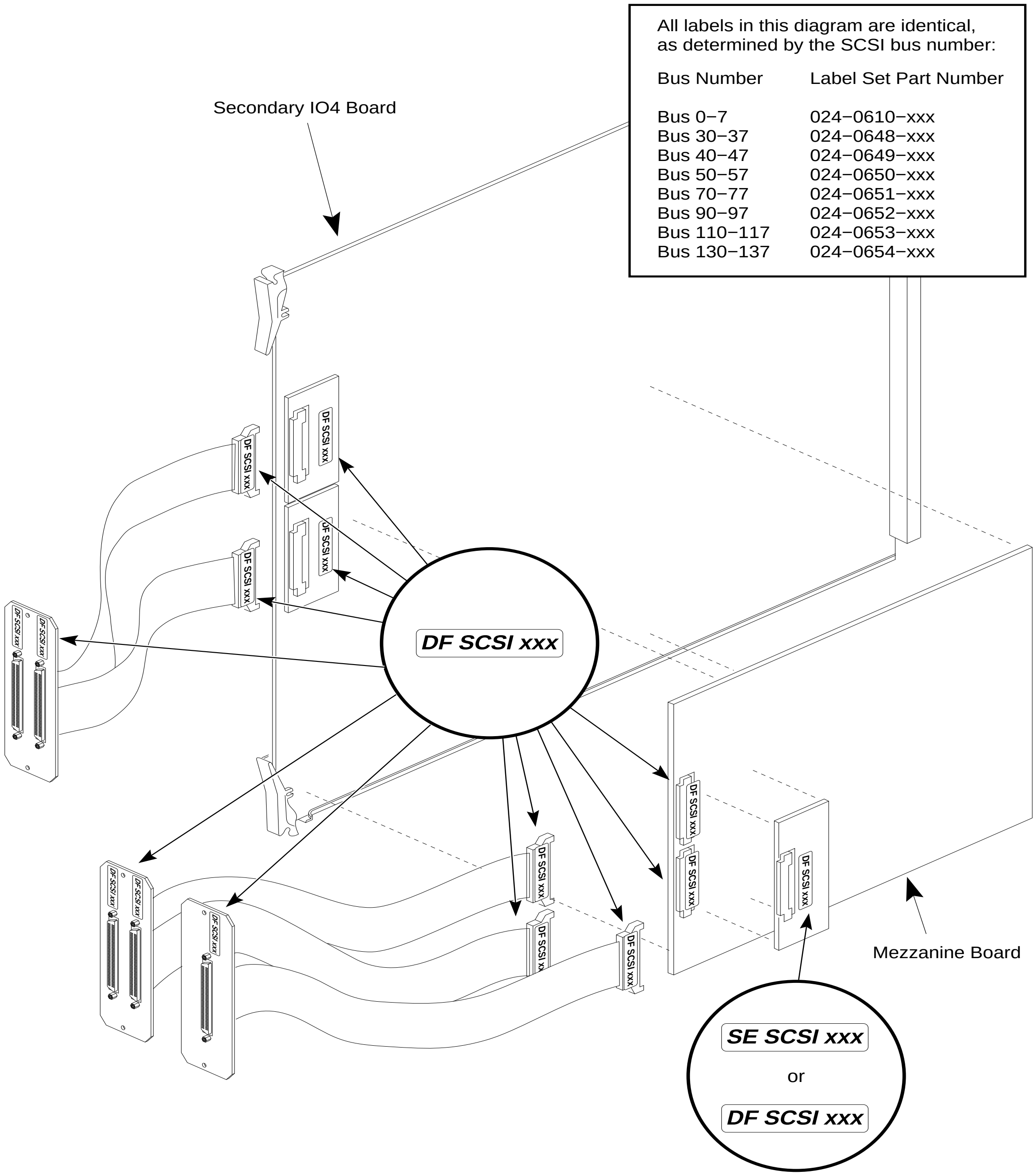


Figure 5-36 SCSI Label Placement for Secondary I/O Boards

5.14 Configuring the Software for Additional IO4 Boards

If you have a CHALLENGE deskside system, you can install up to three IO4 boards in the chassis. This section describes the required software configuration changes you must make when you install additional IO4 boards in a CHALLENGE system.

Note: The information in this section applies only to a CHALLENGE L system with two or more IO4 boards, not the Onyx L. An Onyx deskside system can support only one IO4 board. See also Chapter 3, “Configurations and Components,” regarding legal system configurations.

5.14.1 SCSI Expansion and Software Configuration

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

SCSI bus connector and cable labeling provides physical identification of the buses. Label syntax is

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

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

/ dev / {r}dsk / dksSSndDsP

The *SSn* is the same as the cable / connector label. The *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.

Reconfiguring of the kernel is not required for SCSI expansion. CHALLENGE / Onyx SCSI devices always use the naming scheme wherein 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
```

5.14.2 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 wherein 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 5-20

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

Table 5-20 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/MAKDEV* file as follows:

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

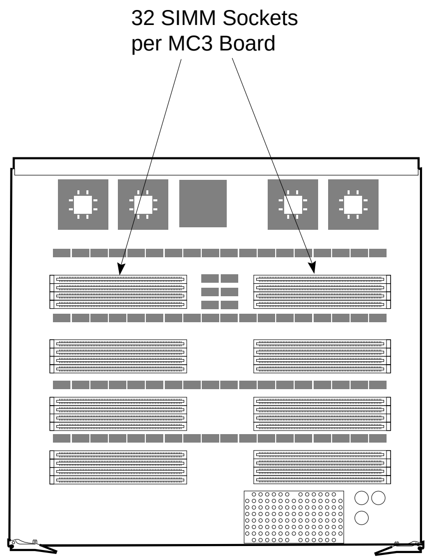
This process will make entries for all the parallel devices seen by the *hinv* command.

5.15 MC3 Configurations

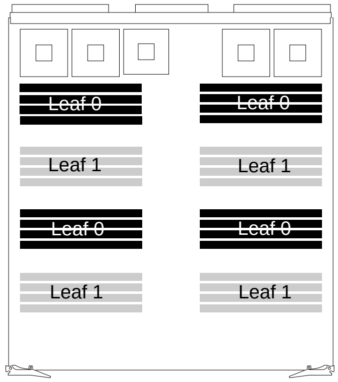
This section contains information on configuring the memory on the MC3 board. See Section 5.15.1, “Key MC3 Terms” for key MC3 terms.

5.15.1 Key MC3 Terms

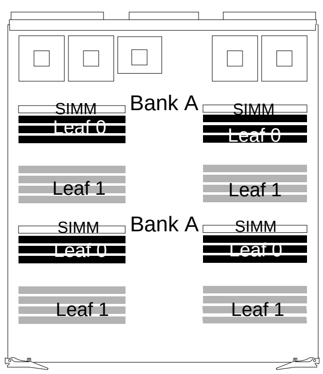
Term	Definition
MC3 or interleaved memory board (IMB)	The MC3 board has 32 SIMM sockets organized into leaves and banks.



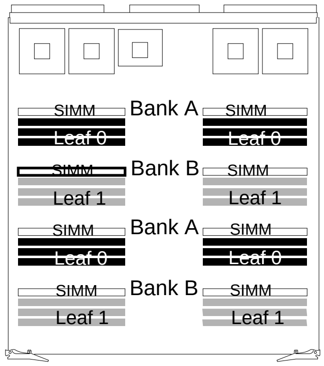
Term	Definition
Leaves (leaf 0 and leaf 1)	The MC3 board consists of two leaves (leaf 0 and leaf 1). Each leaf contains 16 SIMMs. See Section 5.15.2.1, “Leaf Organization,” for more information.



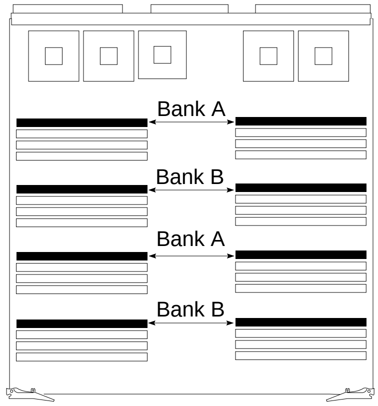
Term	Definition
Bank (also known as block)	A bank or block is the basic building unit of the MC3 board. A single bank is composed of four SIMMs. Each leaf is composed of four banks. See Section 5.15.2.2, “Bank Organization,” for additional information.



Term	Definition
Corresponding Banks	Corresponding banks are groupings of memory blocks that are interleaved together. Bank A of leaf 0 and bank B of leaf 1 are examples of corresponding banks. See Table 5-22 for additional information. There are eight banks per MC3 board (A, B, C, D, E, F, G, and H).

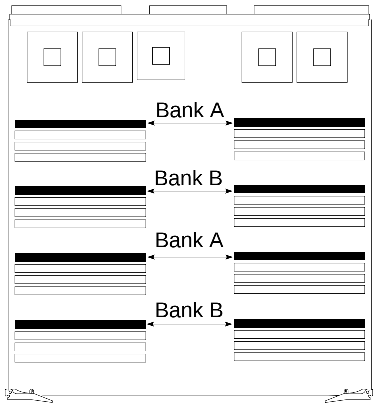


Term	Definition
High-density SIMM	This is the 16 MB SIMM (also known as a type 2 SIMM).
Very high-density SIMM	This is the 64 MB SIMM (also known as a type 3 SIMM).
High-density memory block (or bank)	This is a group of four 16 MB SIMMs, or 64 MBs.
Super-density memory block (or bank)	This is a group of four 64 MB SIMMs, or 256 MBs.
Interleaving	Interleaving is a technique for organizing memory into leaves that results in significant read and write access improvement. See Section 4.3.1, “Interleaving,” and also Section 5.15.4, “Interleaving Memory,” for additional information.
Two-way Interleaving	Two-way interleaving takes place when the same SIMM type (for example, 16 MB) is installed on corresponding banks on a single MC3 board. Two-way interleaving requires a minimum of eight SIMMs. The figure below shows SIMMs installed into corresponding banks A and B. See Section 5.15.4.2, “Two-way Interleaving,” for additional information.

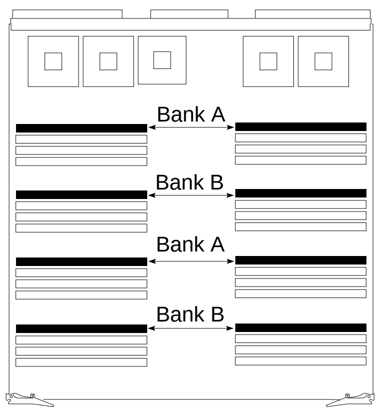


Four-way Interleaving	Four-way interleaving takes place when the same SIMM type (for example, 16 MB) is installed on corresponding banks across *two* MC3 boards. Four-way interleaving requires a minimum of 16 SIMMs. The figure below shows SIMMs installed into corresponding banks A and B on two MC3 boards. See Section 5.15.4.3, “Four-way Interleaving,” for additional information.

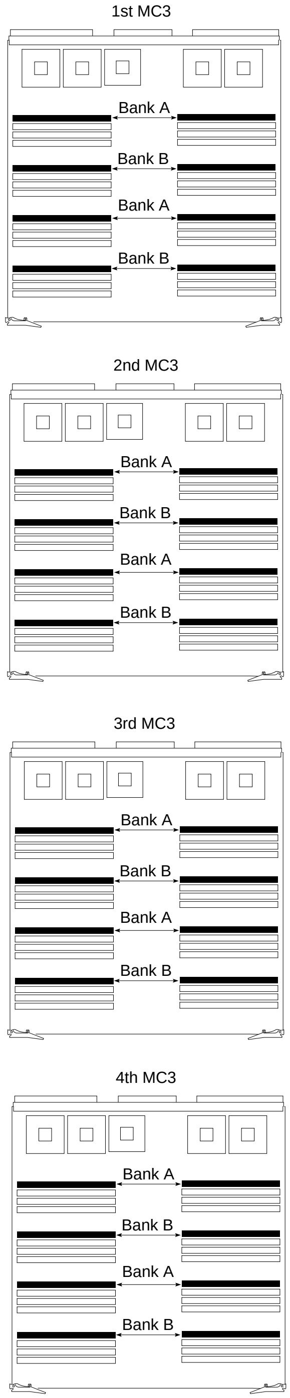
1st MC3



2nd MC3



Eight-way Interleaving	Eight-way interleaving takes place when the same SIMM type (for example, 16 MB) is installed on corresponding banks across *four* MC3 boards. Four-way interleaving requires a minimum of 32 SIMMs. The figure below shows SIMMs installed into corresponding banks A and B on four MC3 boards. See Section 5.15.4.4, “Eight-way Interleaving,” for additional information.



5.15.2 SIMM Leaves and Banks

The MC3 board has 32 SIMM sockets organized as follows (see Figure 5-37):

- two groups of leaves per board (leaf 0 and leaf 1)

- four banks per leaf (banks A, C, E, and G on leaf 0 and banks B, D, F, and H on leaf 1)
- four SIMMs per bank

See Figure 5-37 through Figure 5-41 and the following paragraphs for a breakdown of the memory organization.

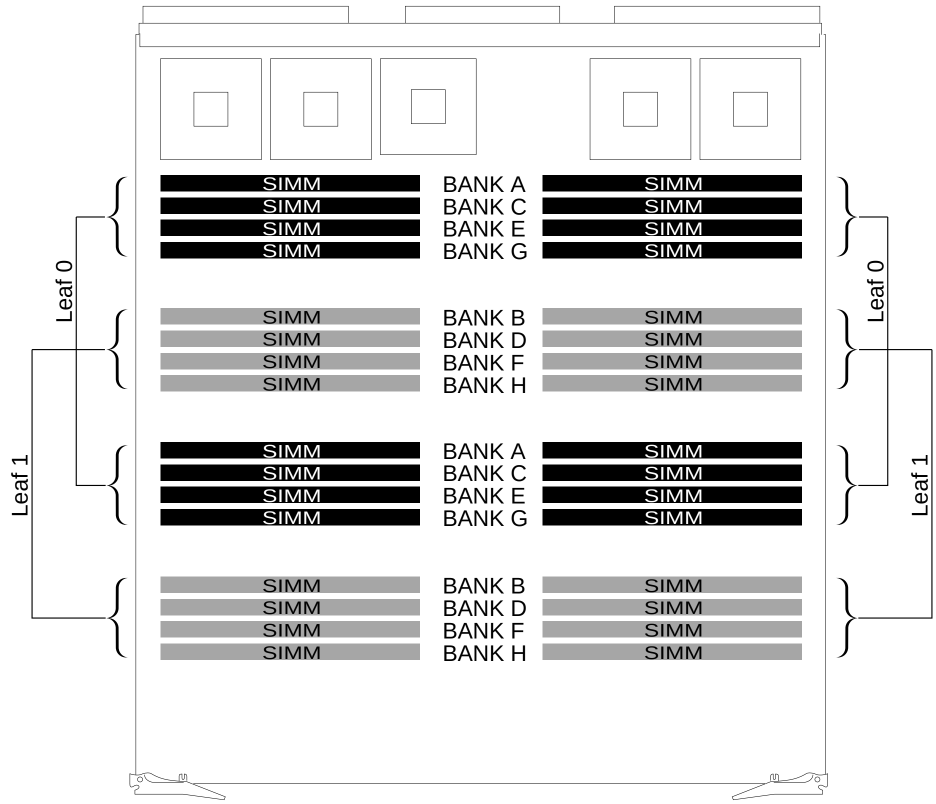


Figure 5-37 Overall Memory Organization

5.15.2.1 Leaf Organization

The MC3 memory board is composed of two leaves, leaf 0 and leaf 1 (see Figure 5-38). Each leaf contains 16 SIMM sockets.

The 16 SIMMs in leaf 0 are highlighted in black, and the 16 SIMMs in leaf 1 are highlighted in a lighter shading (see Figure 5-38). Note how the leaves are physically laid out on the board. Each leaf consists of an upper and lower group of eight SIMMs. Note also how the SIMM groups alternate between leaf 0 and leaf 1, up and down the board.

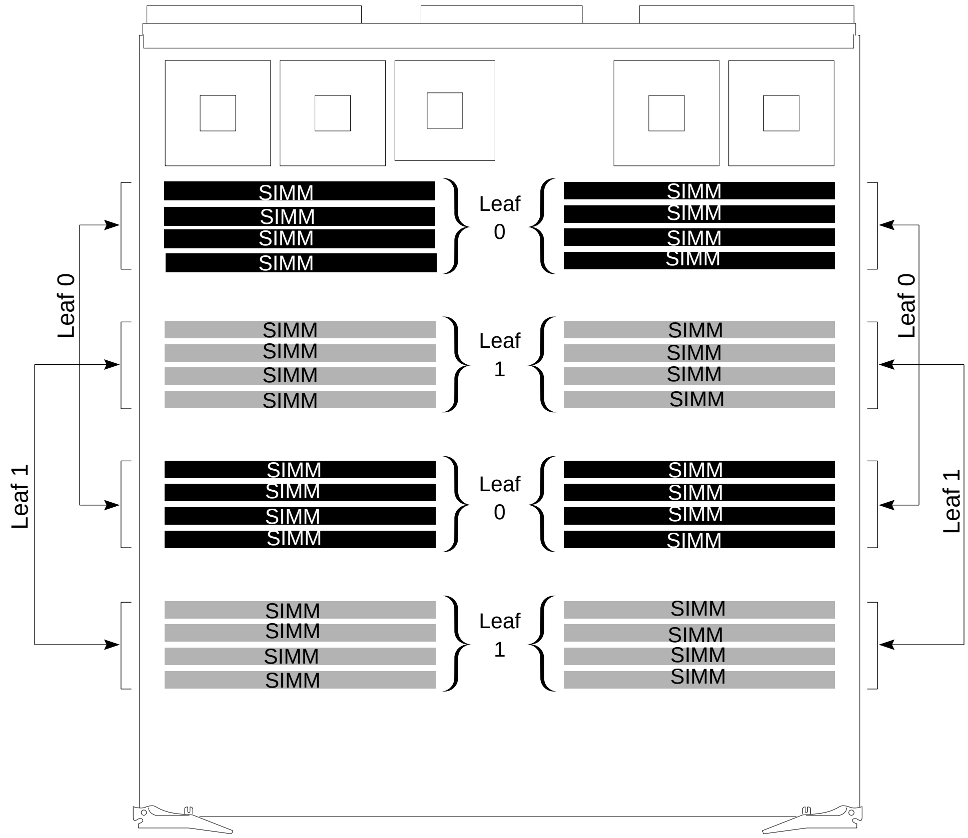


Figure 5-38 Memory Leaves Organization

Note: Each memory board has two leaves, leaf 0 and leaf 1.

5.15.2.2 Bank Organization

Each leaf has 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 5-39). A single memory bank contains four SIMMs (see Figure 5-40) and are numbered 0 through 3 directly on the board. For example, the bank A SIMMs are identified as A0, A1, A2, and A3 (see Figure 5-41).

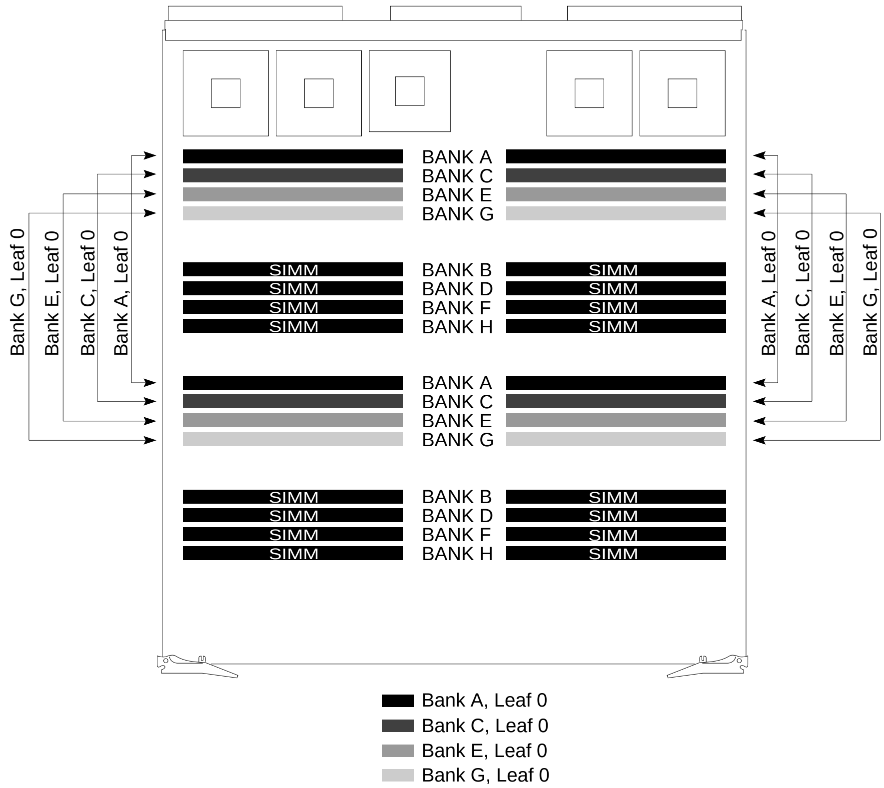


Figure 5-39 Memory Bank Organization

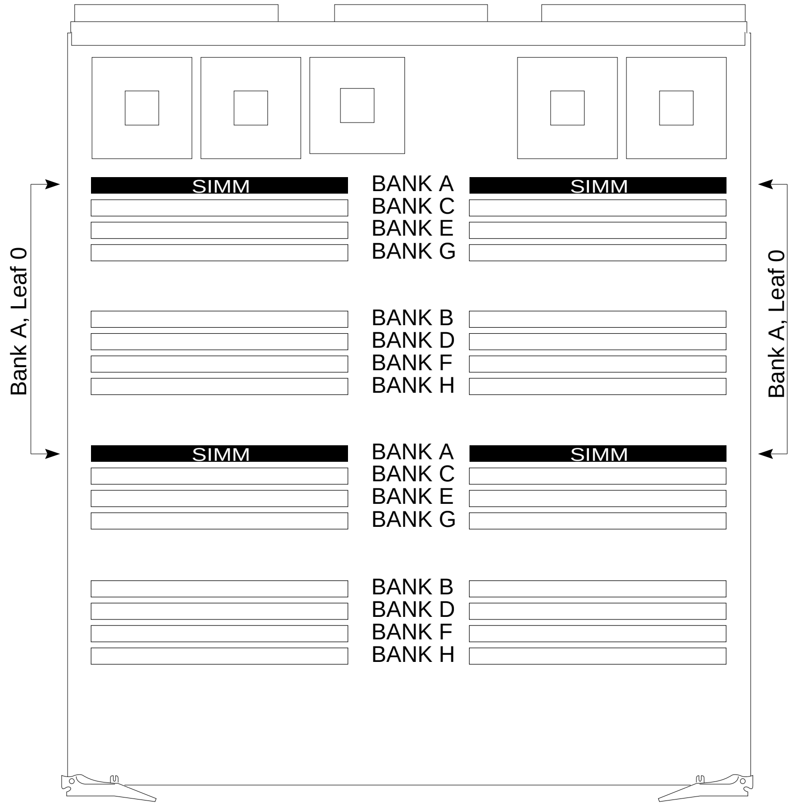


Figure 5-40 SIMM Organization per Bank

Note: Each bank has four SIMMs. Figure 5-40 highlights bank A, leaf 0.

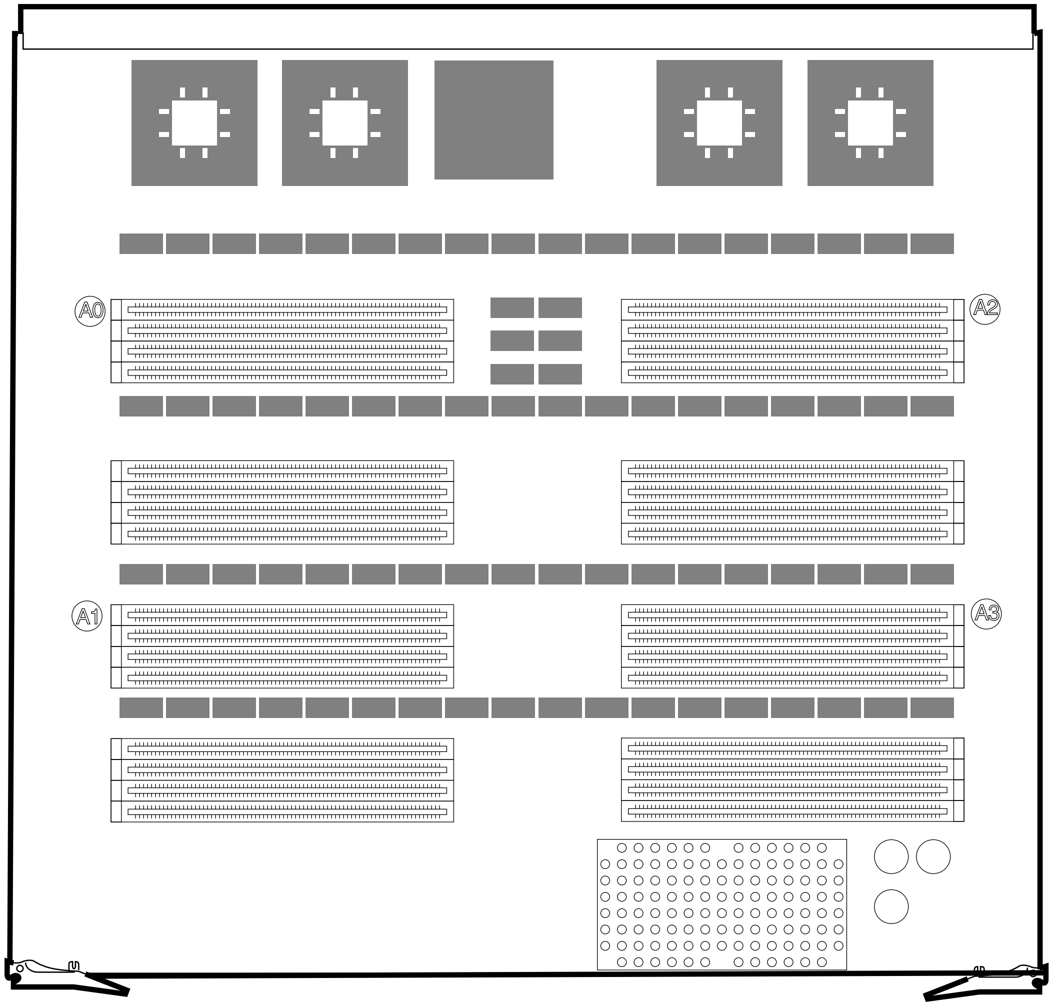


Figure 5-41 Top View of MC3 Board

5.15.3 SIMM Types

The MC3 can use two types of SIMMs:

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

Table 5-21 provides additional information for these modules. Figure 5-42 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 5-21 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 nearest the notched bottom. See Figure 5-42.

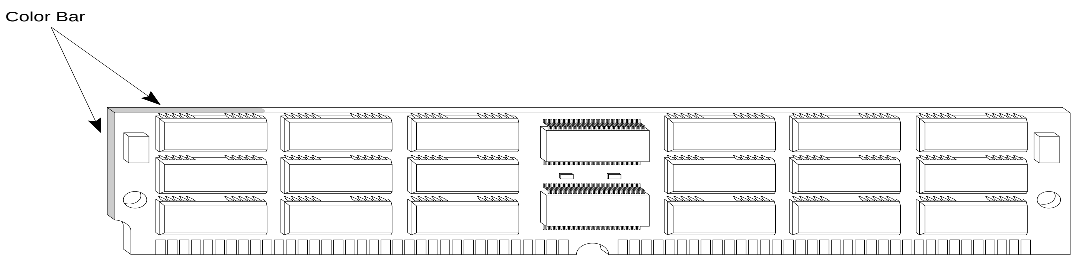


Figure 5-42 MC3 SIMM

5.15.4 Interleaving Memory

Interleaving enables greater utilization of bus bandwidth, as requests are evenly distributed across the leaves, 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 deskside system supports one-, two- and four-way interleaving. The rackmount system supports one-, two-, four-, *and* eight-way interleaving. At boot up, the CPU PROM scans the SIMM configuration on the MC3(s) to determine the system's interleave factor across the board.

5.15.4.1 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 5-43 for an illustration of this configuration.

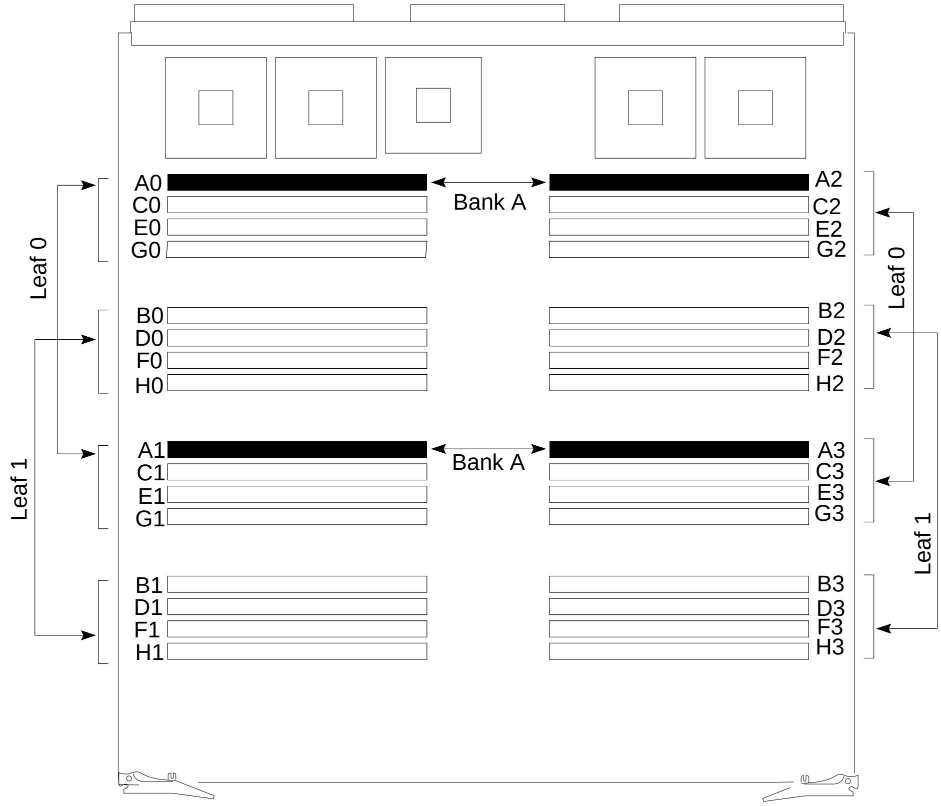


Figure 5-43 One-way Interleaving

5.15.4.2 Two-way Interleaving

Two-way interleaving occurs across a single MC3 board, as a bank of memory on leaf 0 and links with a bank of memory on leaf 1. Two-way interleaving requires a minimum of eight SIMMs. To achieve two-way interleaving, you must install the same SIMM type across corresponding banks in each leaf, for example, banks A and B. See Figure 5-44 for an illustration of this setup. See also Table 5-22 for a list of corresponding banks.

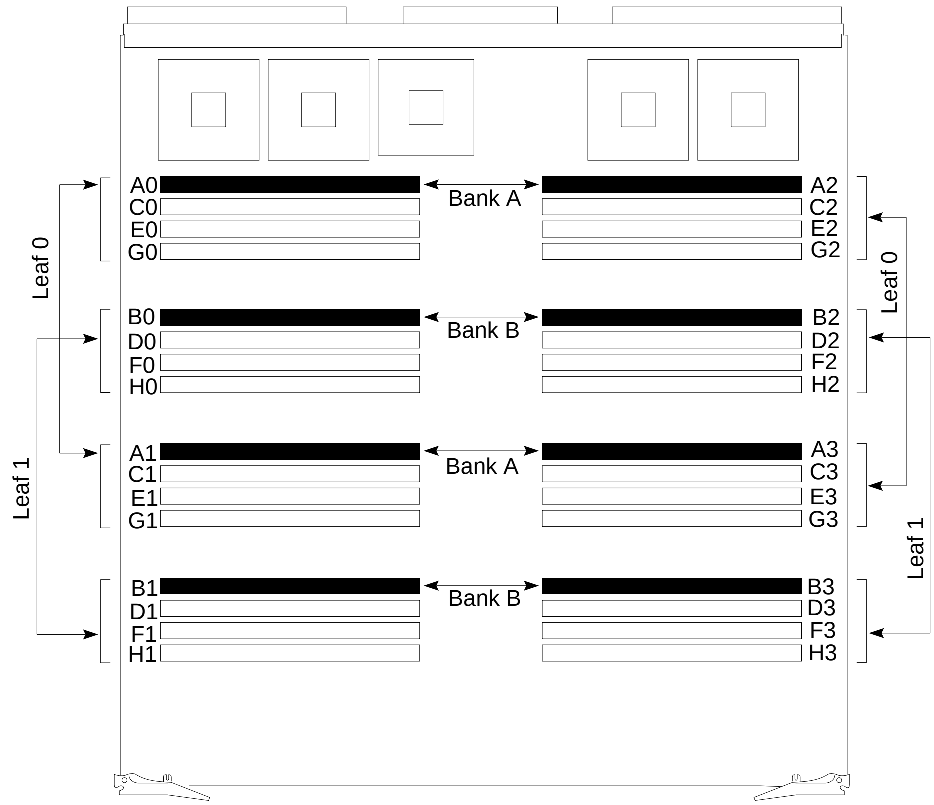


Figure 5-44 Two-way Interleaving (Bank 0 on Leaf 0 and Leaf 1 Shown), One Board

Note: To set up two-way interleaving, install the same SIMM type (for example, 16 MB) across the same corresponding banks (see Table 5-22) in each leaf.

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

Table 5-22 Corresponding Banks across Leaves 0 and 1

5.15.4.3 Four-way Interleaving

To achieve four-way interleaving, you must first have two MC3 boards. Afterward, 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 5-45 for an example of four-way interleaving. See also Table 5-22 for a list of corresponding banks.

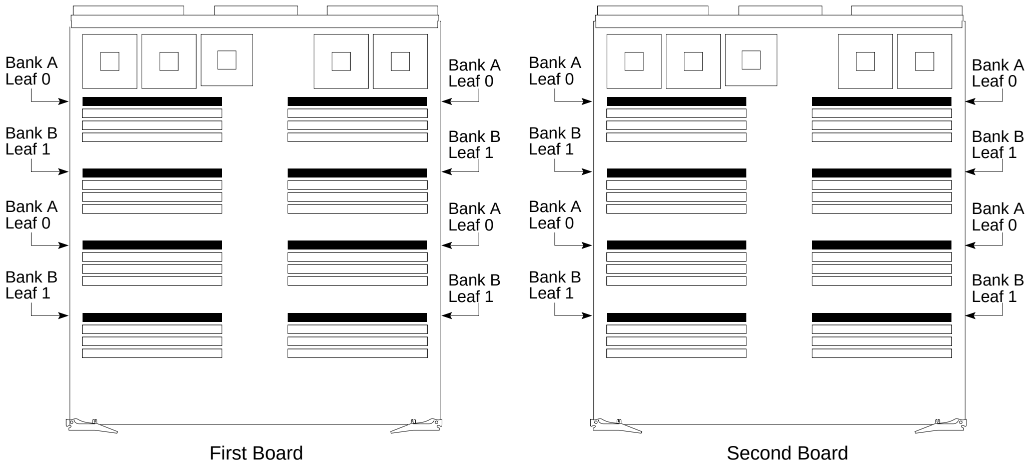


Figure 5-45 Four-way Interleaving (Two Boards Required)

5.15.4.4 Eight-way Interleaving

The CHALLENGE / Onyx rackmount system can achieve eight-way interleaving using four MC3 boards.

Eight-way interleaving requires 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.

5.15.5 Avoiding Three MC3 Board Configurations

Do *not* install three MC3 boards into a system because this is an *illegal* configuration that is not supported by Silicon Graphics. 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 would seriously affect the system's memory performance, because the interleave factor would go from four-way to either one- or two-way (depending on how the third MC3 board is set up). This is because you cannot set up four-way interleaving on a third MC3 board, and because the system defaults to the lowest common interleave factor across the MC3 boards at boot-up time.

5.15.6 Other Factors Affecting Memory Performance

In addition to the interleaving setup, two other factors can significantly affect memory performance:

- SIMM problems
- CPU power

5.15.6.1 Memory Problems

If a memory problem occurs, this could seriously affect the interleave factor for the system. For example, if the system is set up for two-way interleaving and a problem occurs with one of the SIMMs, the system could default to one-way interleaving.

5.15.6.2 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. Figure 5-46 shows the general relationship between memory performance and the number of CPU and MC3 boards.

In addition, Table 5-23 provides guidelines on the recommended interleave factor and the number of MC3s to use, based on the number of CPUs in a system. For example, if you have a deskside server system and you want to install two MC3 boards (four-way interleaving), the system should have three CPU boards.

Interleave Factor and Number of MC3 Boards To Achieve Standard Memory Performance	interleave Factor and Number of MC3 Boards To Achieve Higher Performance	Number of Recommended CPUs
1-way (1 MC3 board)	2-way (1 MC3 board)	2 (using 1 CPU board)
2-way (1 MC3 board)	2-way (1 MC3 board)	4 to 6 (using 1 to 2 CPU boards)
2-way (1 MC3 board)	4-way (2 MC3 boards)	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)
4-way (2 MC3 boards)	8-way (4 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)
8-way (4 MC3 boards)	8-way (4 MC3 boards)	22 to 36 (using 6 to 9 CPU boards)

Table 5-23 Recommended CPU to Interleave Factor Guidelines

Note: Table 5-23 provides a recommended, but not required, set of 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.

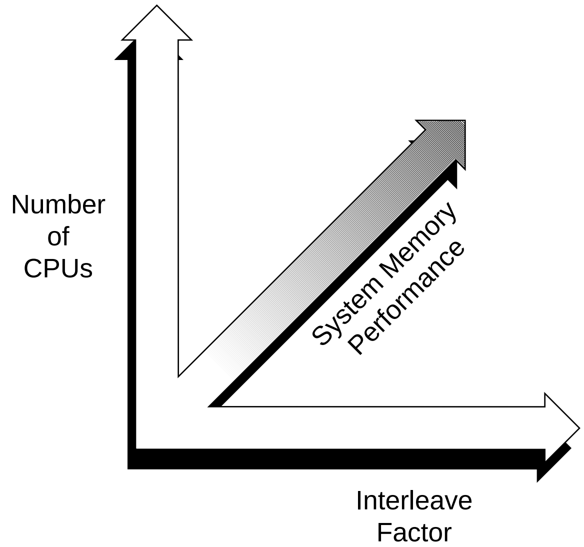


Figure 5-46 Relation between Memory Performance and the Number of CPUs and MC3 Boards

Note: 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.

5.15.7 Allowable Memory Configurations

This section describes the allowable memory configurations for the MC3 board. Table 5-24 and Table 5-24 and Figure 5-48 through Figure 5-61 define the proper configurations for one, two, four and eight-way interleaving.

Caution: Make sure you know the revision level of the MC3 board to determine whether it will support up to 1 GB or up to 2 GB of system memory. Read the following information to find out how much memory a particular MC3 will support.

5.15.7.1 MC3 Boards with Part Numbers 030-0245-007 and Below

MC3 boards with a part number of 030-0245-007 and below will support only up to 1 GB (1024 MB), owing to limitations of the MA ASIC. (See Section 4.3.2, "Memory Board Structure," for a description of the MA ASIC.) As a result, banks E, G, F, and H (the two back banks on these boards*) cannot* be used (see Figure 5-47). Do not populate these banks. Table 5-24 shows the allowable memory configurations for these boards.

Memory Configuration	SIMM Installation Location: One-way Interleaving (1 board)	SIMM Installation Location: Two-way Interleaving (1 board)	SIMM Installation Location: Four-way Interleaving (2 boards)	SIMM Installation Location: Eight-way Interleaving (4 boards)
64 MB	See Figure 5-48.	N / A	N / A	N / A
128 MB	This configuration is not shown and is not recommended. Use two-way interleaving instead.	See Figure 5-49.	N / A	N / A
256 MB	See Figure 5-50.	See Figure 5-51.	See Figure 5-52.	N / A
512 MB	This configuration is not shown and is not recommended. Use two-way interleaving instead.	See Figure 5-53.	See Figure 5-55.	See Figure 5-56.
640 MB	N / A	See Figure 5-57.	N / A	N / A
1024 MB	N / A	See Figure 5-58.	See Figure 5-59.	See Figure 5-61.

Table 5-24 Allowable Memory Configurations for MC3 Boards with Part Numbers 030-0245-007 and Below

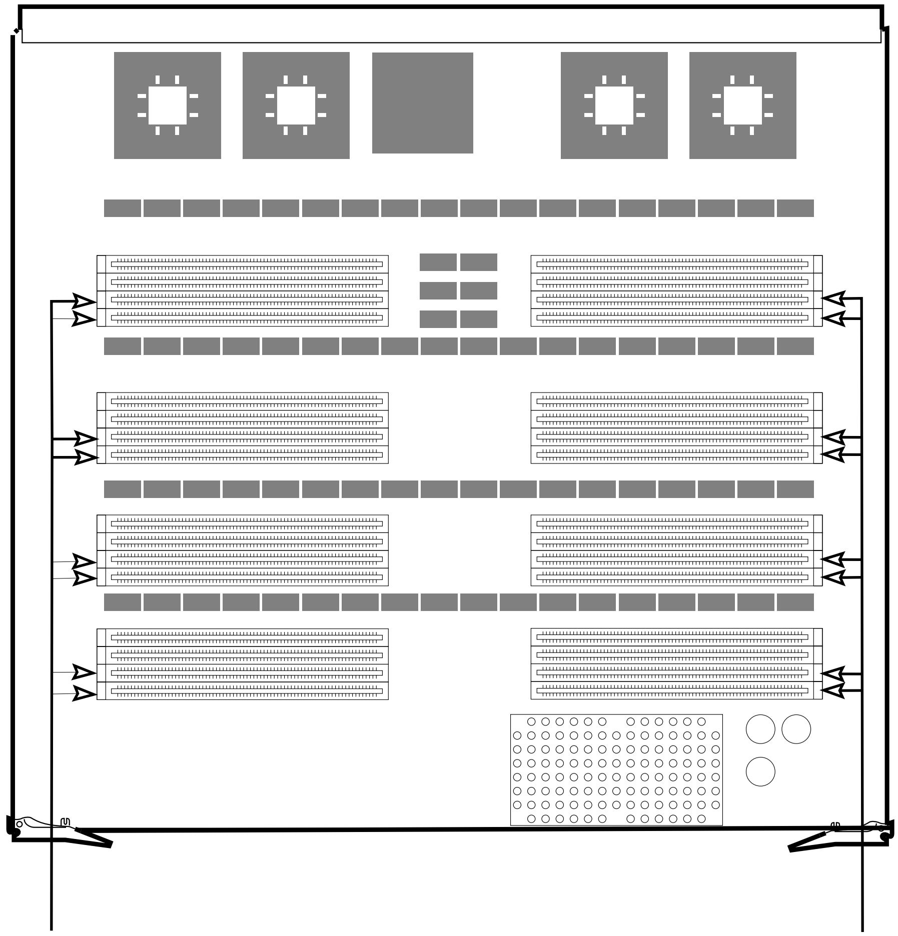


Figure 5-47 Unusable Banks for MC3 Boards with P/N 030-0245-007 and Below

5.15.7.2 MC3 Boards with Part Numbers 030-0245-008 and Above

MC3 boards with a part number of 030-0245-008 and above contain the updated MA ASIC and will support up to 2 GB of memory. See Table 5-24 for the allowable configurations.

Memory Configuration	SIMM Installation Location: One-way Interleaving (1 board)	SIMM Installation Location: Two-way Interleaving (1 board)	SIMM Installation Location: Four-way Interleaving (2 boards)	SIMM Installation Location: Eight-way Interleaving (4 boards)
64 MB	See Figure 5-48.	N/A	N/A	N/A

Table 5-25 Allowable Memory Configurations for MC3 Boards with P/N 030-0245-008 and Above

Memory Configuration	SIMM Installation Location: One-way Interleaving (1 board)	SIMM Installation Location: Two-way Interleaving (1 board)	SIMM Installation Location: Four-way Interleaving (2 boards)	SIMM Installation Location: Eight-way Interleaving (4 boards)
128 MB	This configuration is not shown and is not recommended. Use two-way interleaving instead.	See Figure 5-49.	N / A	N / A
256 MB	See Figure 5-50.	See Figure 5-51.	See Figure 5-52.	N / A
512 MB	This configuration is not shown and is not recommended. Use two-way interleaving instead.	See Figure 5-53 and Figure 5-54.	See Figure 5-55.	See Figure 5-56.
640 MB	NA /	See Figure 5-57.	N / A	N / A
1024 MB	N / A	See Figure 5-58.	See Figure 5-59 and Figure 5-59.	See Figure 5-61.
1280 MB	N / A	N / A	See Figure 5-62.	
2048 MB	N / A	N / A	See Figure 5-63.	See Figure 5-61.

Table 5-25 (continued) Allowable Memory Configurations for MC3 Boards with P / N 030-0245-008 and Above

64 MB Memory Configuration

1MC3, 1 Leaf

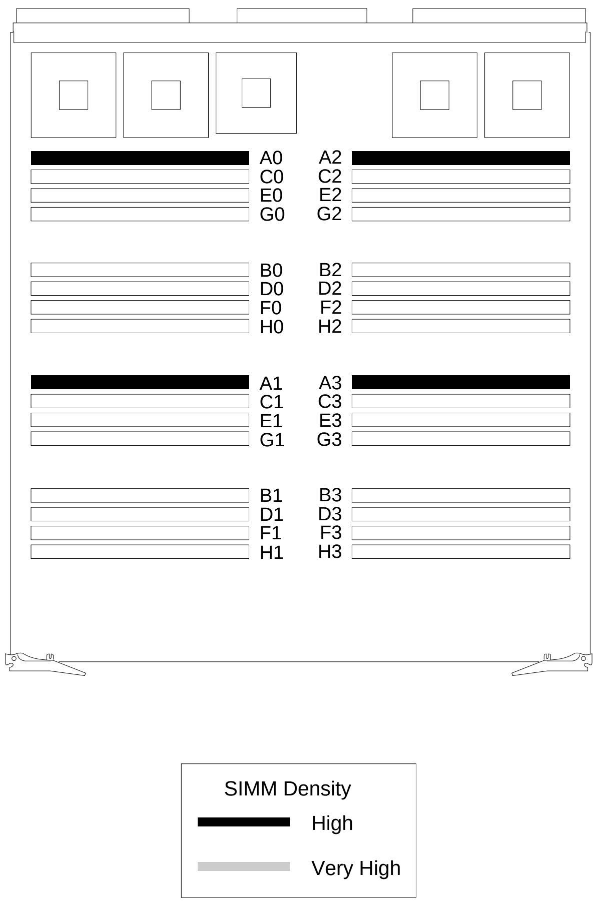


Figure 5-48 64 MB Configuration

Note: Install one bank of high-density SIMMS (4 x 16 MB) into bank A.

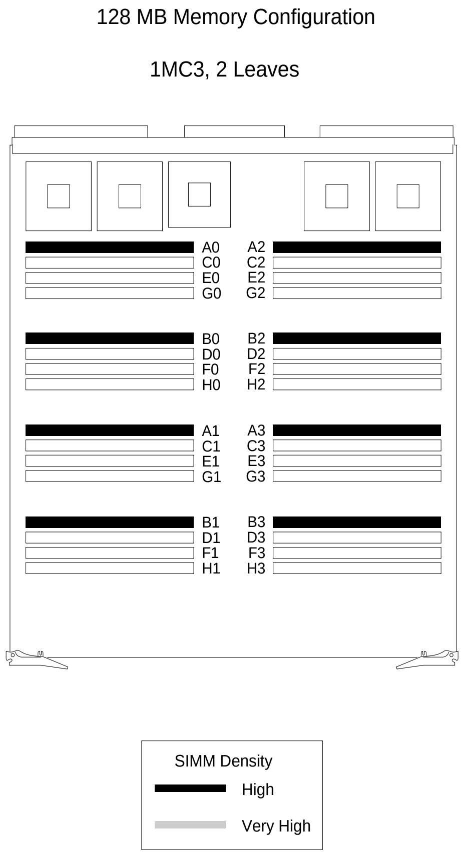


Figure 5-49 128 MB Configuration

Note: Install two banks of high-density SIMMs (8 x 16 MB) into banks A and B.

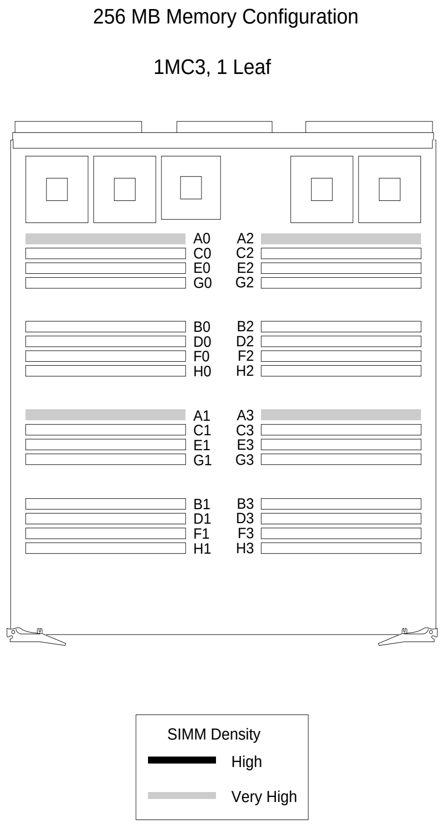


Figure 5-50 256 MB Configuration

Note: Install one bank of very high-density SIMMs (4 x 64 MB) into bank A.

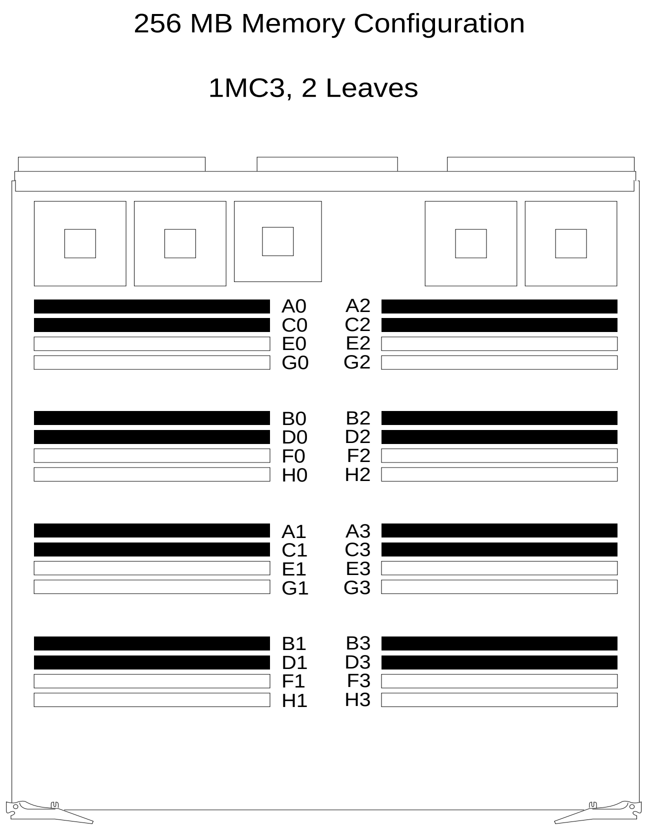


Figure 5-51 256 MB Configuration (Two-way Interleaving)

Note: Install four banks of high-density SIMMs (16 x 16 MB) into banks A, B, C, and D.

256 MB Memory Configuration

2MC3s, 4 Leaves

Figure 5-52 256 MB Configuration (Four-way Interleaving)

Note: Install four banks of high-density SIMMs (16 x 16 MB) into banks A and B on two MC3 boards.

512 MB Memory Configuration

1MC3, 2 Leaves

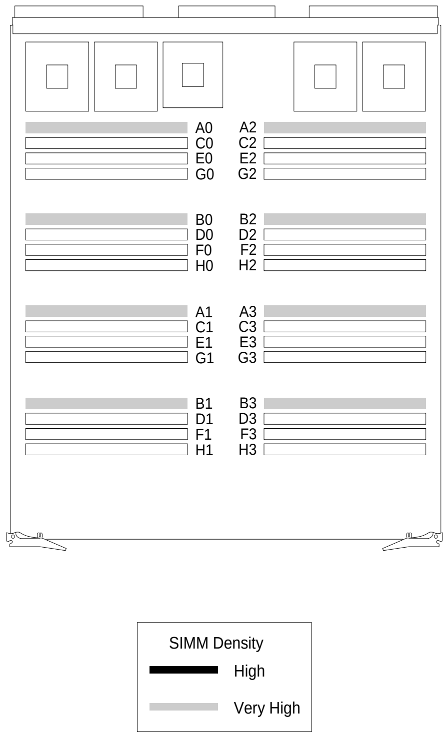


Figure 5-53 512 MB Configuration Using Very High-density SIMMs (Two-way Interleaving)

Note: Install two banks of very high-density SIMMs (8 x 64 MB) into banks A and B.

512 MB Memory Configuration

1MC3, 2 Leaves

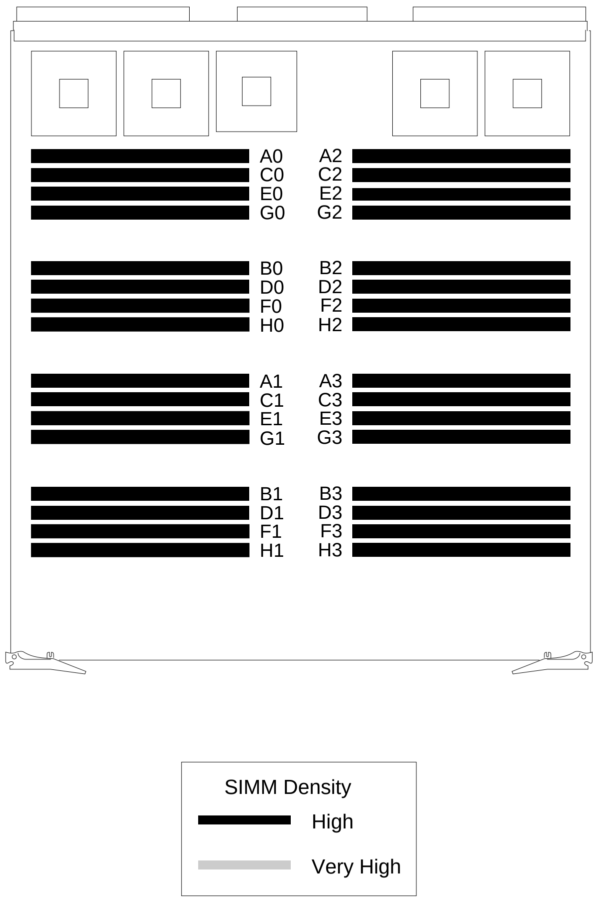


Figure 5-54 512 MB Configuration Using High-density SIMMs (Two-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Install eight banks of high-density SIMMS (32 x 16 MB) into banks A, B, C, D, E, F, G, and H on one MC3 board.

512 MB Memory Configuration

2MC3s, 4 Leaves

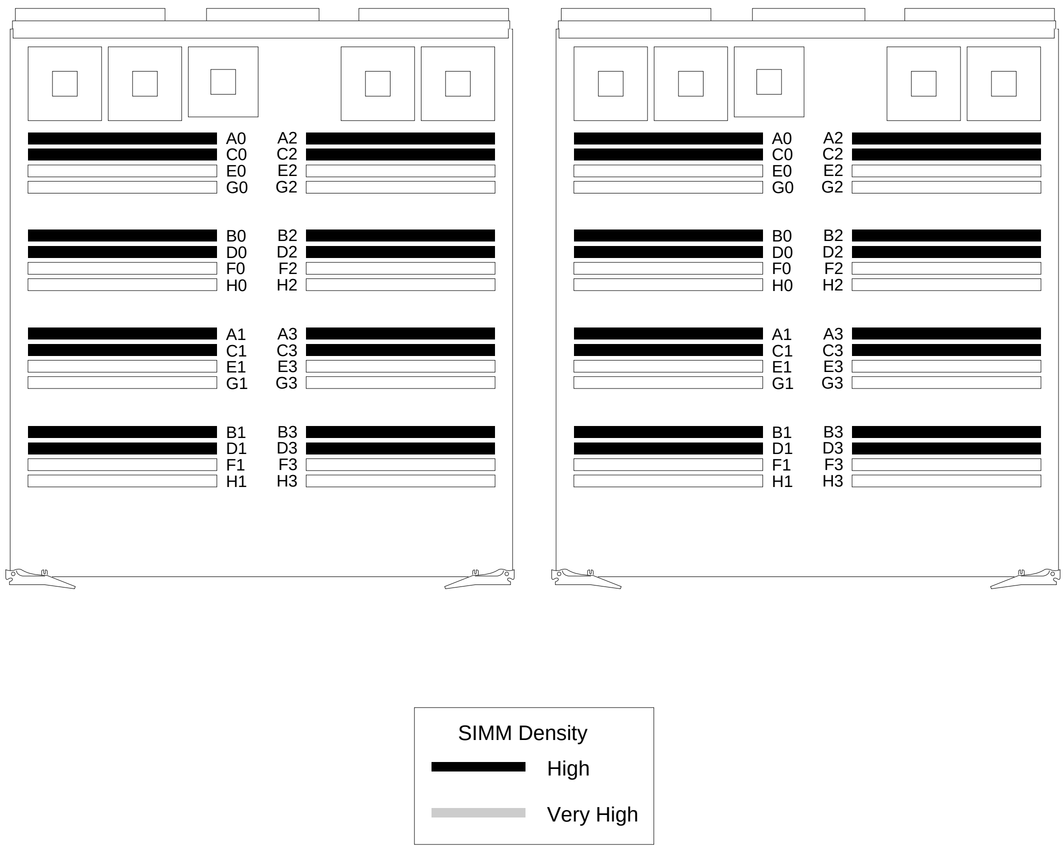


Figure 5-55 512 MB Configuration (Four-way Interleaving, Two MC3 Boards)

Note: Install eight banks of high-density SIMMs (32 x 16 MB) into banks A, B, C, and D on two MC3 boards.

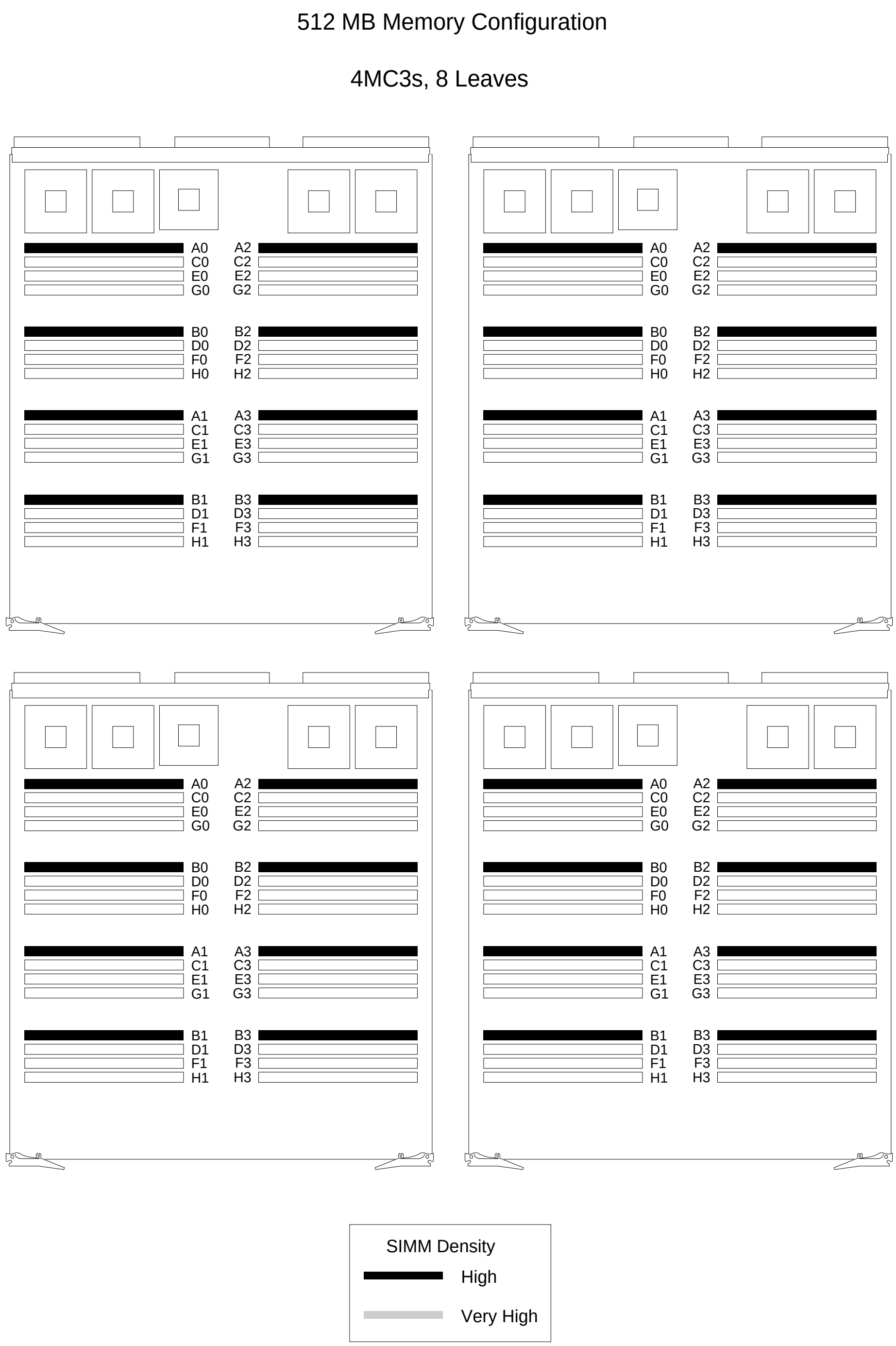


Figure 5-56 512 MB Configuration (Eight-way Interleaving, Four MC3 Boards)

Note: Install eight banks of high-density SIMMs (32 x 16 MB) into banks A and B on four MC3 boards.

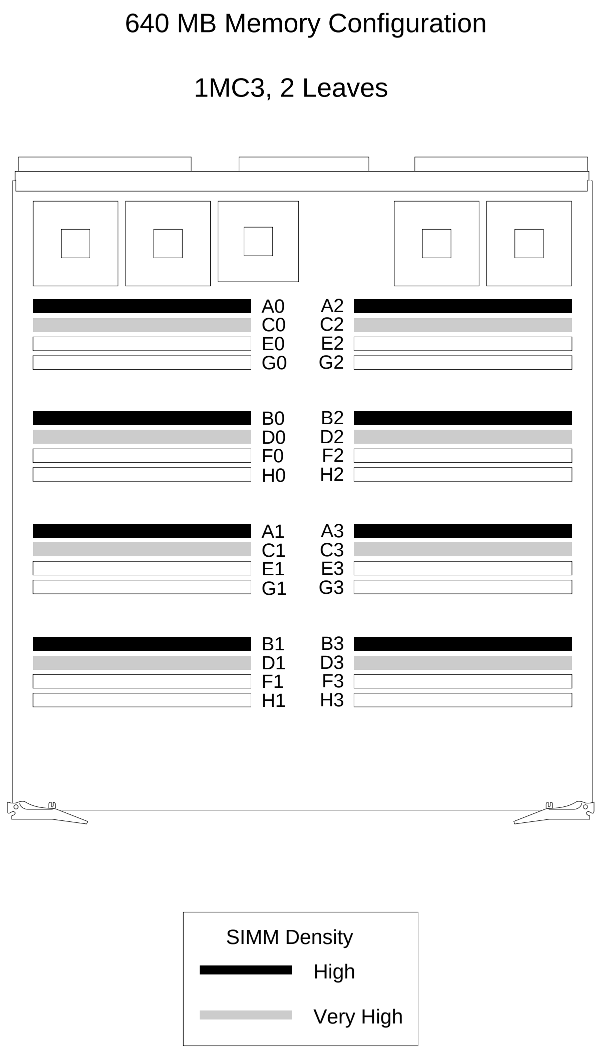


Figure 5-57 640 MB Configuration (Two-way Interleaving, One MC3 Board)

Note: Install two banks of high-density SIMMs (8 x 16 MB) into banks A and B, then install two banks of very high-density SIMMs (8 x 64 MB) into banks C and D.

1024 MB Memory Configuration

1MC3, 2 Leaves

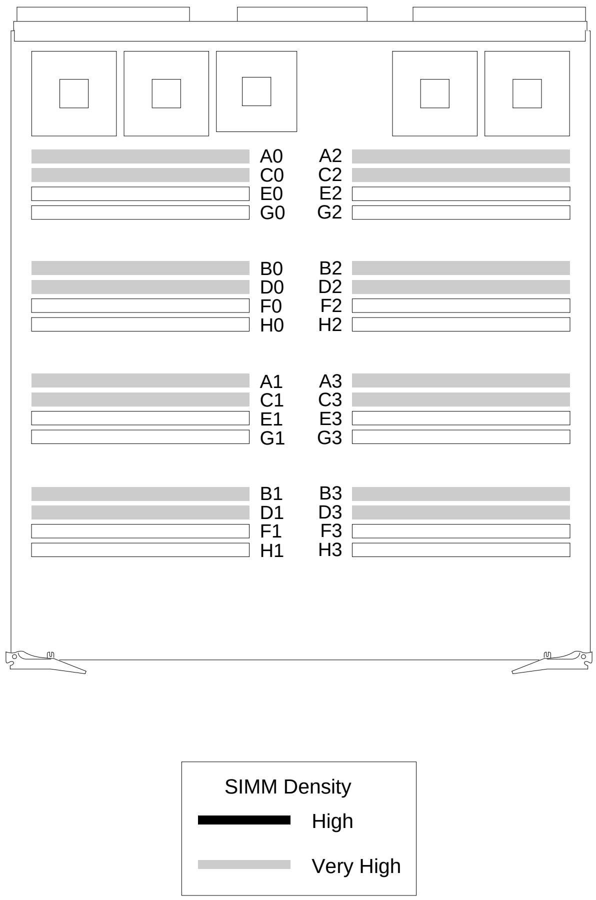


Figure 5-58 1024 MB Configuration (Two-way Interleaving, One MC3 Board)

Note: Install four banks of very high-density SIMMs (16 x 64 MB) into banks A, B, C, and D.

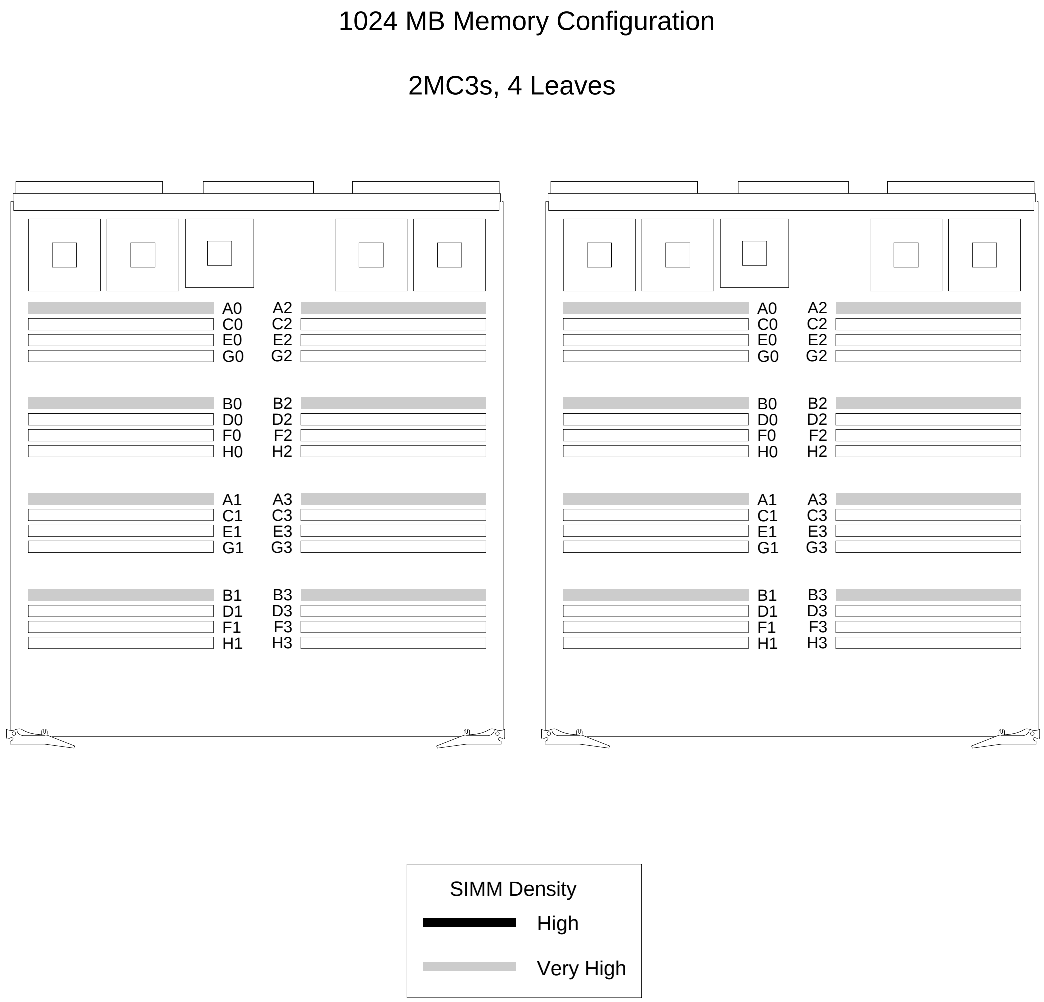


Figure 5-59 1024 MB Configuration Using Very High-density SIMMs (Four-way Interleaving, Two MC3 Boards)

Note: Install four banks of very high-density SIMMs (16x 64 MB) into banks A and B on two MC3 boards.

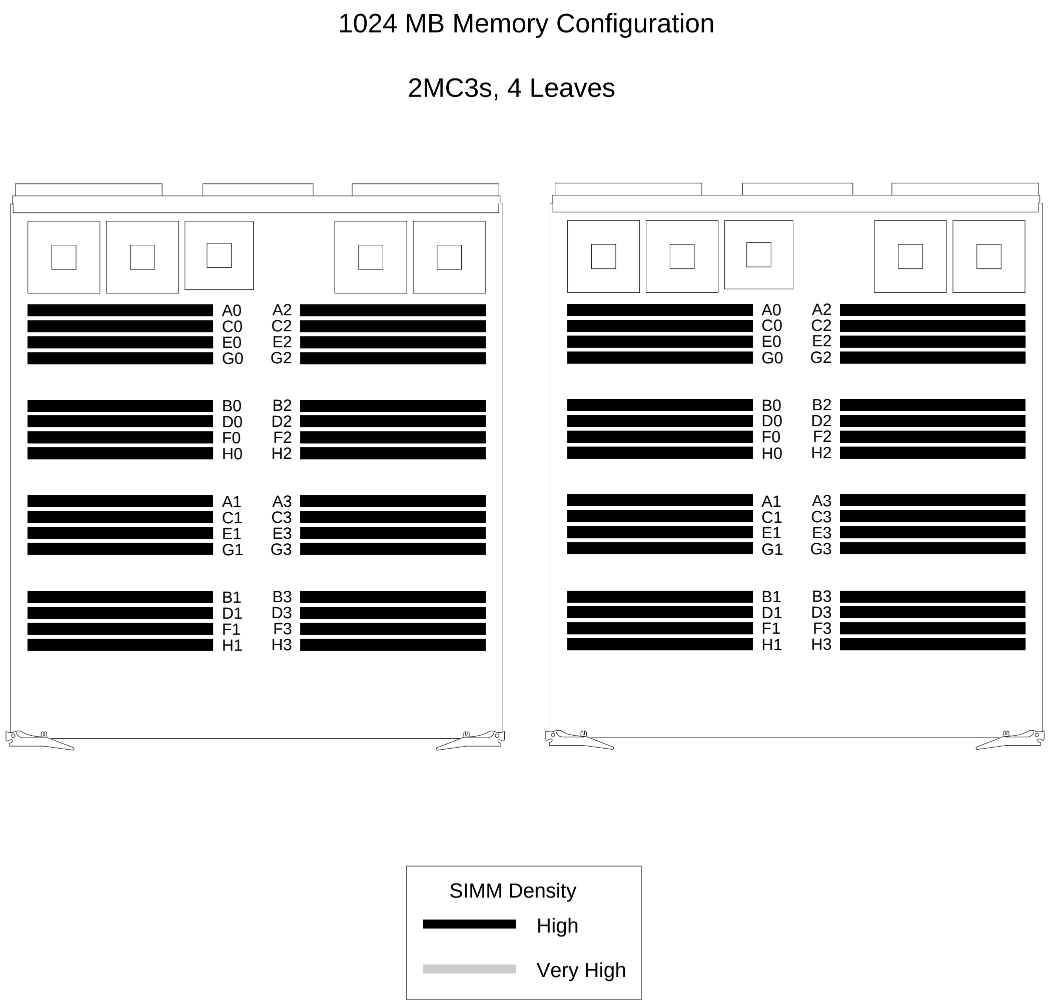


Figure 5-60 1024 MB Configuration Using High-density SIMMs (Four-way Interleaving, Two MC3 Boards)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Install 16 banks of high-density SIMMS (64 x 16 MB) into banks A, B, C, D, E, F, G, and H on two MC3 boards.

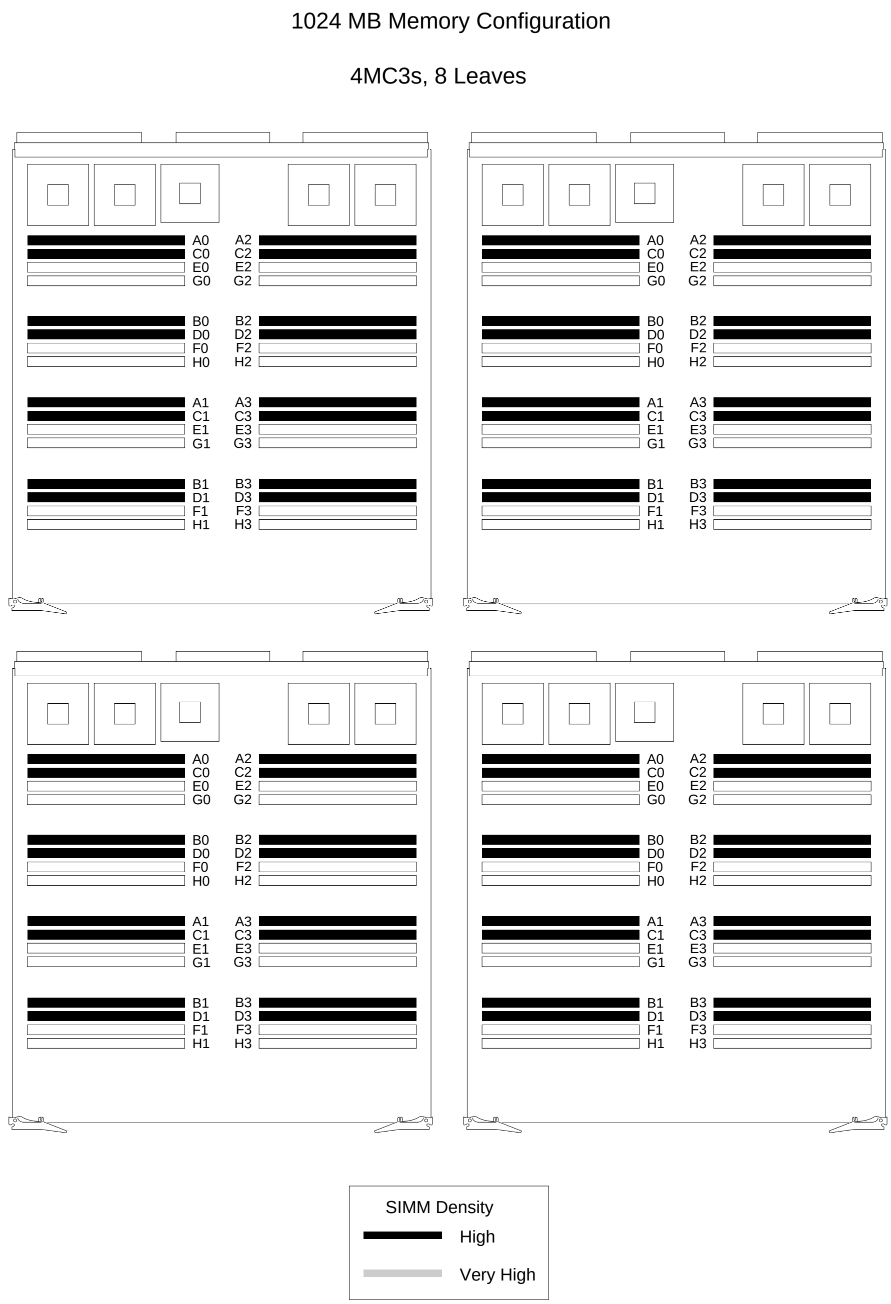


Figure 5-61 1024 MB Configuration (Eight-way Interleaving, Four MC3 Boards)

Note: Install 14 banks of high-density SIMMs (64 x 16 MB) into banks A,B, C, and D on four MC3 boards.

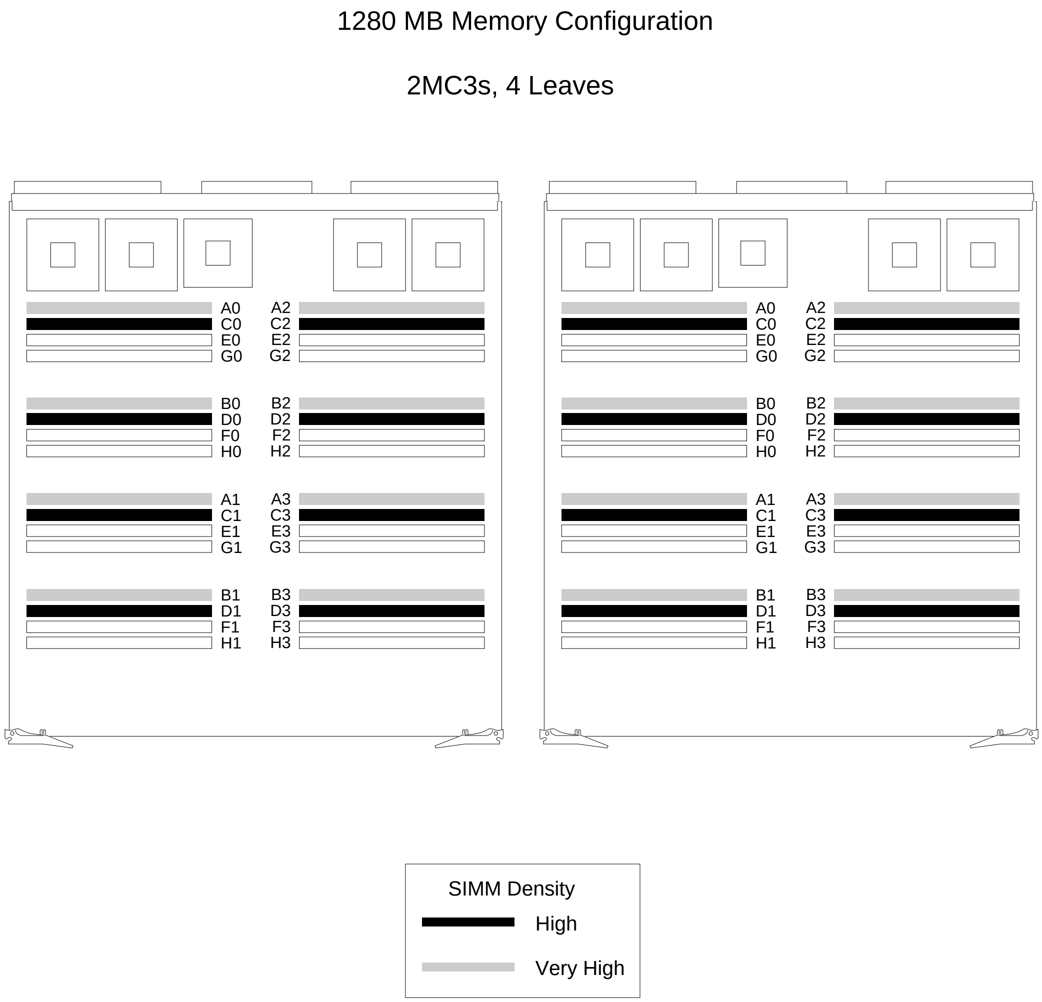


Figure 5-62 1280 MB Configuration (Four-way Interleaving, Two MC3 Boards)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Install four banks of very high-density SIMMs (16 x 64 MB) into banks A and B and four banks of high-density SIMMs (16 x 16 MB) into banks C and D on two MC3 boards.

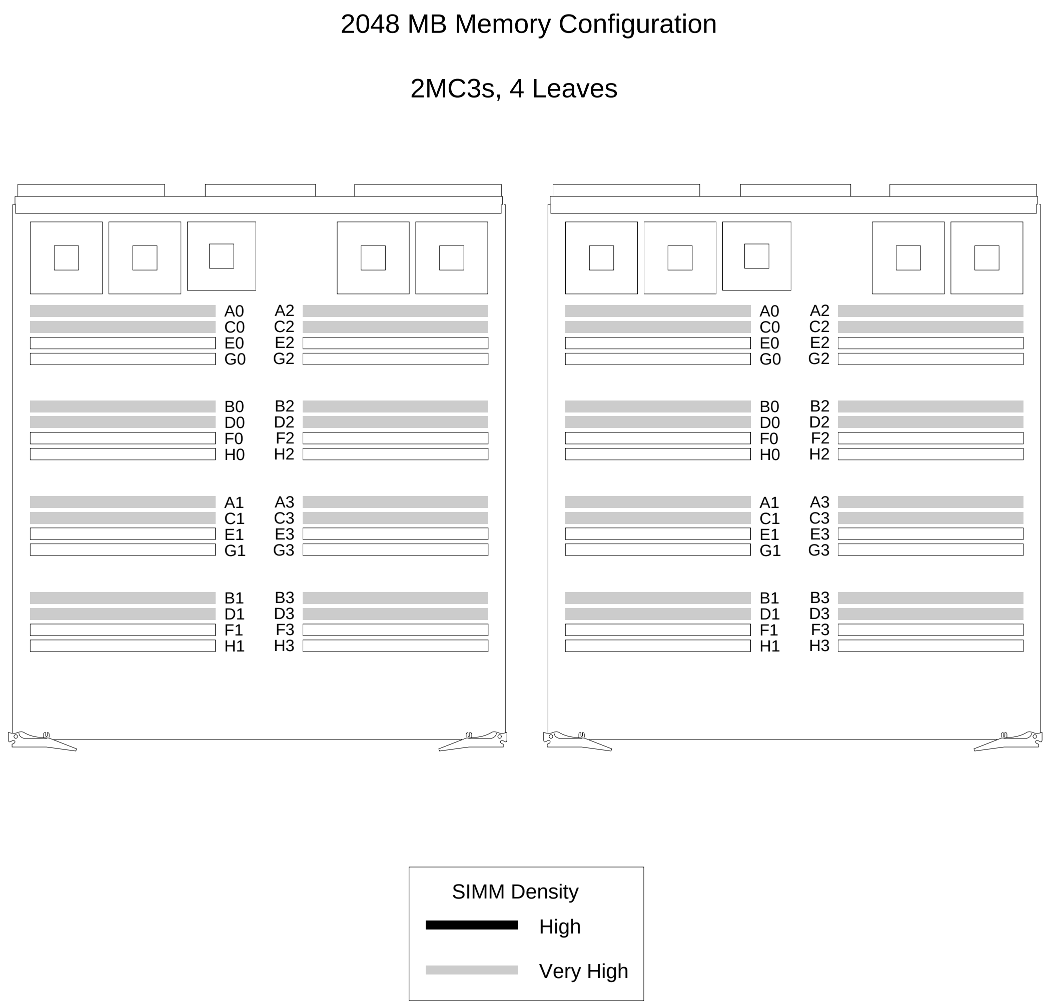


Figure 5-63 2048 MB Configuration (Four-way Interleaving, Two MC3 Boards)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Install eight banks of very high-density SIMMS (32 x 64 MB) into banks A, B, C, and D on two MC3 boards.

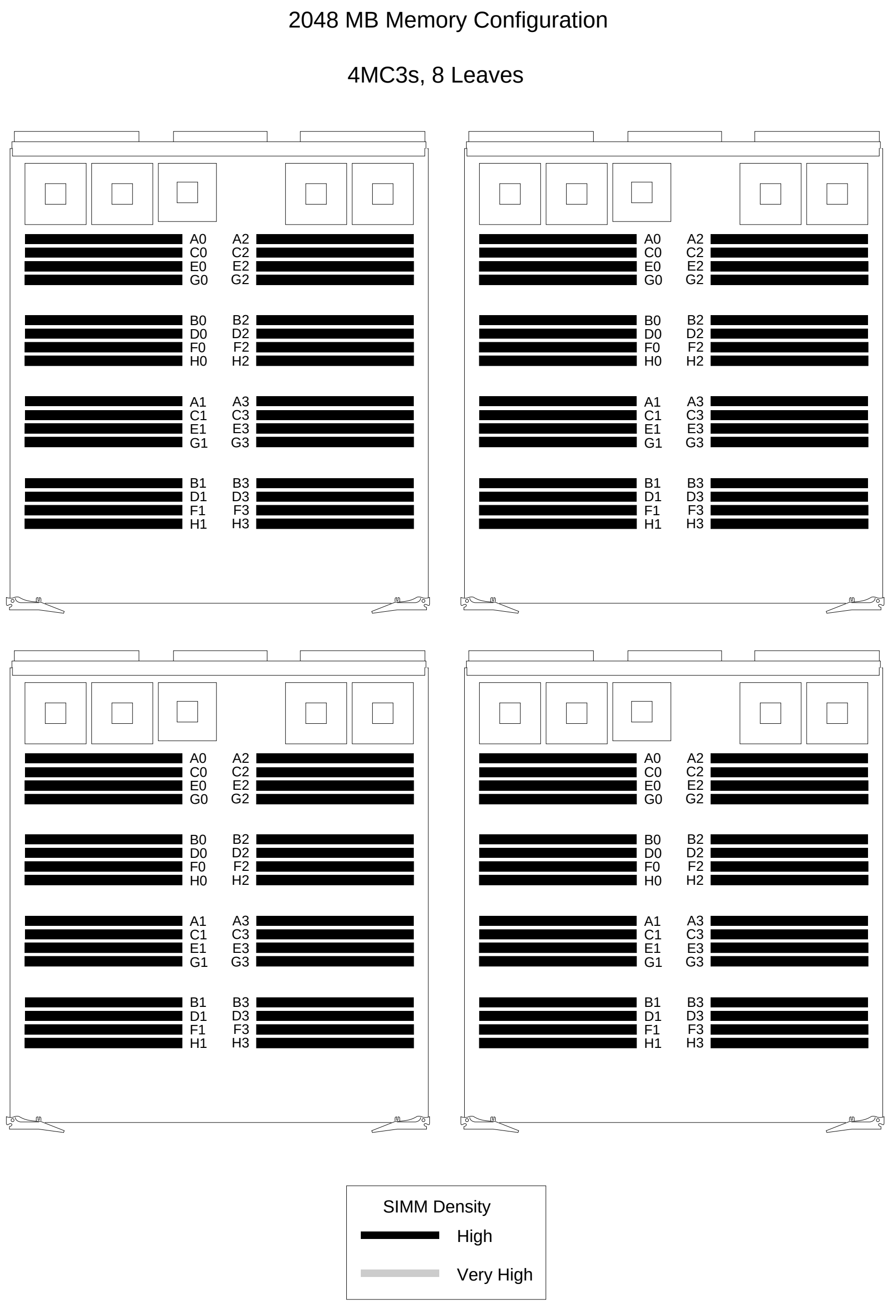


Figure 5-64 2048 MB Configuration (Eight-way Interleaving, Four MC3 Boards)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Install 16 banks of high-density SIMMS (64 x 16 MB) into banks A, B, C, D, E, F, G, and H on two MC3 boards.

5.15.8 Memory Upgrades

See Appendix C, "Memory Upgrade Configurations," for a description of all the available memory upgrades.

5.15.9 Installing SIMMs

Use the following instructions and Figure 5-65 to install SIMMs on the MC3 board. Review Section 5.15.7, "Allowable Memory Configurations," before you begin.

Caution: MC3 boards with P / N 030-0245-007 and below support only up to 1 GB of memory. MC3 boards with P / N 030-0245-008 and above support up to 2 GB of memory. Determine the revision level of the board before installing SIMMs.

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.

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

1. Slide each SIMM module directly into a single SIMM location with the notch at the ejector tab end.
2. Install the SIMM, a bank at a time, for example, A0, A1, A2, and A3.

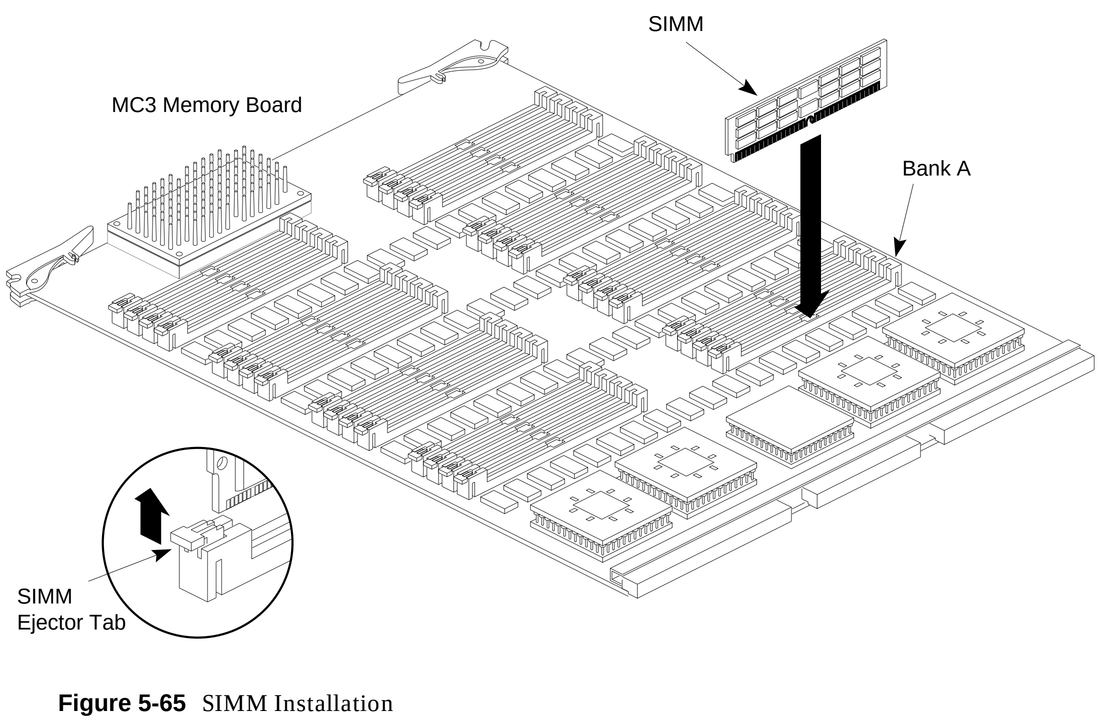


Figure 5-65 SIMM Installation

5.15.10Removing SIMMs

Use the SIMM extraction tool (see Figure 5-66) to remove SIMMs from the MC3 board.

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

1. Place the extraction tool over the SIMM ejector tab as shown in Figure 5-66.
2. Grasp the SIMM extraction tool with your hand, then lift up the two stirrups on each side of the tool with your fingers.
3. Carefully remove the SIMMs and set them aside.

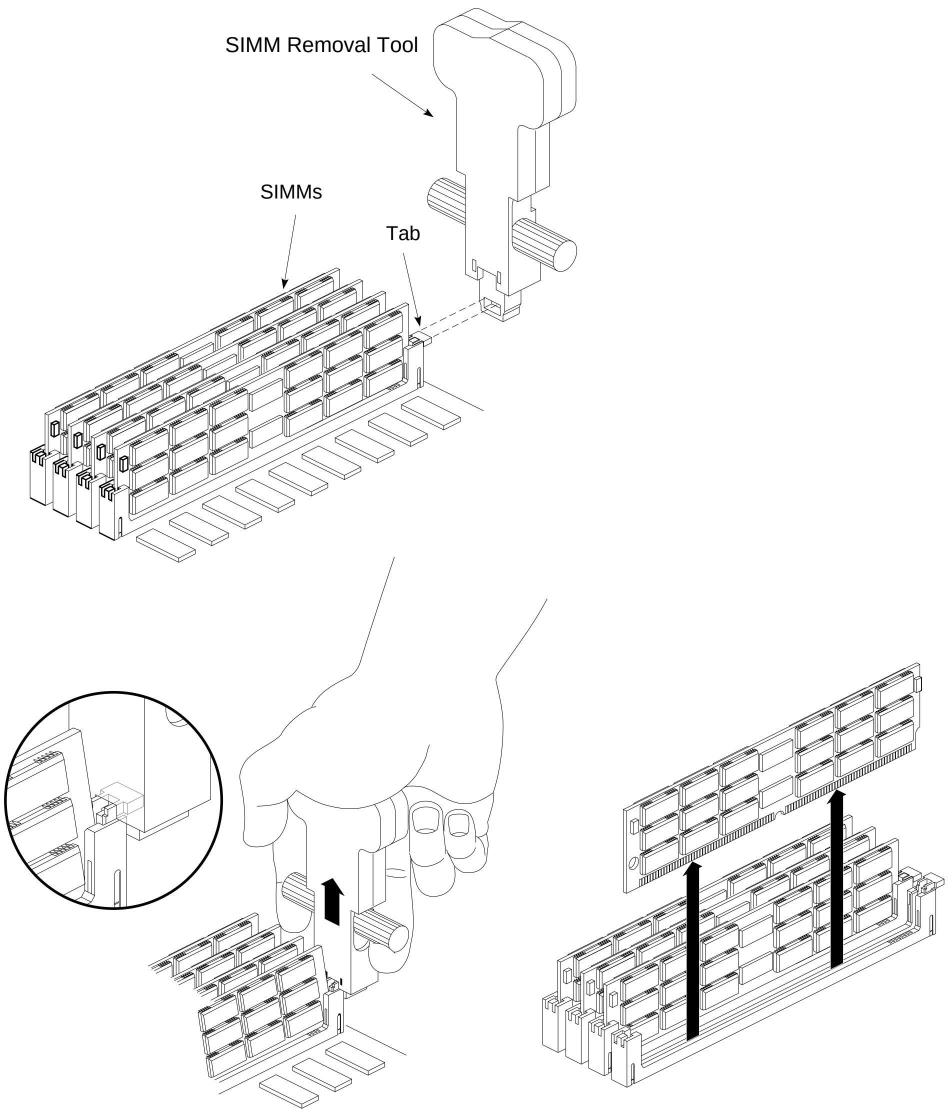


Figure 5-66 Removing SIMMs from an MC3 Board

5.16 General Replacement Procedures

This section describes the installation and removal procedures for the field-replaceable units (FRUs) in the CHALLENGE / Onyx deskside system and contains information that is common to many maintenance activities.

5.16.1 General Information

Read the following subsections for safety information and general procedures.

5.16.1.1 Safety Information

Before beginning the replacement procedures, observe these precautions.

Warning: **This equipment uses electrical power internally that is hazardous if the equipment is improperly disassembled. The procedures in this manual require specific training and technical knowledge and are for use only by Silicon Graphics system support engineers or other Silicon Graphics-trained personnel.**

Caution: This equipment is extremely sensitive and susceptible to damage by electrostatic discharge (ESD). The buildup of electrical static potential on clothing and other materials may cause ESD.

Use proper ESD preventive measures and observe these precautions:

- Wear a properly grounded wrist strap when connecting and disconnecting peripherals.
- Be sure that you and all the electrical equipment you handle are at ground potential to avoid damage from ESD. Do not rely on the power source ground: the ground is lost when the system is disconnected from the power source.
- Keep boards in their antistatic bags until you are properly grounded to the chassis ground with a ground strap.
- Do not use an ohmmeter or digital voltmeter on a board.

5.16.1.2 General Procedures

The CHALLENGE / Onyx deskside system uses sheet-metal housing and outer plastic panels. Two hinge pins and two plunger latches hold the chassis front door in place. The remaining panels attach to the sheet metal using ball and socket fasteners. Figure 5-67 provides an exploded view of the doors and panels.

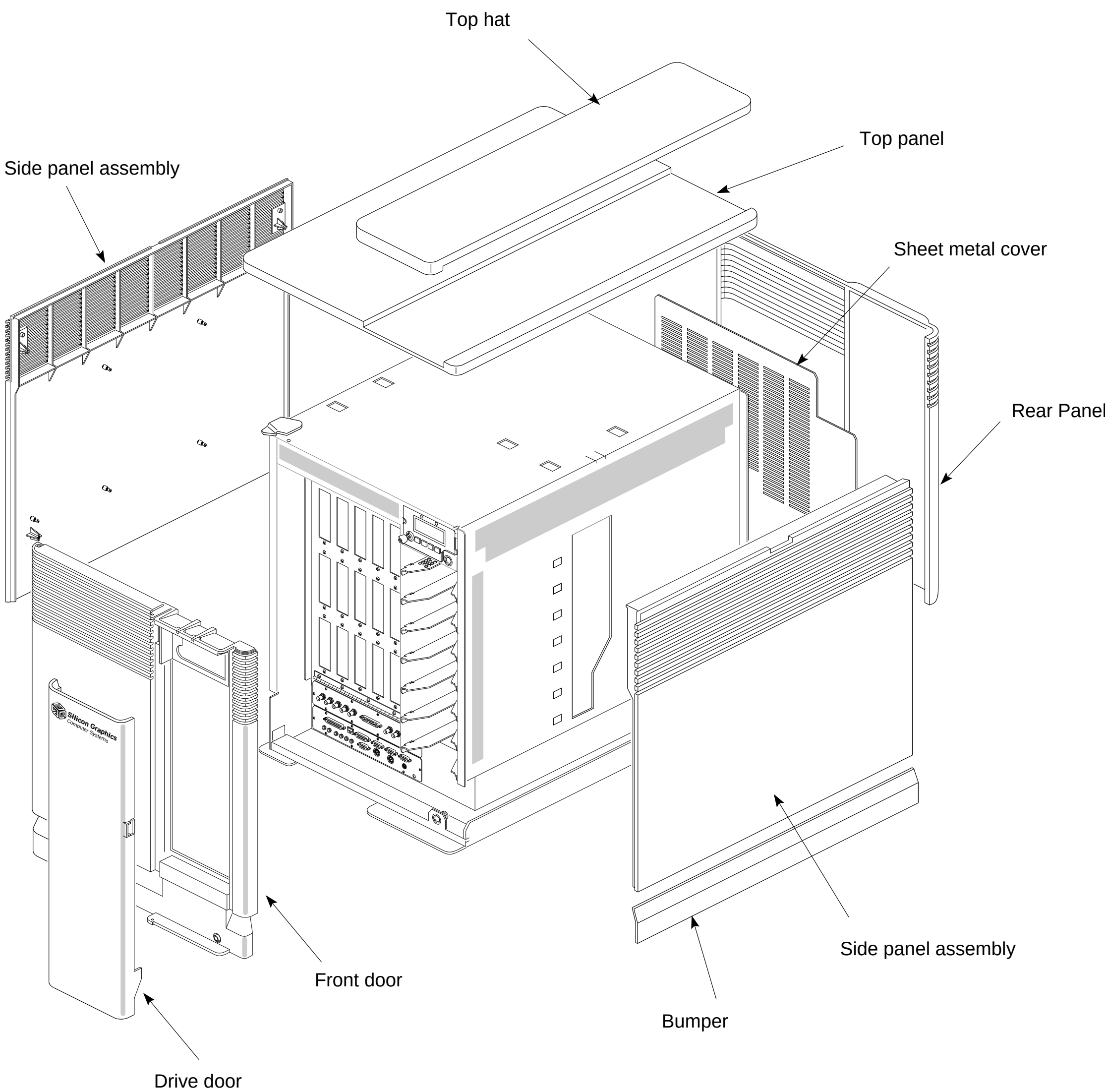


Figure 5-67 CHALLENGE / Onyx Deskside System Plastic Doors and Panels

5.16.2 Powering Down the System

Use these procedures to power down the system:

1. Ensure that the customer backs up the system, verifies the saved files, and makes sure that all users are off the target system.
2. Become superuser, then shut down the system software as follows:

   # shutdown -y g0

3. Power off the system. The switch is located in the rear of the chassis, near the AC power cord receptacle. See Figure 5-68. Disconnect the system from the power source.

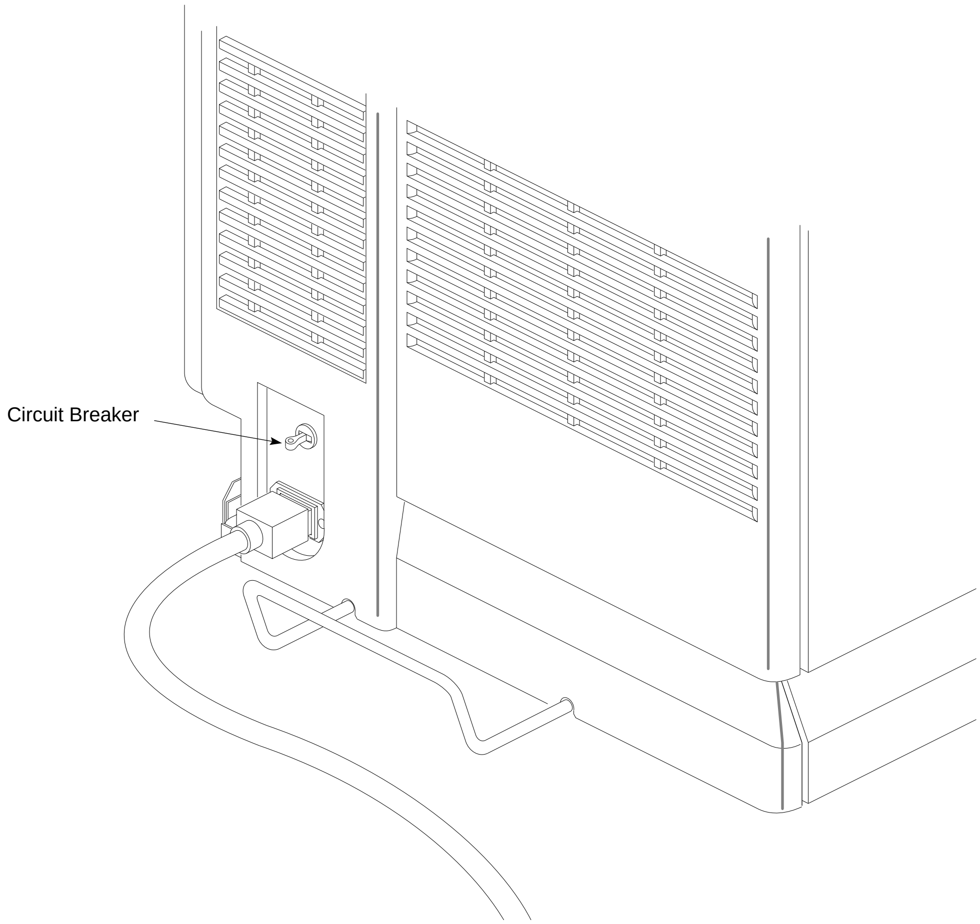


Figure 5-68 Powering Down the System

5.16.3 Opening the Chassis Front Door

Use these procedures to open the front door:

1. Open the drive door to expose the drives and front panel retainer latches.
2. Release the two retainer latches by fully depressing and releasing each latch with a pointed object, such as a screwdriver. Depress the inner button completely; Figure 5-69 shows the latch location and operation.
3. To close the front door, swing it to the closed position; then use a pointed object to fully depress and release the retainer latches.

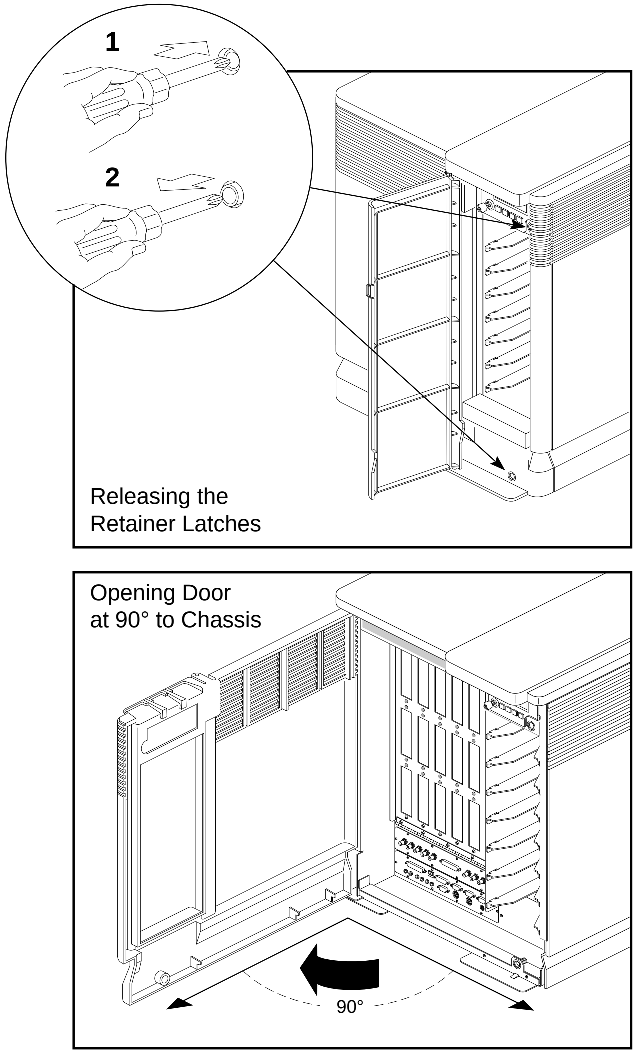


Figure 5-69 Opening the Front Door

5.16.4 Replacing the Front Door

Use these procedures to replace the front door:

1. Open the front door, as described in Section 5.16.3.
2. Grasp beneath the lower hinged corner of the front door. See Figure 5-70.
3. Lift the lower corner of the front door up and away from the lower hinge pin.
4. Drop the upper corner of the front door away from the upper hinge pin.
5. Reverse these steps to install the front door.

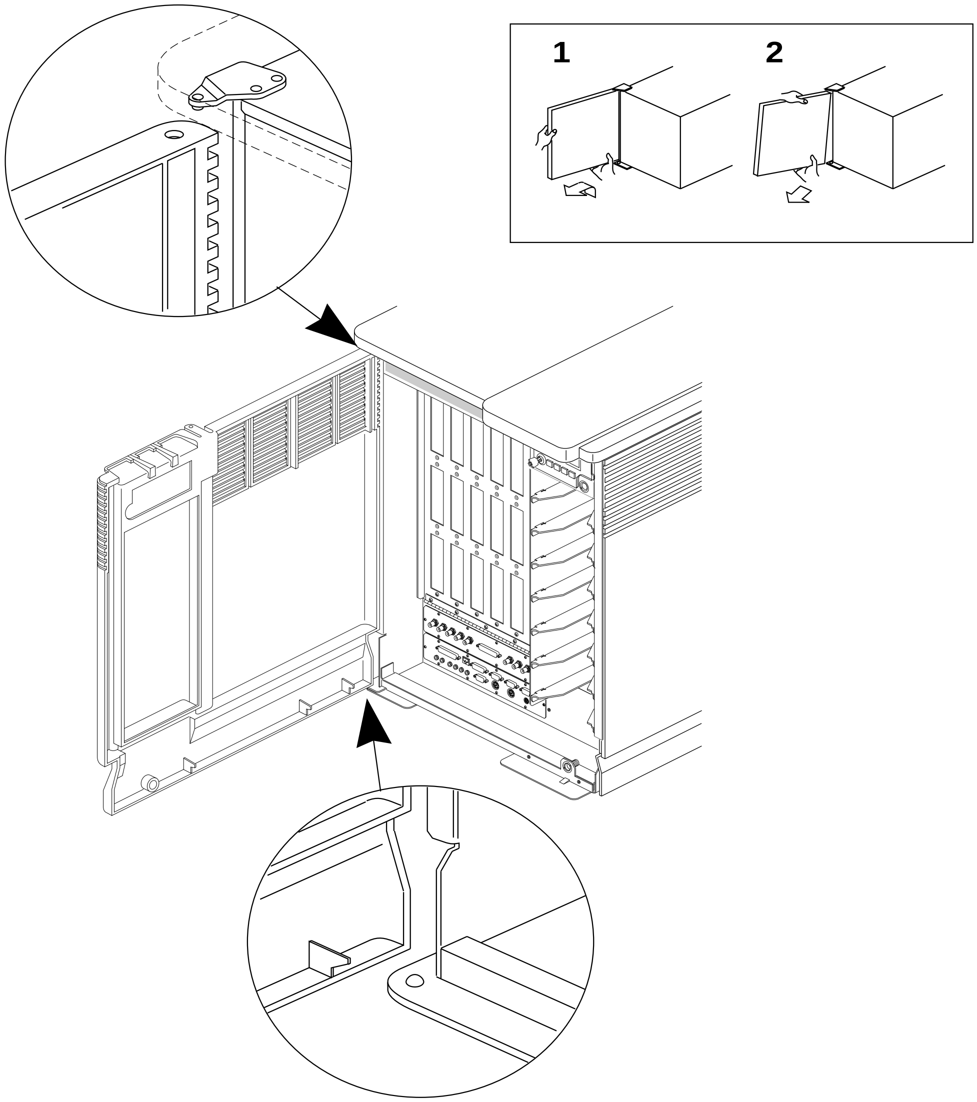


Figure 5-70 Removing the Front Door

5.16.5 Opening the I/O Door

Follow these procedures to open the I/O door:

1. Power down the system, as described in Section 5.16.2, “Powering Down the System.”
2. Open the chassis front door until it is perpendicular to its normal, closed position, as shown in Figure 5-69 (the chassis front must be in this position for the I/O door to open completely).
3. Label any unusual external cables and connectors to simplify reassembly.
4. Disconnect all external cables from their sheet-metal I/O connector plates above the door hinge, if necessary.

5. Release the I/O door by removing the three screws on the door's upper edge, as shown in Figure 5-71.
6. Lower the I/O door.

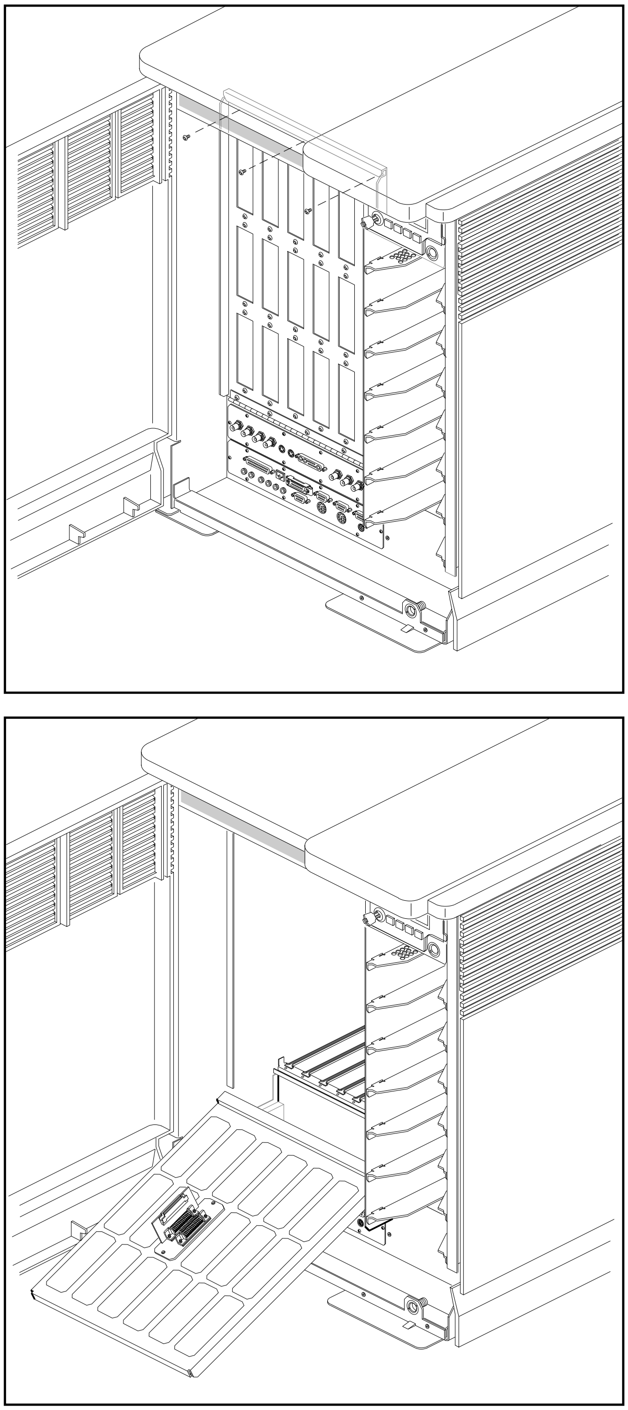


Figure 5-71 Opening the I/O Door

5.16.6 Replacing the I/O Door

To remove the I/O door (P/N 013-0409-*xxx*), see Figure 5-72 and follow these steps:

1. Open the front door, as described in Section 5.16.3.
2. Open the I/O door, as described in Section 5.16.5, “Opening the I/O Door.”
3. Disconnect the I/O plate connectors.
4. Remove the screws holding the I/O door hinge to the chassis.
5. Carefully remove the I/O door from the chassis.
6. Reverse these steps to install the I/O door.

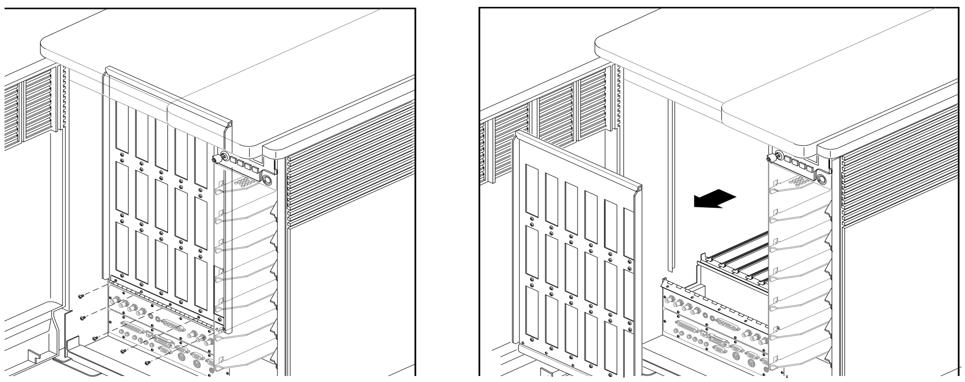


Figure 5-72 Removing the I/O Door

5.16.7 Removing the Rear Plastic Panel and Sheet-metal Cover

To remove the rear panel and sheet-metal cover, follow these procedures:

1. Power down the system, as described in Section 5.16.2, “Powering Down the System.”
2. Loosen the back plastic panel from the chassis by grasping the bottom of the panel and giving it a quick pull away from the chassis.
3. Tilt the lower edge of the panel away from the chassis until it presses against the U-shaped bumper at the bottom of the chassis.
4. Drop the top edge of the panel down to clear the top hat.
5. Lift the panel away from the chassis.
6. Remove the sheet-metal panel from the chassis by partially removing the screws holding the door in place. Figure 5-73 shows the prepared back panel.

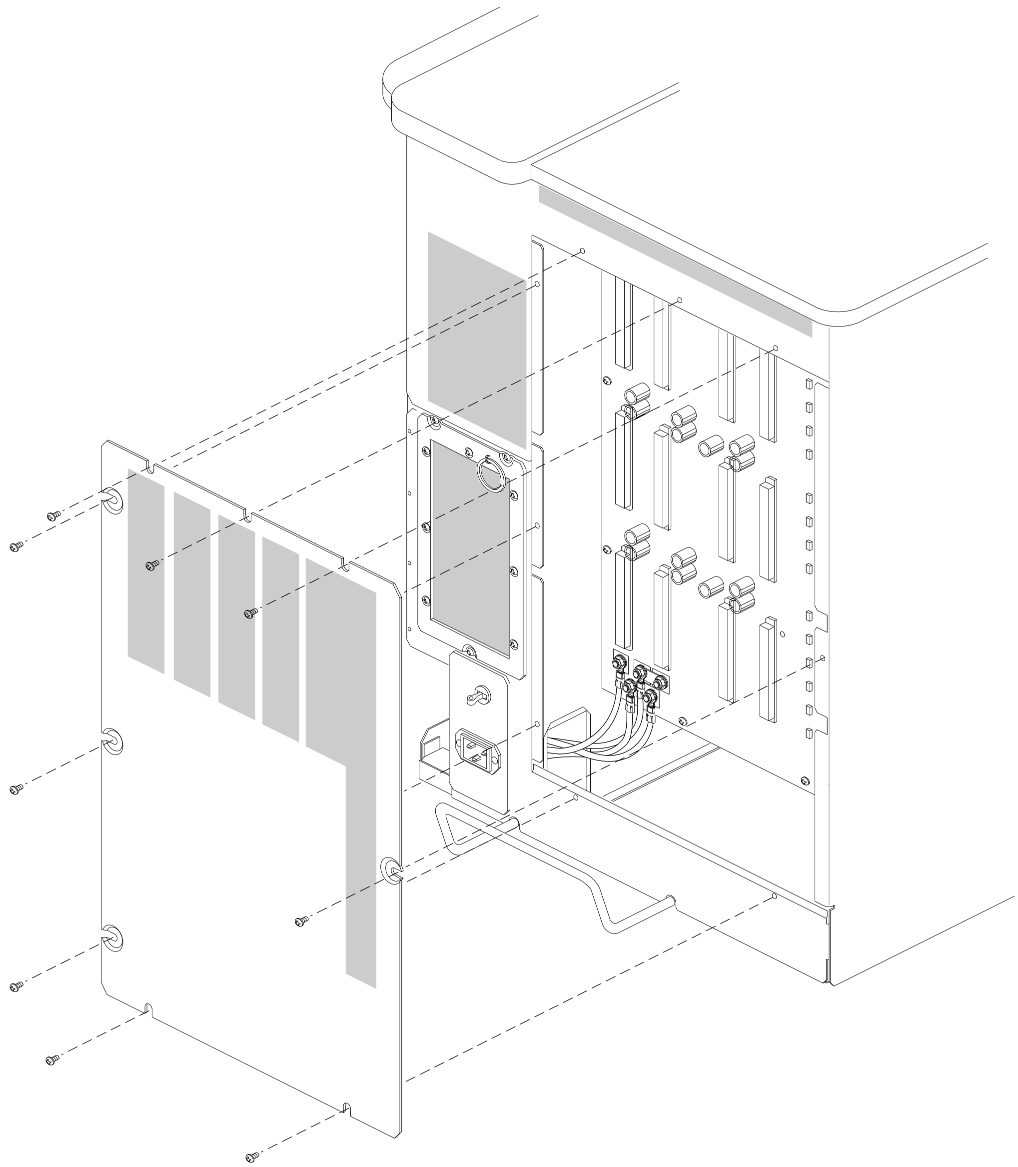


Figure 5-73 Removing the Rear Sheet-metal Cover

5.16.8 Removing the Side Panels

To remove the side panels (013-0343-*xxx*), see Figure 5-74 and follow these steps:

1. Grasp the bottom edge of the panel.
2. Pull the panel away from the chassis until the ball and socket fasteners release.
3. Drop the panel away from the top panel lip.

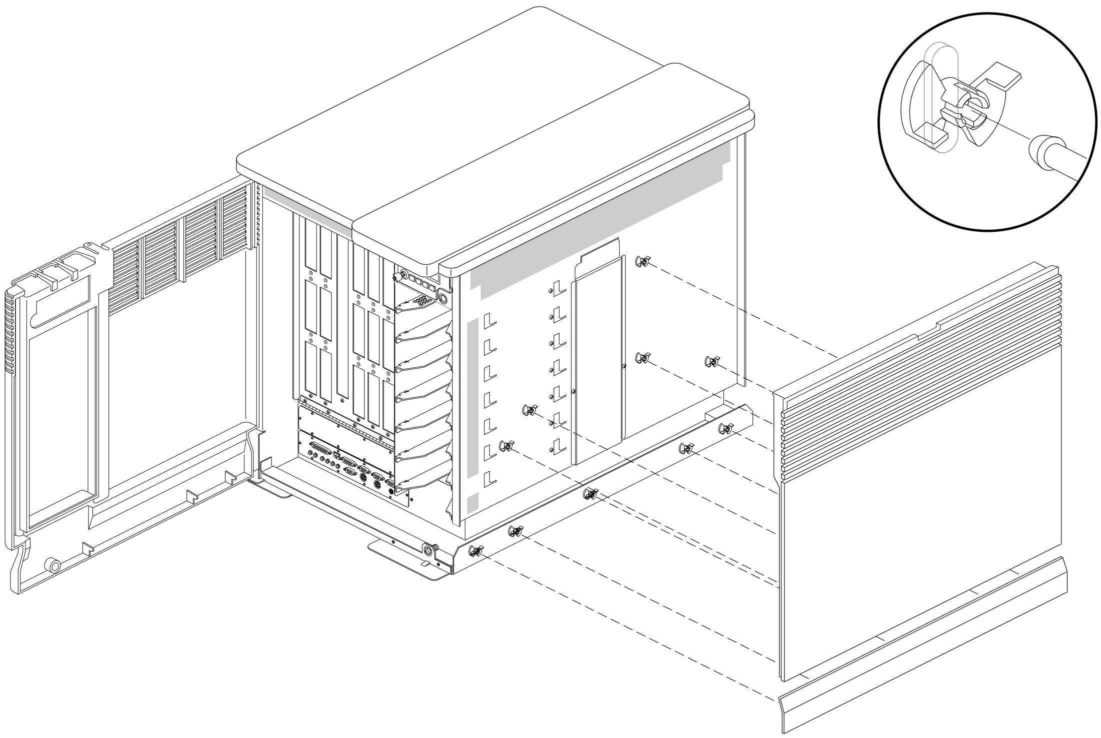


Figure 5-74 Removing the Side Panels

5.16.9 Replacing the Top Hat

Follow these procedures to replace the top hat (P / N 050-0006-*xxx*):

1. Gently pry up the top hat with a flat-bladed screwdriver.
2. Lift the front edge of the top hat until it clears the top panel (see Figure 5-75).
3. Slide the top hat toward the rear of the chassis and remove the top hat from the chassis.
4. Reverse these steps to replace the top hat.

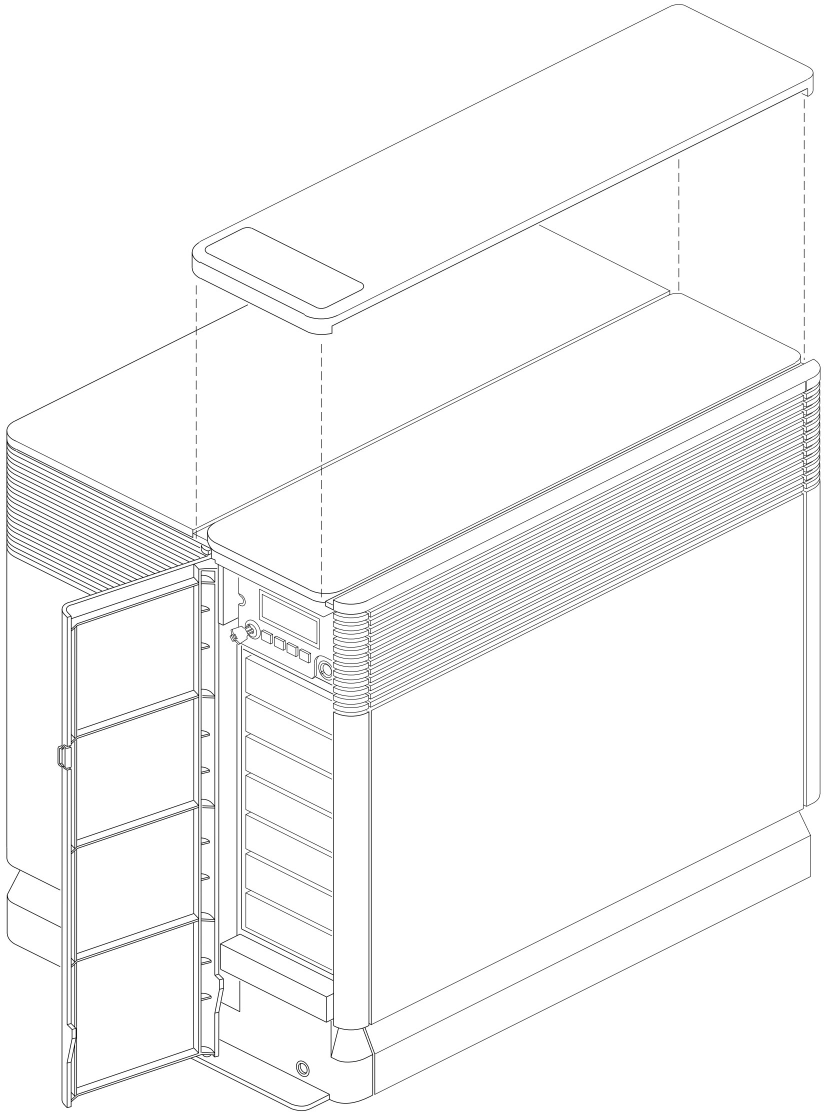


Figure 5-75 Replacing the Top Hat

5.16.10 Replacing the Top Panel

To replace the top panel (P/N 050-0007-*xxx*), see Figure 5-76 and follow these procedures:

1. Remove the right side panel, as described in Section 5.16.8, “Removing the Side Panels.”
2. Locate the hidden catch plate centered along the right side of the top panel.
3. Press down on the catch plate with a flat-bladed screwdriver.
4. Slide the top panel from right to left. The top panel is now free.

5. To install the top panel, check that the hidden catch is bent slightly upward. Align the plastic fingers of the top panel with their corresponding slots and slide the panel right; the hidden catch plate engages automatically.

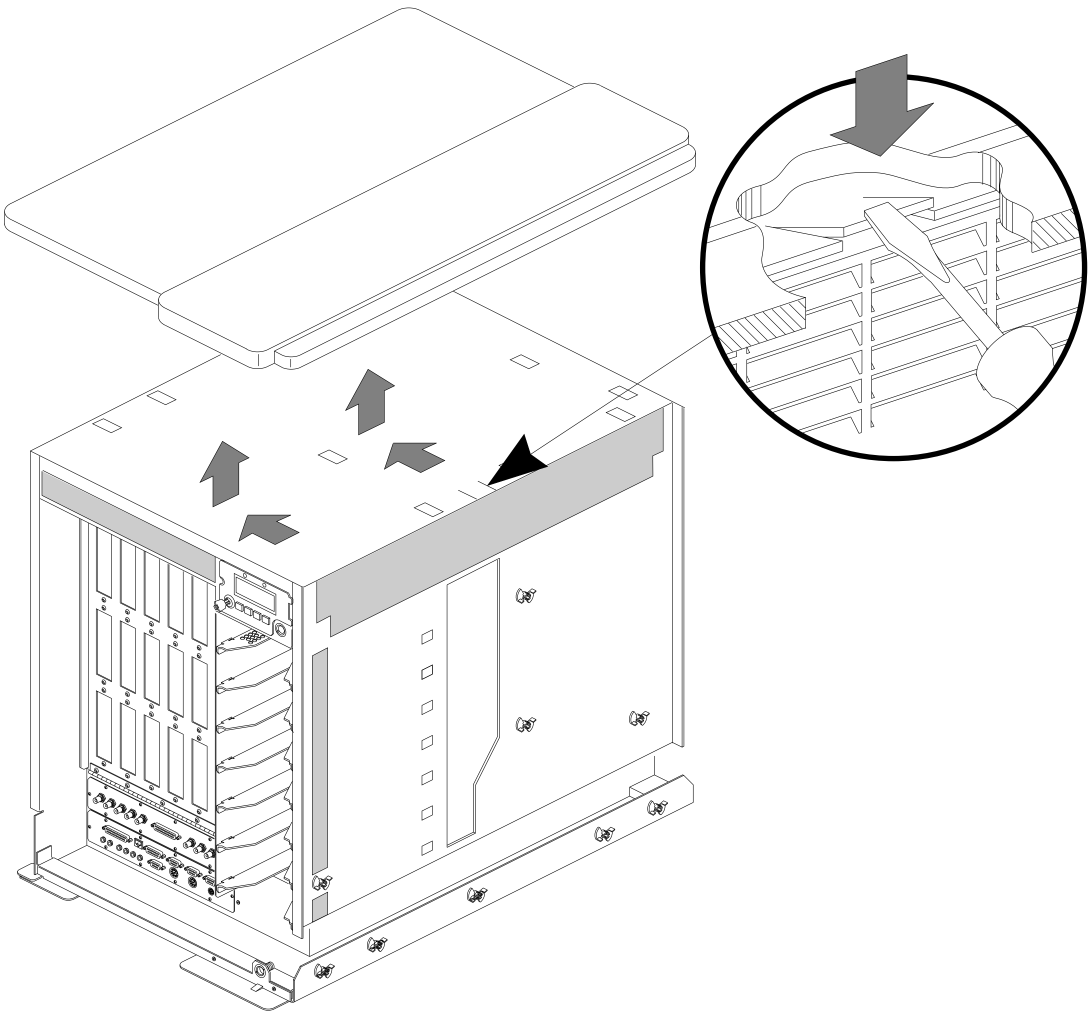


Figure 5-76 Replacing the Top Panel

5.16.11 Label Placement

Figure 5-77 illustrates how to change the top hat label.

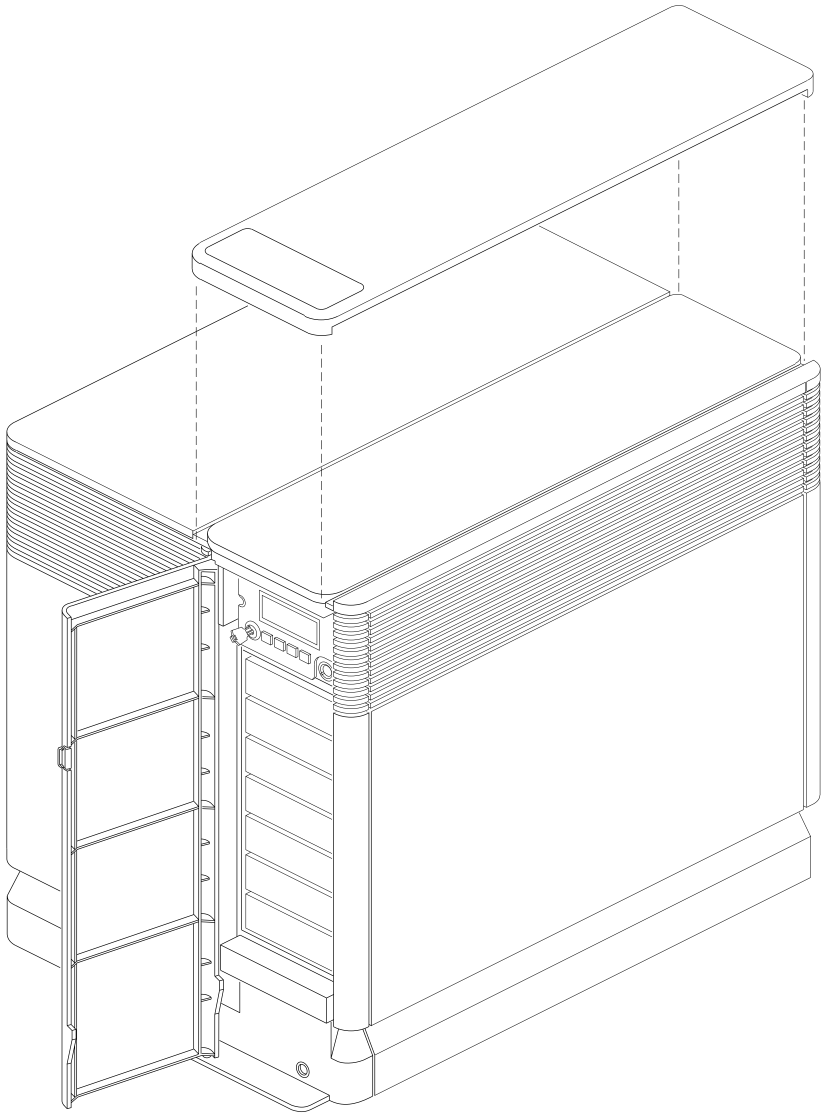


Figure 5-77 Top Hat Label Placement

5.17 Specific Procedures

The following section provides instructions for replacing the field-replaceable units (FRUs). To replace an FRU, first use Figure 5-78 to identify the appropriate unit and its position in the chassis. Then proceed to the appropriate section and perform the steps.

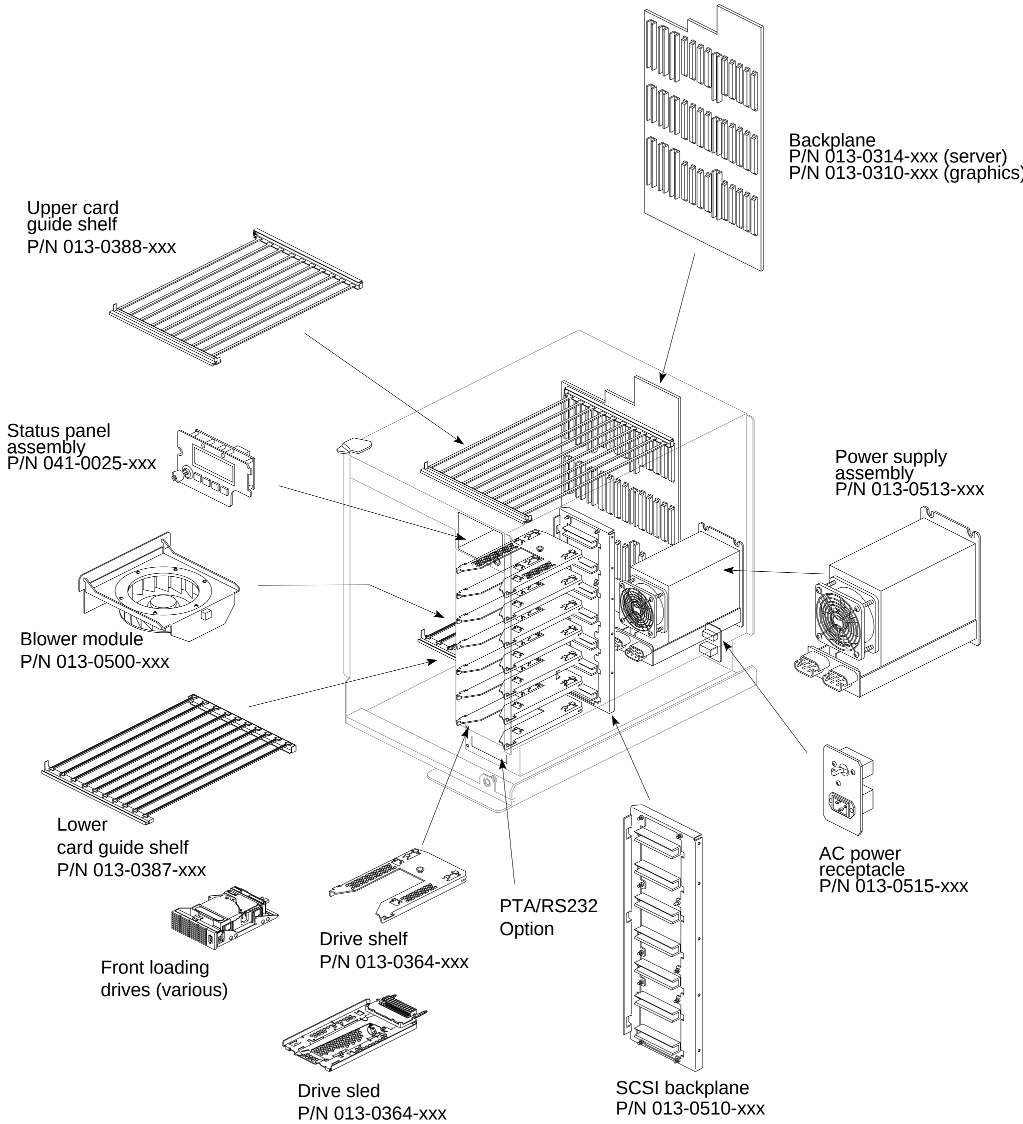


Figure 5-78 CHALLENGE / Onyx Deskside System Replaceable Parts

Note: See also Chapter 3, "Configurations and Components," for additional chassis part numbers.

5.17.1 Replacing the Status Panel

To replace the status panel (P / N 041-0025-*xxx*), perform the following:

1. Power down the system, as described in Section 5.16.2.
2. Open the front door, as described in Section 5.16.3.
3. Remove the screw from the left side of the system controller.
4. Pull the left side of the system controller out until the two tabs on the right side of the controller are clear of their slots in the chassis. See Figure 5-79.
5. Carefully remove the status panel from its cavity in the chassis.
6. Disconnect the ribbon cable from its connector on the status panel.
7. Reverse these steps to install the status panel.

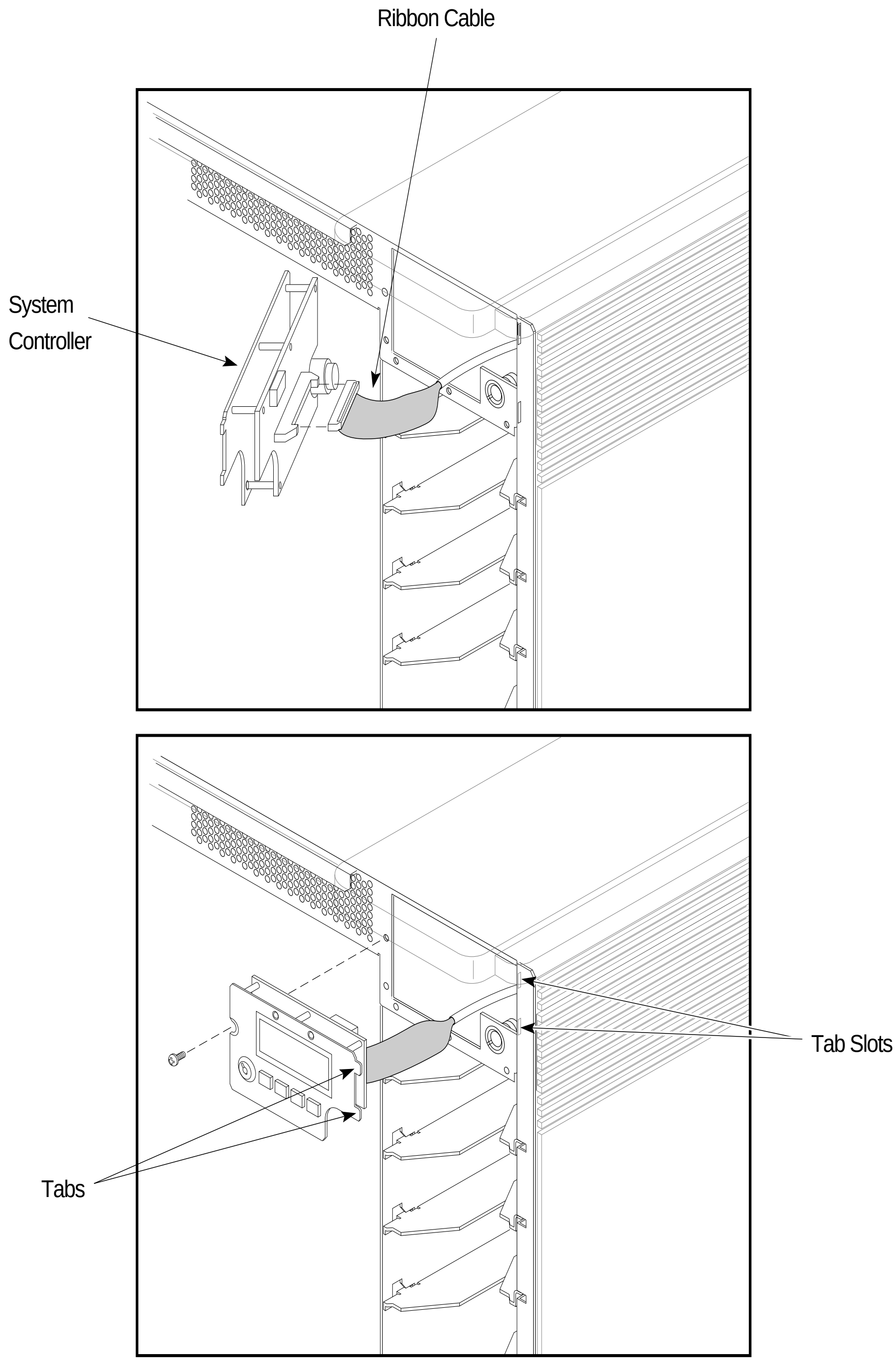


Figure 5-79 Replacing the Status Panel

5.17.2 Replacing the Backplane

To remove the backplane, see Figure 5-80 and follow these steps.

Note: The backplane part number for a server system is 030-0314-*xxx*. The backplane part number for a graphics system is 030-0310-*xxx*.

1. Power down the system, as described in Section 5.16.2.
2. Open the front door, as described in Section 5.16.3.
3. Open the I/O door, as described in Section 5.16.5.
4. Slide out all boards one-quarter of their length so that they are released from the backplane but still supported by the card guide shelves.
5. Remove the rear plastic panel and sheet-metal cover, as described in Section 5.16.7.
6. Remove the exhaust divider (P/N 040-0395-xxx) by removing three screws (see Figure 5-80). Two screws secure the middle of the divider to the backplane. The third screw can be found near the bottom of the chassis.
7. Lift the divider out of the chassis.
8. Remove the black plastic baffle by prying up the bottom with your fingers (see Figure 5-80). The bottom of the baffle mounts onto two metal pins near the top of the backplane. The baffle covers the status panel connector located near the top left-hand corner of the backplane.
9. Disconnect the cables that attach to the backplane:
   - 8-volt connector wires (four total)
   - 4-pin OLS controller cable
   - 2-pin SCSI power cable

     Note: Be sure to remove the black plastic baffle, as described in step 8.
   - 4-pin blower power cable
   - RS-232 control cable
10. Remove the 14 screws holding the backplane to the chassis and card guide shelves.
11. Remove the backplane by sliding it off the four positioning tabs on the card guide shelves and angling the backplane to clear the chassis.

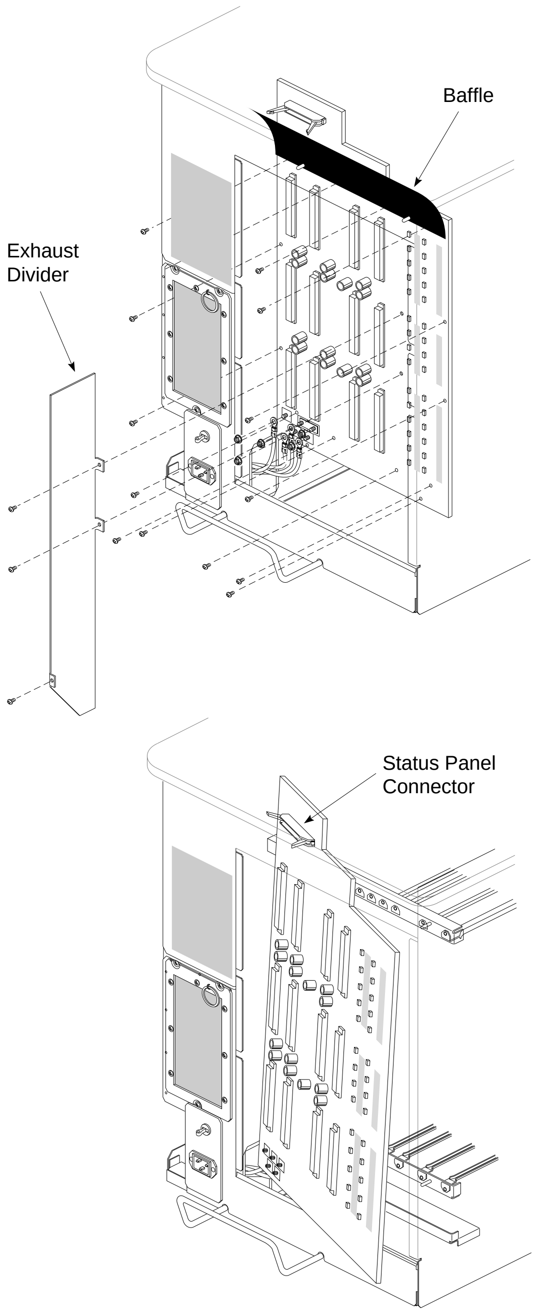


Figure 5-80 Removing the Backplane

5.17.3 Replacing the Offline Switcher (OLS) Power Supply

Use these procedures to replace the OLS (P / N 013-0513-xxx):

Note: The OLS is an autoranging power supply that works for both 110 and 220 VAC operation.

1. Power down the system, as described in Section 5.16.2.
2. Remove the rear plastic panel and sheet-metal cover, as described in Section 5.16.7.
3. Remove the three screws that hold the OLS to the chassis (see Figure 5-81).
4. Pull out the OLS using the ring (see Figure 5-81).

   Note: You may need to wiggle the OLS slightly from side to side before you can pull it away.

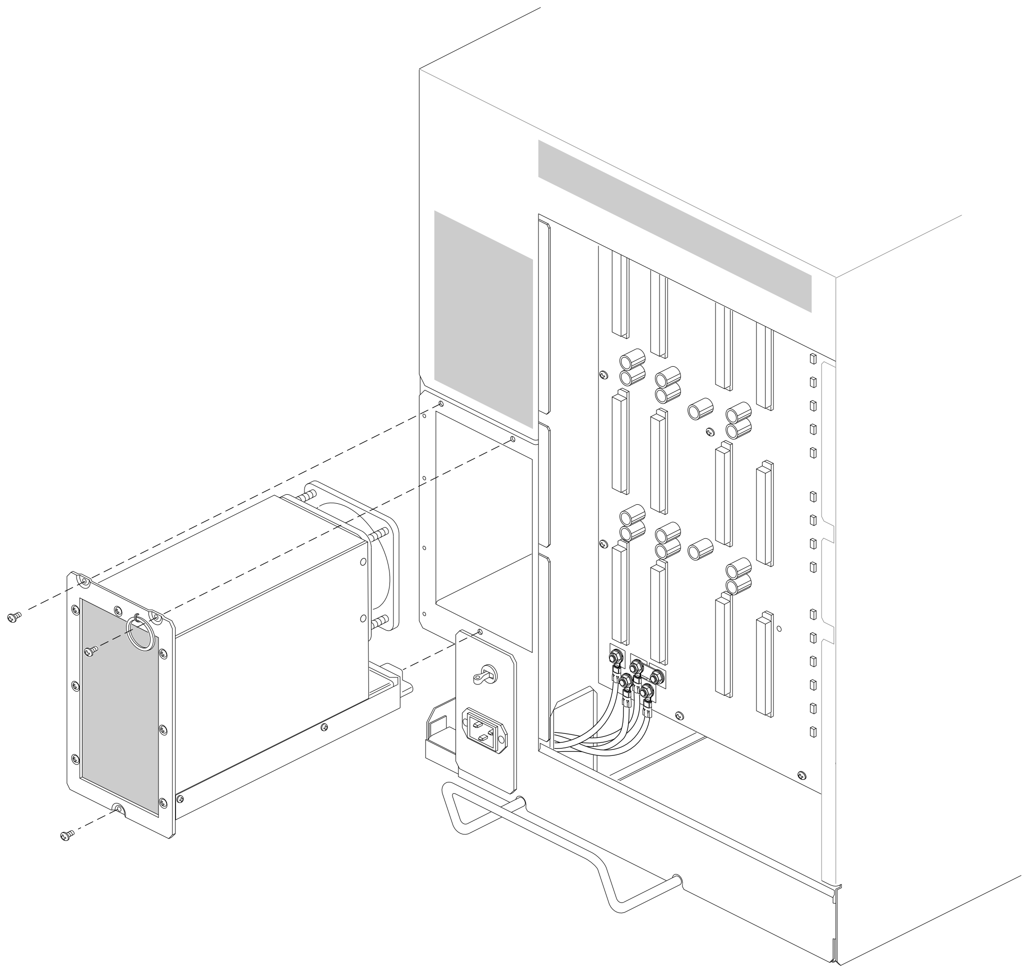


Figure 5-81 Replacing the Power Supply Assembly

5.17.4 Replacing the Power Connector Assembly

Note: The power connector assembly (P / N 013-0515-*xxx*) is used for both 110 and 220 VAC.

Use these procedures to replace the power connector assembly:

1. Power down the system, as described in Section 5.16.2, and remove the power cord.
2. Remove the back plastic panel and sheet-metal cover, as described in Section 5.16.7.
3. Disconnect the AC hot, neutral, and earth ground wires from the power supply.
4. Remove the four screws that hold the power connector assembly to the chassis.
5. Remove the ground wire from the power to the chassis.
6. Remove the power connector assembly from the chassis (see Figure 5-82).
7. Reverse these steps to install a new power connector assembly.

   Caution: Do not force fit the new power connector assembly. If it does not easily fit, readjust the toroid placement.

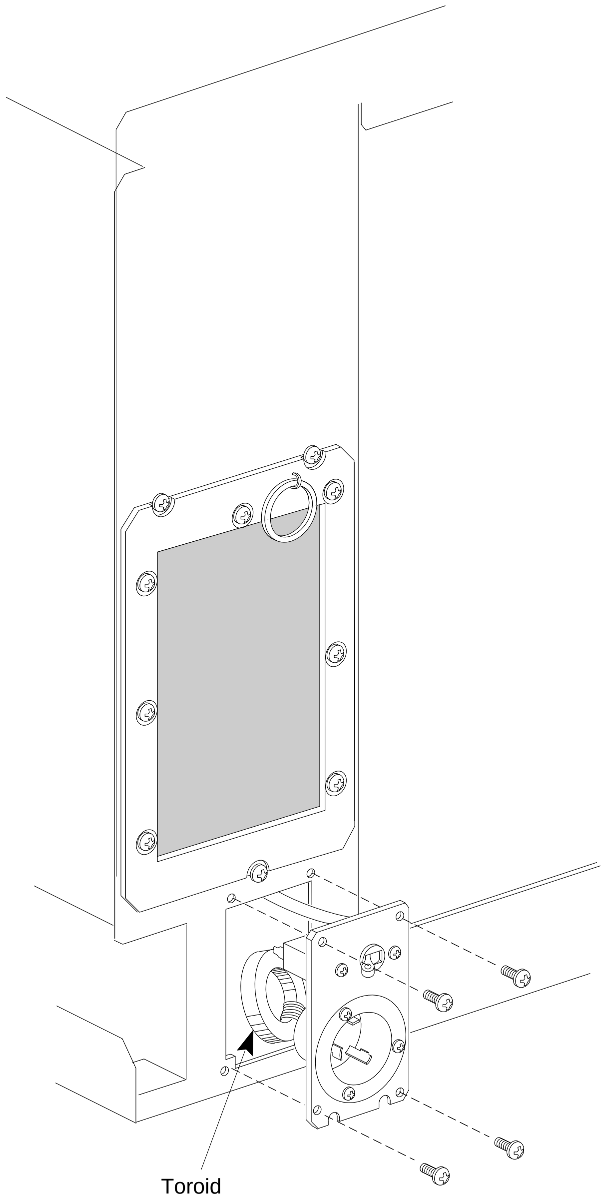


Figure 5-82 Replacing the Power Connector Assembly

5.17.5 Replacing a System Board

The Everest bus (Ebus) boards (IP19, MC3, and IO4) use 560-pin Futurebus+ Metral connectors that require some force to engage the pins and sockets. Use care when installing these boards because the connector pins can bend.

Caution: Before installing a new board, check for ribbon cables to the immediate left of the slot receiving the new board. Disconnect or secure these cables before inserting the new board; otherwise, the cables of the adjacent board may be chafed and damaged by the pins of the new board.

The components are extremely sensitive to electrostatic discharge. Use proper antistatic procedures when handling all components.

1. Power down the system, as described in Section 5.16.2.
2. Open the front door, as described in Section 5.16.3.
3. Open the I/O door, as described in Section 5.16.5.
4. Inspect the chassis connector pins and straighten any bent pins (if possible).
5. Remove the two board braces (013-0578-xxx) that secure the top and bottom of the system boards by loosening the Phillips screws and moving the slide bar to the right. You can then pull out the braces (see Figure 5-83).

   Note: If present, take out the bottom disk drive before removing the bottom brace.

6. Place the new board in the card guides and slide the board halfway into the chassis (see Figure 5-84). The two rails running along the top and bottom of the chassis act as guides and secure the boards within the chassis.
7. Pull the upper and lower ejector tabs toward you until they line up lengthwise with the horizontal edges of the board.
8. Slide the board completely into the slot while angling the ejectors of the board so that the U-shaped grooves of the ejectors fit into the metal frames of the chassis.
9. Apply equal pressure on the upper and lower ejector tabs toward the center of the board's lower edge until both lips are vertical.
10. You should hear and feel the board snap into the board ejectors and backplane connectors. The board is now seated in the backplane.

5.17.6 Replacing an Option Board

This section provides basic instructions for replacing an option board but does not cover special requirements. To install a special option board, please refer to the installation instructions provided with the board.

Caution: Before installing a new board, check for ribbon cables to the immediate left of the slot receiving the new board. Disconnect or secure these cables before inserting the new board; otherwise, the cables of the adjacent board may be chafed and damaged by the pins of the new board and observer proper ESD practices.

The backplane adheres to a new practice that allows a VME option board to be installed without opening the rear of the chassis. When installing VME boards, use the left slot first and continue installing boards to the right without skipping any slots. This sequence is required because the backplane loops the signals from slot 5 to slots 1 through 4, and any open slot interrupts the signal flow to subsequent slots.

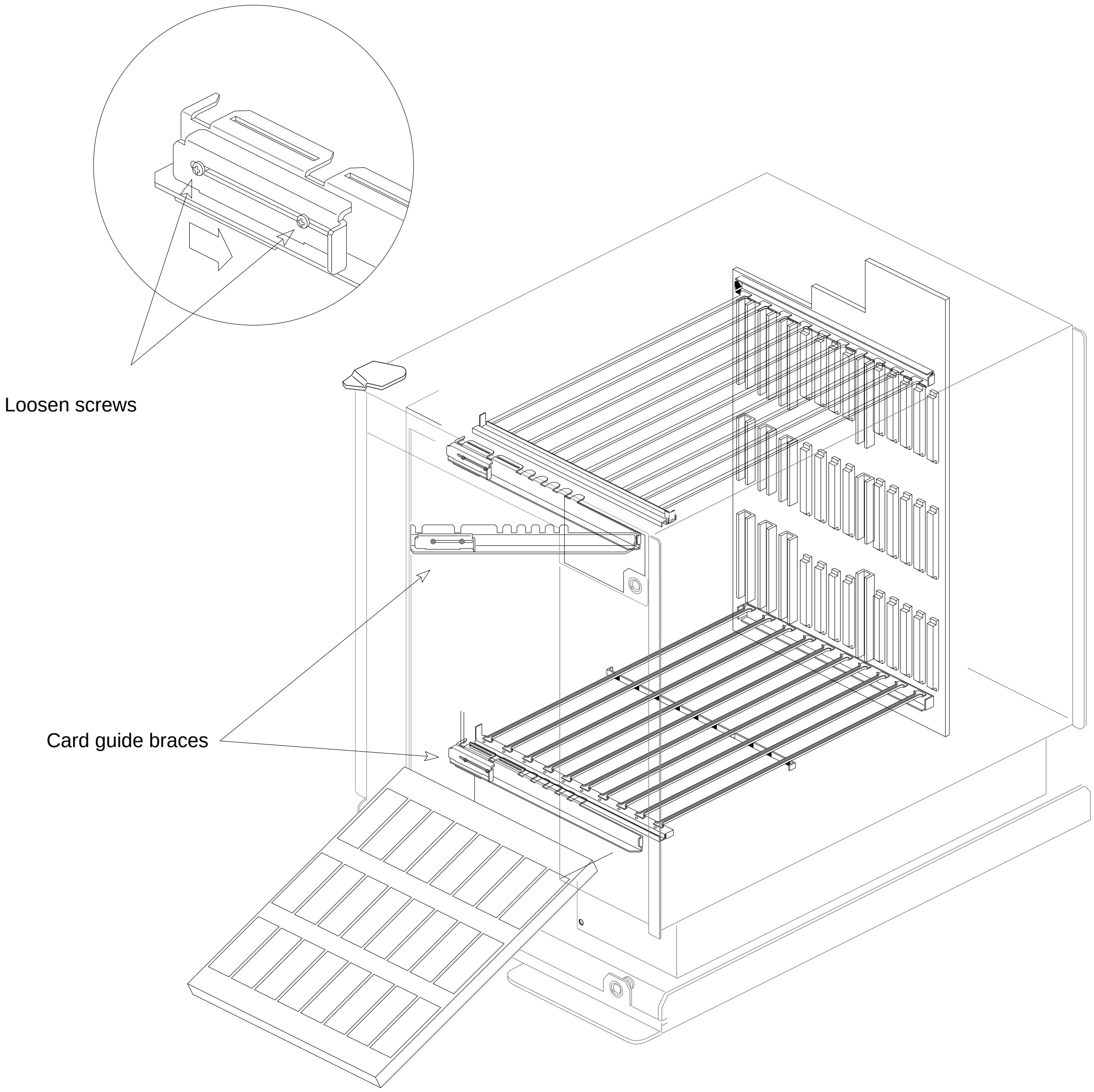


Figure 5-83 Removing the Board Brace

Follow these instructions to replace an option board:

1. Power down the system, as described in Section 5.16.2.
2. Open the front door, as described in Section 5.16.3.
3. Open the I/O door, as described in Section 5.16.5.

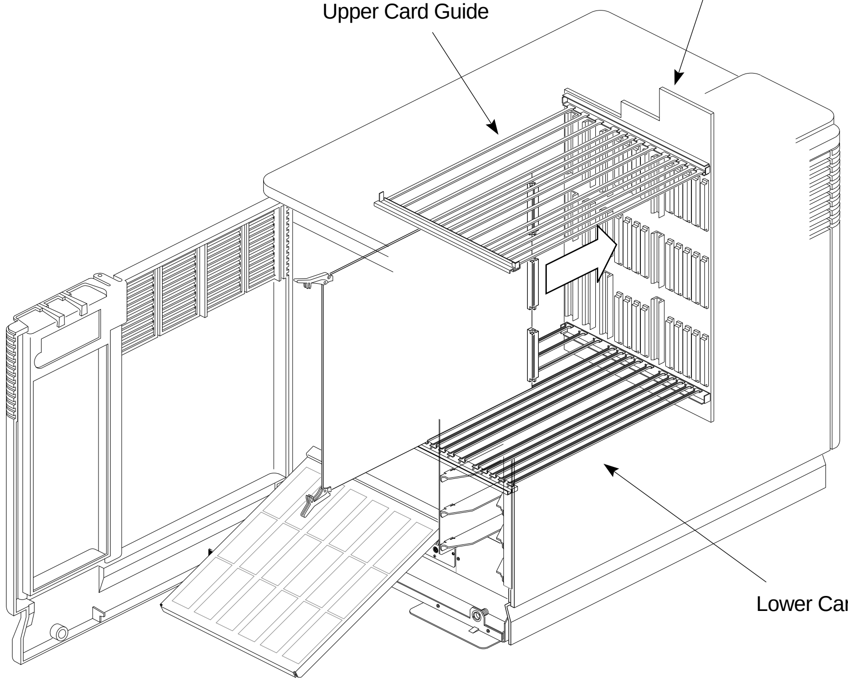


Figure 5-84 Installing / Removing a Board

4. Remove the two board
5. braces (013-0578-xxx) that secure the top and bottom of the system boards by loosening the Phillips screw and moving the slide bar to the right. You can then pull out the braces (see Figure 5-83).

   Note: If present, take out the bottom disk drive before removing the bottom brace.

6. Grasp the option board by the two upper and lower ejector tabs (see Figure 5-84).
7. Place the new board in the card guides and slide the board halfway into the chassis. The two rails running along the top and bottom of the chassis act as guides and secure the boards within the chassis.
8. Pull the upper and lower ejector tabs toward you until they line up lengthwise with the horizontal edges of the board.
9. Slide the board completely into the slot while angling the plastic ejectors of the board so that the U-shaped grooves of the ejectors fit into the upper and lower metal frames of the chassis.
10. Push the upper and lower ejector tabs outward.
11. You should hear and feel the board snap into the board ejectors and backplane connectors. The board is now seated in the backplane.
12. Resecure the board lock bars across the top and bottom of the boards in the card cage.

5.17.7 Skipping a VME Slot

Skipping a slot is occasionally required to fit oversized VME boards or improve air flow. A slot can be skipped if jumper blocks are placed on the appropriate VME jumper block pins located on the rear of the backplane (see Figure 5-85).

Note: If you install the VME boards in order (from left to right), then no jumpering is required.

The general guideline is to insert jumpers into the jumper banks corresponding to the VME slot number that you are skipping. For example, if you are skipping the first VME slot, you need to insert jumpers into jumper bank 1. See the following additional examples:

- If you are skipping the first VME slot (that is, slot 5 in an Onyx or slot 7 in a CHALLENGE system) to use the next VME slot, you must place five jumpers in the jumper bank, designated as slot 1 (see Figure 5-85).
- If you are skipping the first two VME slot and wish to use the third VME slot, you must place jumpers in jumper banks 1 and 2.
- If you wish to skip over VME slots, for example, from the first VME slot over to the third VME slot, you must place jumpers in bank 2.

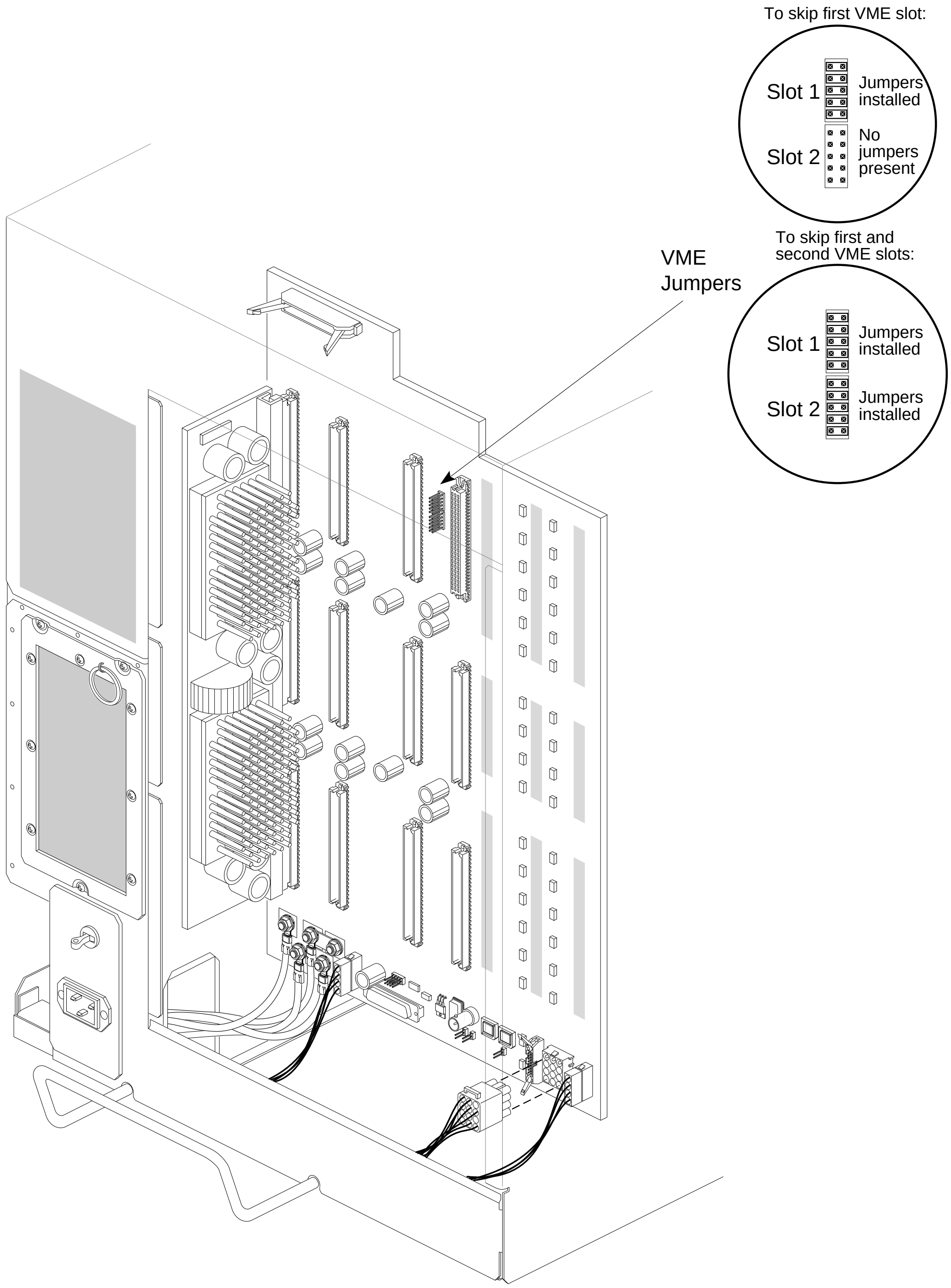


Figure 5-85 VME Slot Jumper Locations

5.17.8 Replacing a Mezzanine Board

The optional SCSI and FDDI mezzanine boards attach to the IO4 baseboard through four standoffs. An IO4 board can house up to two mezzanine boards. Follow these procedures to install or remove a mezzanine board:

1. Orient the board so that the I/O channels face the same direction as the IO4 baseboard channels, then line the holes on each corner of the mezzanine board with the applicable standoffs (see Figure 5-86).
2. Press down on the mezzanine board so that the connector underneath engages the connector on the IO4 board.
3. Secure the mezzanine board to the IO4 baseboard using the truss-head screws.

Note: The mezzanine board may appear to fit very loosely on the IO4 baseboard. This is normal. The mezzanine boards are designed to *float* on the standoffs.

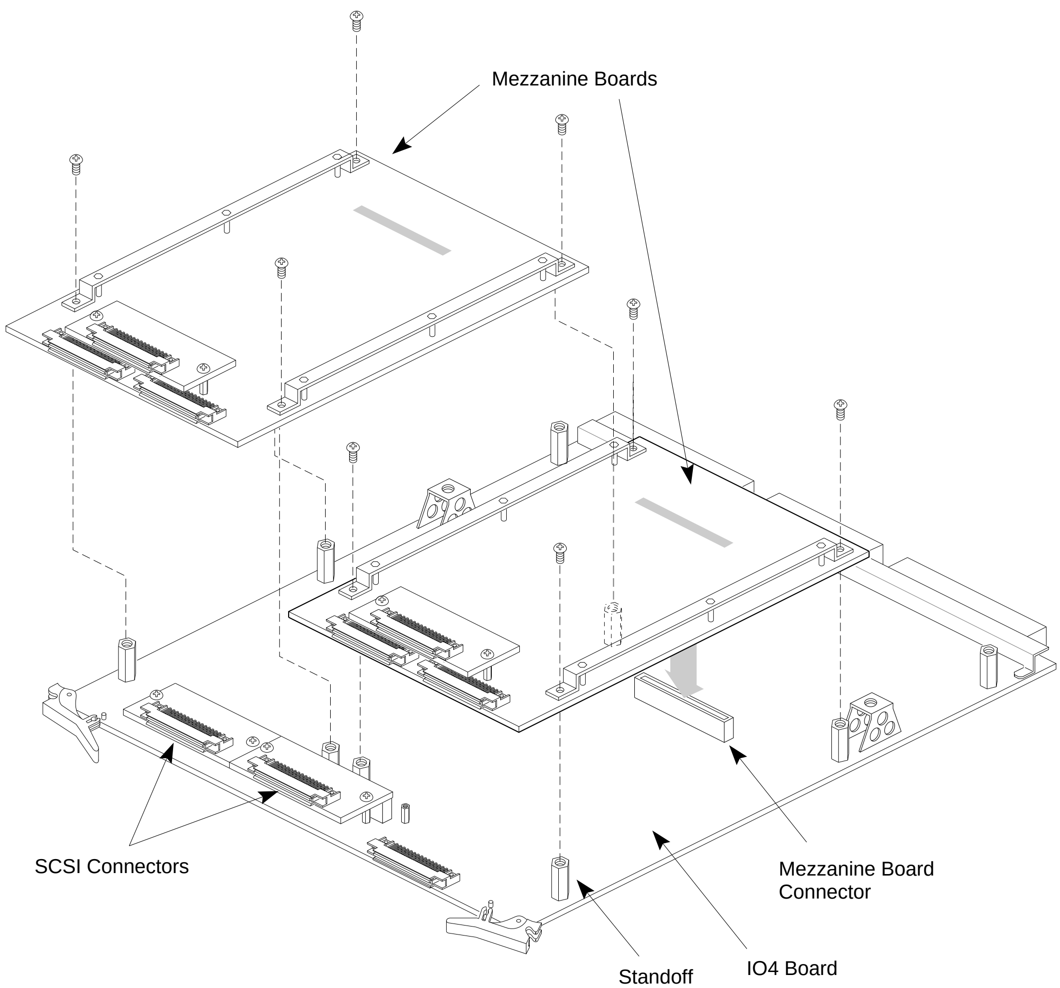


Figure 5-86 Installing a Mezzanine Board

5.17.9 Installing the VCAM Board

The VCAM (VME channel adapter module) board mounts on the rear of the IO4 baseboard and comes standard with every CHALLENGE or Onyx system. Follow these instructions to install or remove a VCAM board:

1. Orient the VCAM board so that the backplane connectors face the rear.
2. Line up the four holes on the board with the two standoffs and mounting braces (see Figure 5-87).
3. Push down evenly on the board so that the two connectors on the bottom of the VCAM board engage the two connectors on the IO4 baseboard.
4. Secure the VCAM board using four Phillips screws and washers.

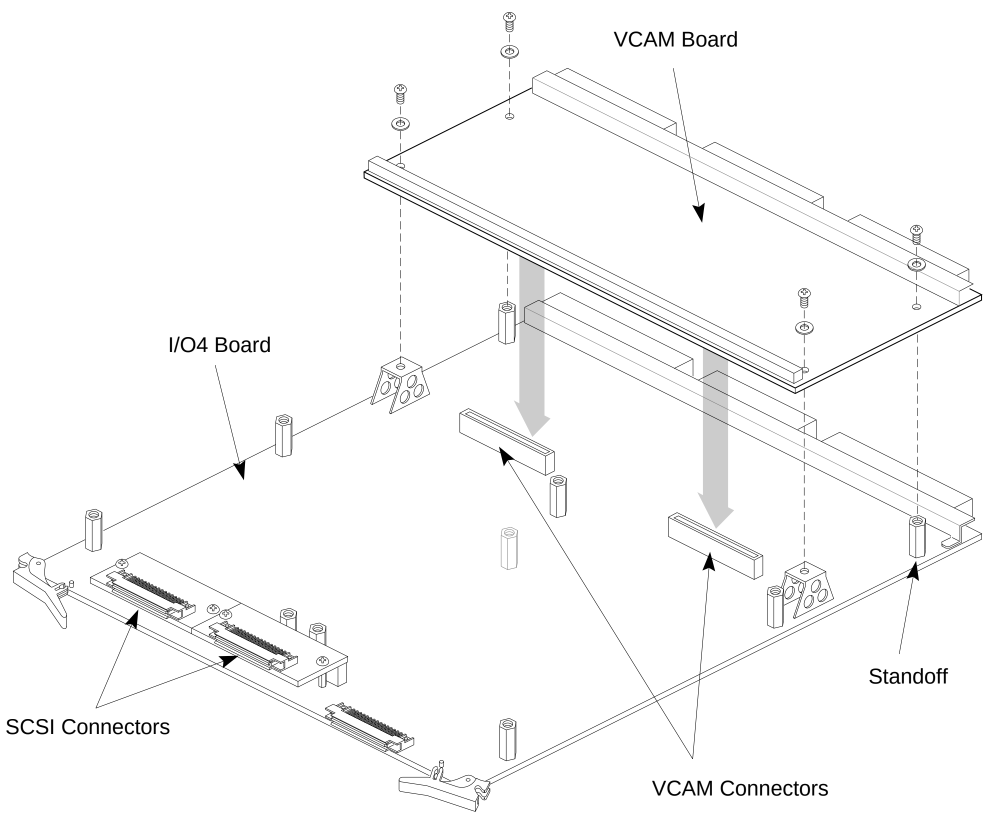


Figure 5-87 Installing a VCAM Board

5.17.10 Replacing a Power Board

The power boards install directly onto the backplane. To remove or replace a power board, see Figure 5-88 and follow these steps:

1. Power down the system, as described in Section 5.16.2.
2. Remove the rear plastic panel and sheet-metal cover, as described in Section 5.16.7.

3. Grasp the applicable power board, then use two hands to pull the board straight out.

   Note: For power board locations, see Chapter 2, "Chassis Tour."

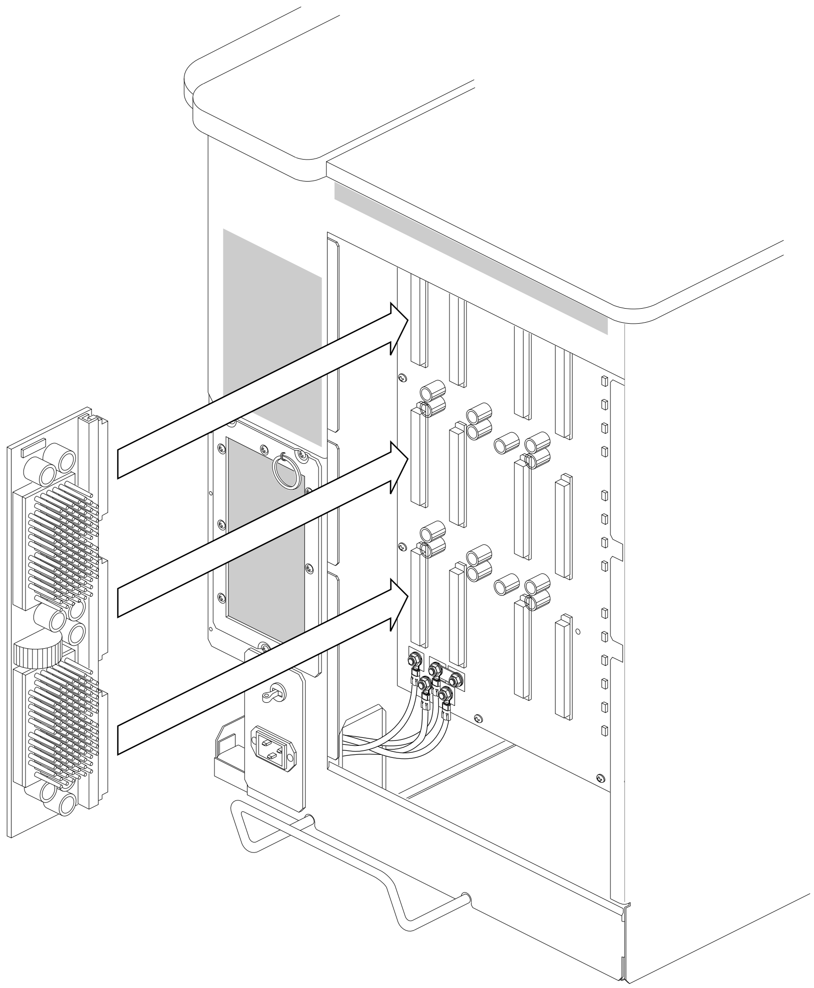


Figure 5-88 Installing a Power Board

5.17.11 Upgrading the PROM on the System Controller Board

This section describes how to upgrade the PROM in the System Controller board in the CHALLENGE / Onyx system, if applicble. The System Controller board (also called the E-power board) is one of the power boards that plugs into the backplane (see Figure 5-89). This board contains the control logic for the status panel display and also supplies power for the Ebus.

This firmware upgrade corrects the following sporadic failures:

- blower failure problems
- serial communication problems associated with the UART

- deskside chassis (CHALLENGE / Onyx L) start-up display errors

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.

5.17.11.1 Removing the System Controller Board

To remove the System Controller board, follow these instructions.

Caution: Observe proper electrostatic discharge precautions when handling components: use an antistatic surface and wear a ground strap.

1. Ensure that the system is backed up; then power down the system.
2. See Section 5.17.10, “Replacing a Power Board,” to access the System Controller board.
3. Remove the System Controller board from its slot on the backplane.
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, preventing possible IC pin breakage when you install the PROM.

5.17.11.2 Installing the New PROM

See Figure 5-89 for the location of the PROM on the System Controller board.

Follow these instructions to install the new firmware:

Caution: Observe proper electrostatic discharge precautions when handling components: use an antistatic surface and wear a ground strap.

1. Locate the old PROM (see Figure 5-89), then use an IC puller to remove this PROM from its location.
2. Note the orientation of pin 1 in Figure 5-89, then install the new PROM (P / N 070-1117-005) and be careful not to bend or break any pins.
3. Attach the deviation authorization label to the System Controller PCB (DA# 798).
4. Install the updated System Controller board in its power board location.

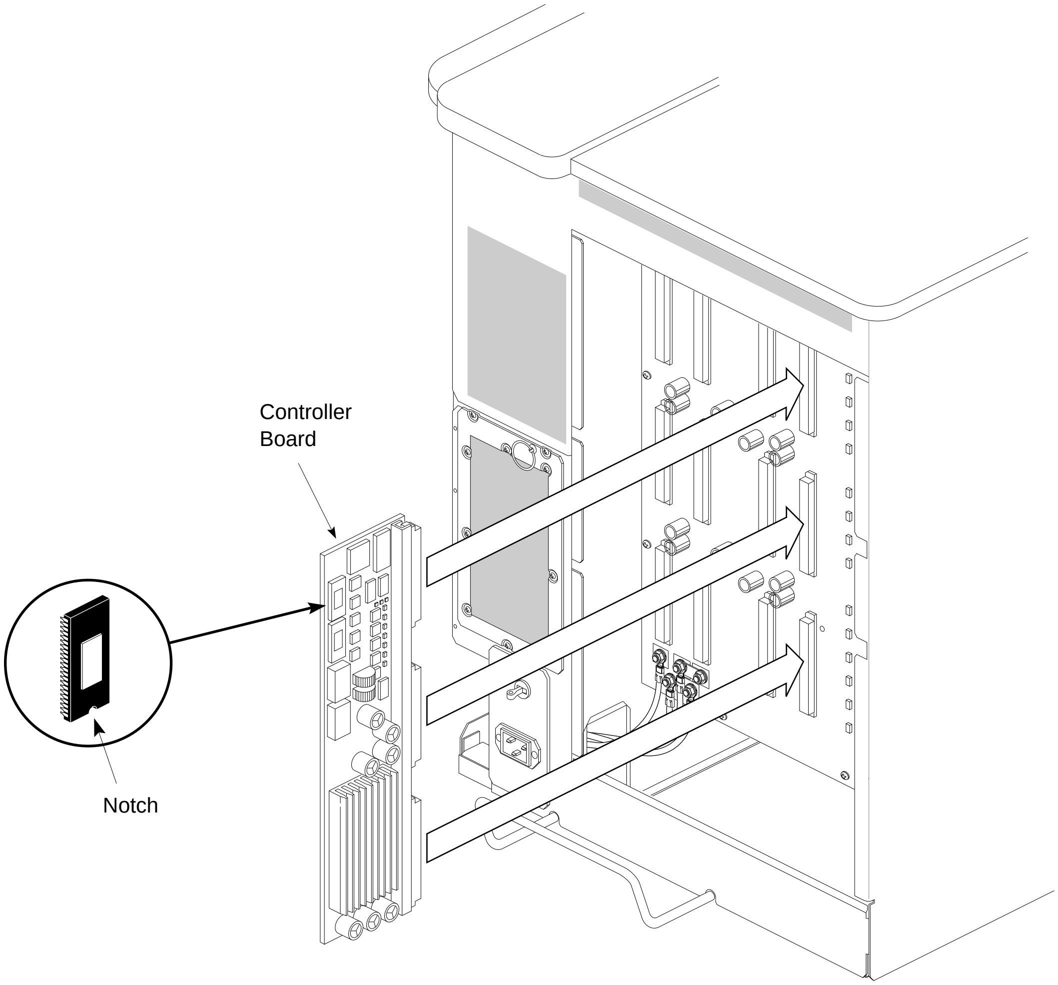


Figure 5-89 System Controller PROM Location (Onyx Deskside Backplane Shown)

5.17.12Replacing a Drive in the CHALLENGE/Onyx Deskside Chassis

The CHALLENGE / Onyx deskside system provides seven half-height drive bays or up to three full-height bays. See the *Peripherals Reference Guide* (Document Number 108-7027-*xxx*) for important information concerning system limits and drive configuration before continuing with this section.

Caution: Disk drives can be damaged if they are removed while spinning. Wait until the system is powered down and the drive has halted before removing it from the system.

5.17.12.1 Installing a Drive on a Drive Sled

The CHALLENGE / Onyx deskside system does not use the previous front-loading drive mounts of earlier Silicon Graphic systems, such as the Single Tower or Crimson. The drives now sit on a drive sled that mounts on a drive shelf in the chassis (see Figure 5-90).

To install a SCSI drive on a drive sled

1. If the drive did not come already mounted to a sled, place it on top, as shown in Figure 5-90. Be sure the EMI shelf is affixed to the bottom of the drive and aligned, as shown in the drawing.
2. Secure the drive to the bottom of the sled with the four screws provided.
3. Plug the drive adapter cable into the proper channel connector.
4. Orient the drive and sled assembly so that the connectors on the back face away from you.

   Note: The differential IBM drives may also need to be oriented so that the connectors are on the bottom half of the drive.

5. Carefully insert the device into the drive until it seats firmly into the lever catch and the locking lever has moved all the way to the right.

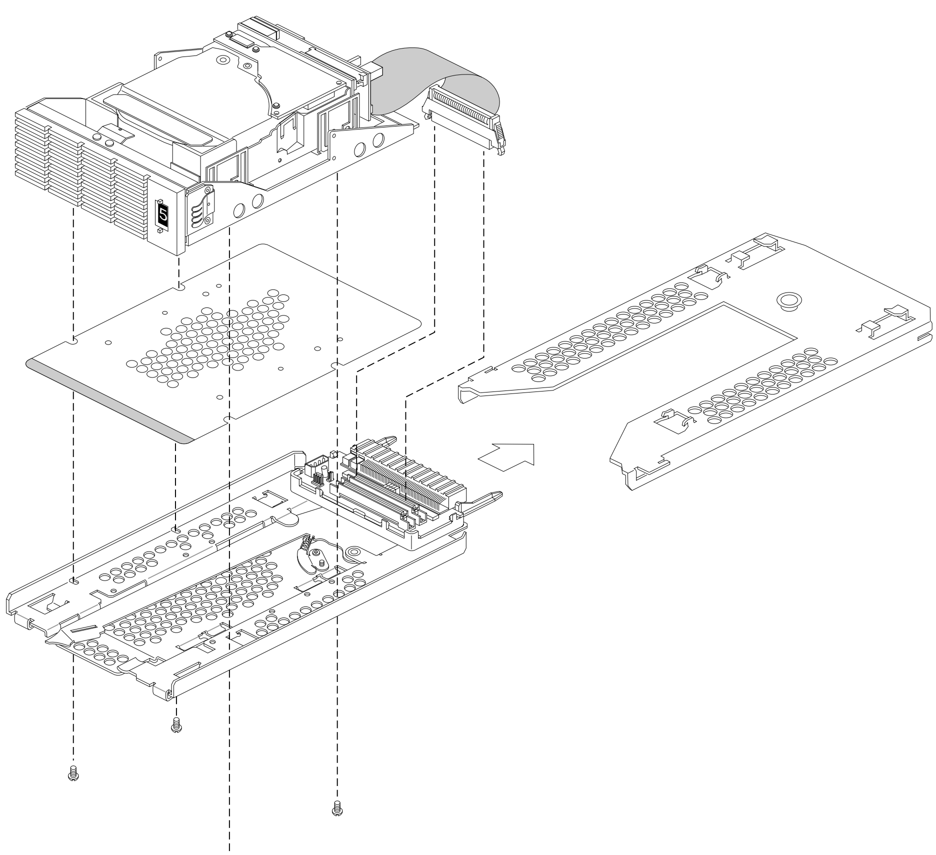


Figure 5-90 Installing a Drive on a Drive Sled

5.17.12.2 Converting Old-style Front-loading Drives

If you need to convert an existing old-style front-loading drive, see Figure 5-91 and follow these steps:

1. Place the drive to be converted on top of an antistatic surface.
2. Remove the side bracket on each side of the drive by removing four screws (total); see Figure 5-91.
3. Remove the old data connector and power connector to the drive and remove the metal bracket assembly in back of the drive.
4. Place the EMI shield on top of the drive sled assembly. Ensure that the cutouts align with the four mounting holes on the drive sled.
5. Place the drive on top of the EMI shield and drive assembly.
6. Secure the drive by attaching four screws underneath the drive sled.
7. Plug the data connector into the A or B channel on the drive sled.
8. Plug the power cable into the power connector on the drive sled (see Figure 5-91).

5.17.12.3 Installing a Drive into an CHALLENGE/Onyx Deskside Chassis

Ensure that the drive is mounted on a drive sled. See Section 5.17.12.1, “Installing a Drive on a Drive Sled,” for more information.

To install a SCSI drive

1. Install the drive module into the drive tray and slide the module all the way into place, then push the drive lever down. The drive module should click into place, flush with the slot, and should not come out when you pull it.
2. Slide the drive lever to the right so that the hook engages the mounting stem.

5.17.12.4 Removing a Drive from the Chassis

To remove a SCSI drive

1. Power down the system, as described in Section 5.16.2.
2. Open the front door, as described in Section 5.16.3.
3. Push the drive lever to the left. This disengages the hook from its mount.
4. Carefully slide the device and drive sled out of the slot.

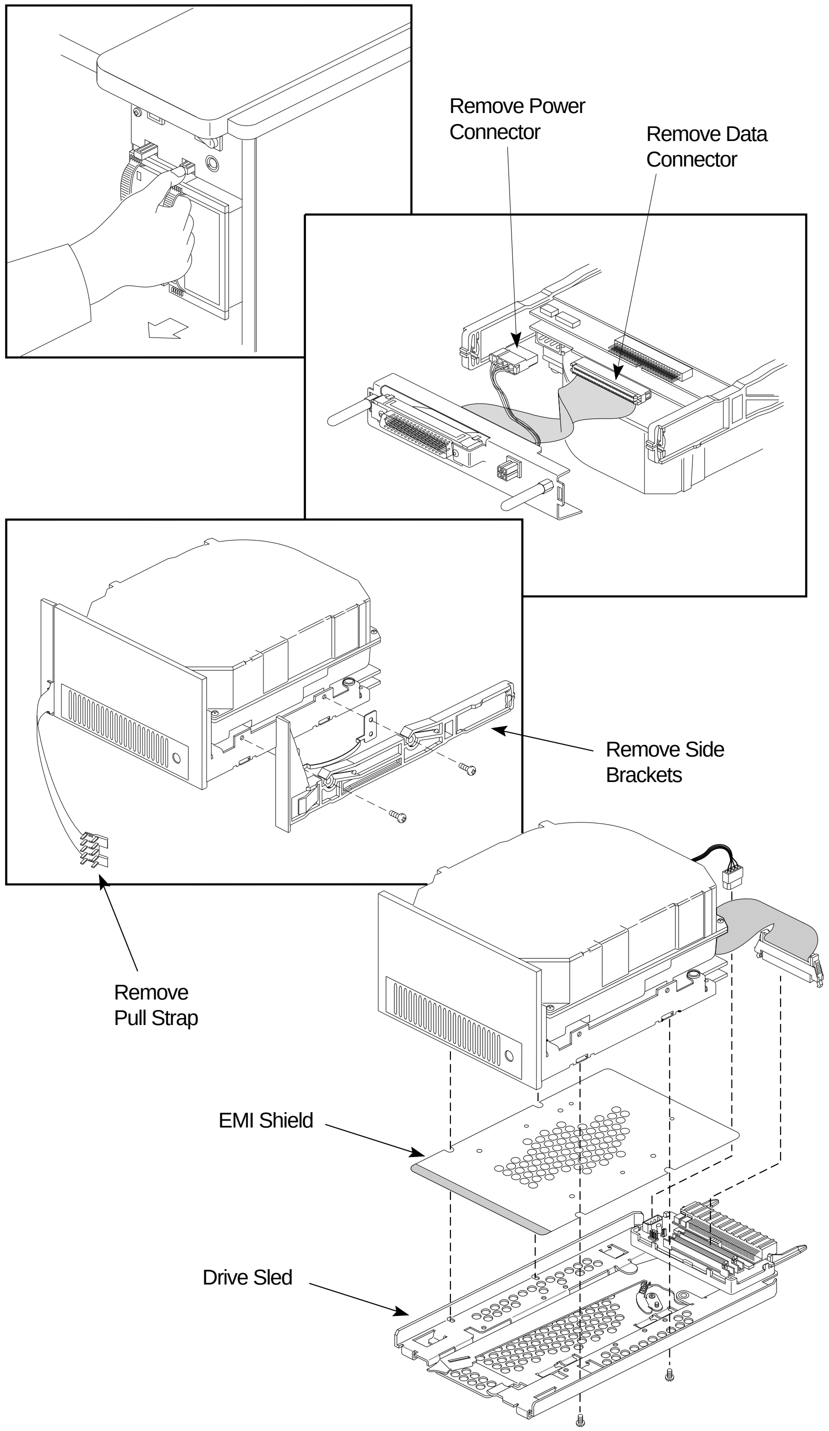


Figure 5-91 Modifying an Old Front-loading Drive

5.17.13Removing or Replacing the Drive Shelf

To convert a half-height slot to a full-height slot or vice versa, you must either remove or add a drive shelf.

To remove a drive shelf,

1. Power down the system, as described in Section 5.16.2.
2. Open the chassis front door, as described in Section 5.16.3.
3. Remove the appropriate drives, as described in Section 5.17.12.
4. Remove the right-side panel (the panel closest to the drives), as described in Section 5.16.8.
5. On the exposed sheet-metal, remove the screw holding the appropriate drive shelf in place. See Figure 5-92.
6. Grasp the back of the shelf firmly, then pull the drive shelf straight out.

   Note: Owing to a friction-fit, you may have some difficulty in pulling the drive shelf out.

7. Pull the drive shelf forward until the right side drops down in its chassis slots.

To install a drive shelf,

1. Position the drive shelf with the mounting knob up.
2. Align the cut-in grooves in the back of the shelf, with the rear tabs on each side of the drive walls. Position the grooves in the front of the shelf to mesh with cut-ins in the front of each side of the drive walls.
3. Push the drive shelf firmly into the chassis.
4. Secure the drive shelf with a screw to the right side of the chassis.
5. Reverse the steps 1 through 4 in the removal procedure to complete the installation.

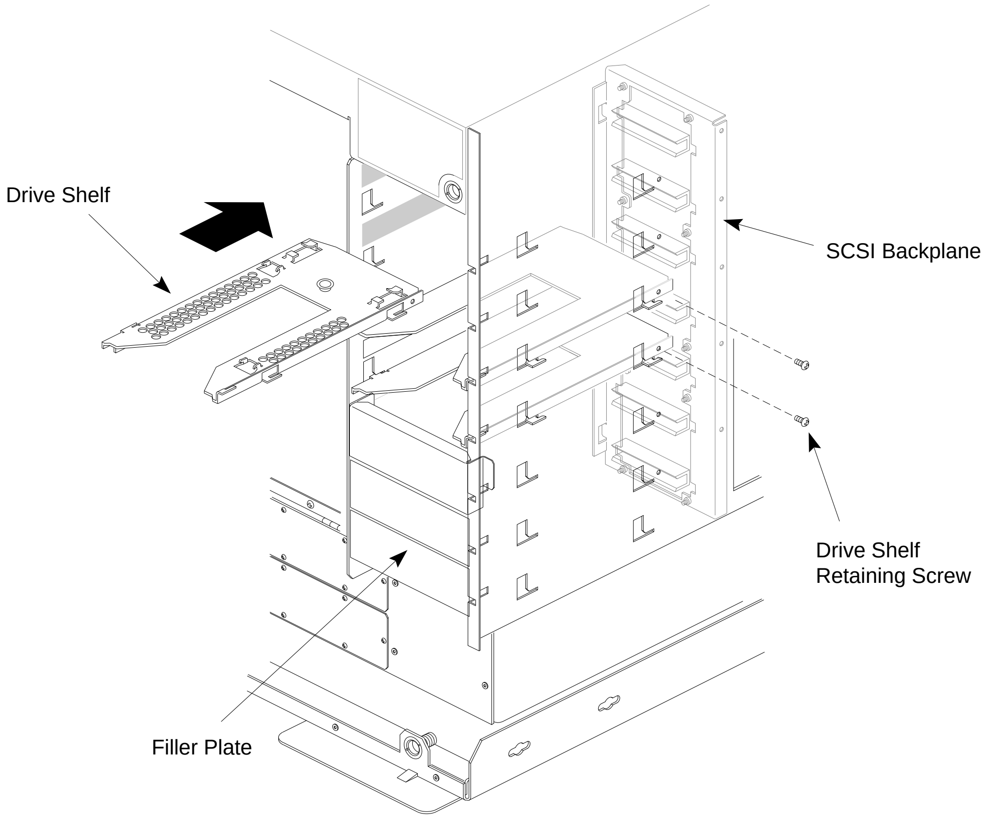


Figure 5-92 Replacing a Drive Shelf

5.17.14 Replacing the Drive Bulkhead Assembly

Use these procedures to replace the drive bulkhead assembly (P / N 013-0510-*xxx*):

1. Power down the system, as described in Section 5.16.2.
2. Remove the front-loading drives, as described in Section 5.17.12.
3. Remove the rear panel, as described in Section 5.16.7.
4. Remove the three screws that secure the OLS, as described in Section 5.17.3.
5. Pull the OLS out a few inches or so from the chassis so that you can remove the power connector to the SCSI backplane.
6. Next, remove the side panel (see Section 5.16.8).
7. Remove the access cover plate over the bulkhead assembly by removing four screws from the sheet-metal housing on the right side of the chassis (see Figure 5-92). Lift the cover from the bottom and away from the chassis.

Caution: With the cover off, you can now see the bulkhead assembly. Before you start pulling out cables, note the SCSI cable connectors A and B on the bottom of the SCSI backplane (see Figure 5-92). Be sure to label these cables (SCSI A and SCSI B) to ease reinstallation.

8. With the exposed bulkhead assembly, remove the SCSI A and B cables from their connectors on the bottom of the SCSI backplane. Be sure to label the SCSI cables to prevent miscabling during reinstallation
9. Remove the OLS power cable and the fan power cable from the back of the SCSI backplane (see Figure 5-92).
10. Remove the five screws that attach the drive bulkhead assembly to the center of the sheet-metal housing (see Figure 5-94).
11. Push the drive bulkhead assembly from the front of the SCSI backplane to the rear, then lift out the bulkhead from the chassis.

To install the drive bulkhead assembly,

Note: Note the three tabs on the left side of the bulkhead assembly (see Figure 5-95). Be sure these tabs align with the slits located on the center wall of the chassis.

1. Insert the drive bulkhead assembly with the alignment tabs going into the chassis first.
2. Reverse steps 1 through 11 of the removal procedure to install the drive bulkhead.

   Note: When reinserting the side cover, install the top of the cover first into the outside sheet-metal housing. The top of the cover should mesh with the lip of the housing (see Figure 5-92).

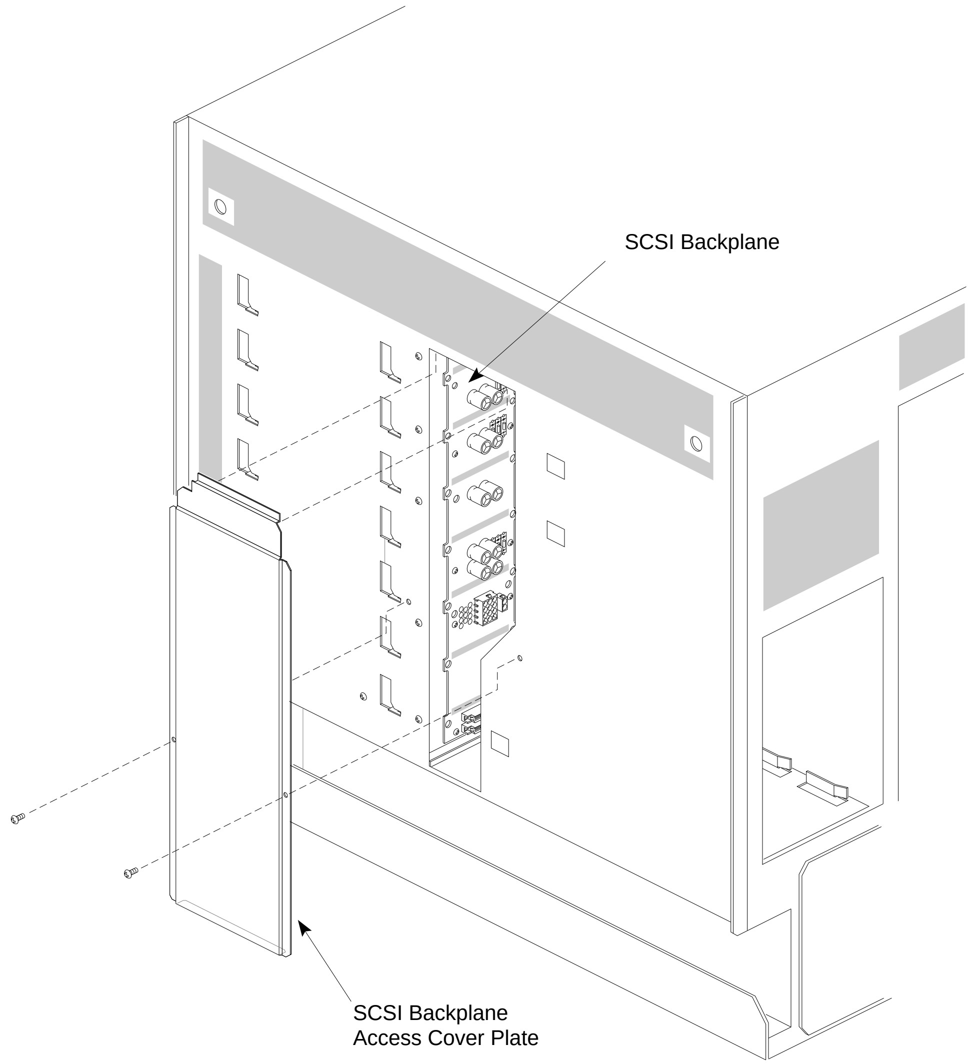


Figure 5-93 Removing the SCSI Backplane Access Cover Plate

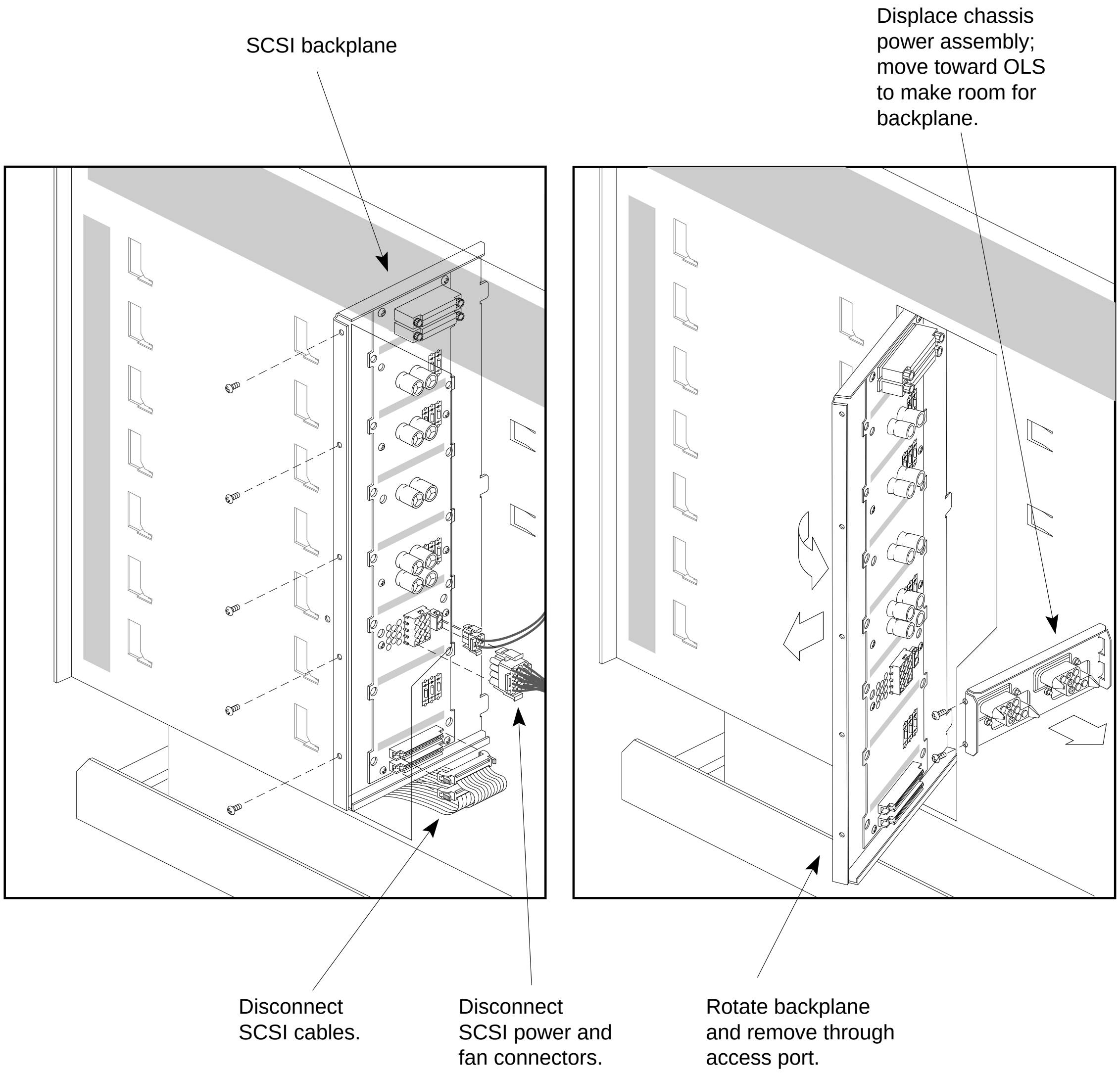


Figure 5-94 Removing the Bulkhead Assembly

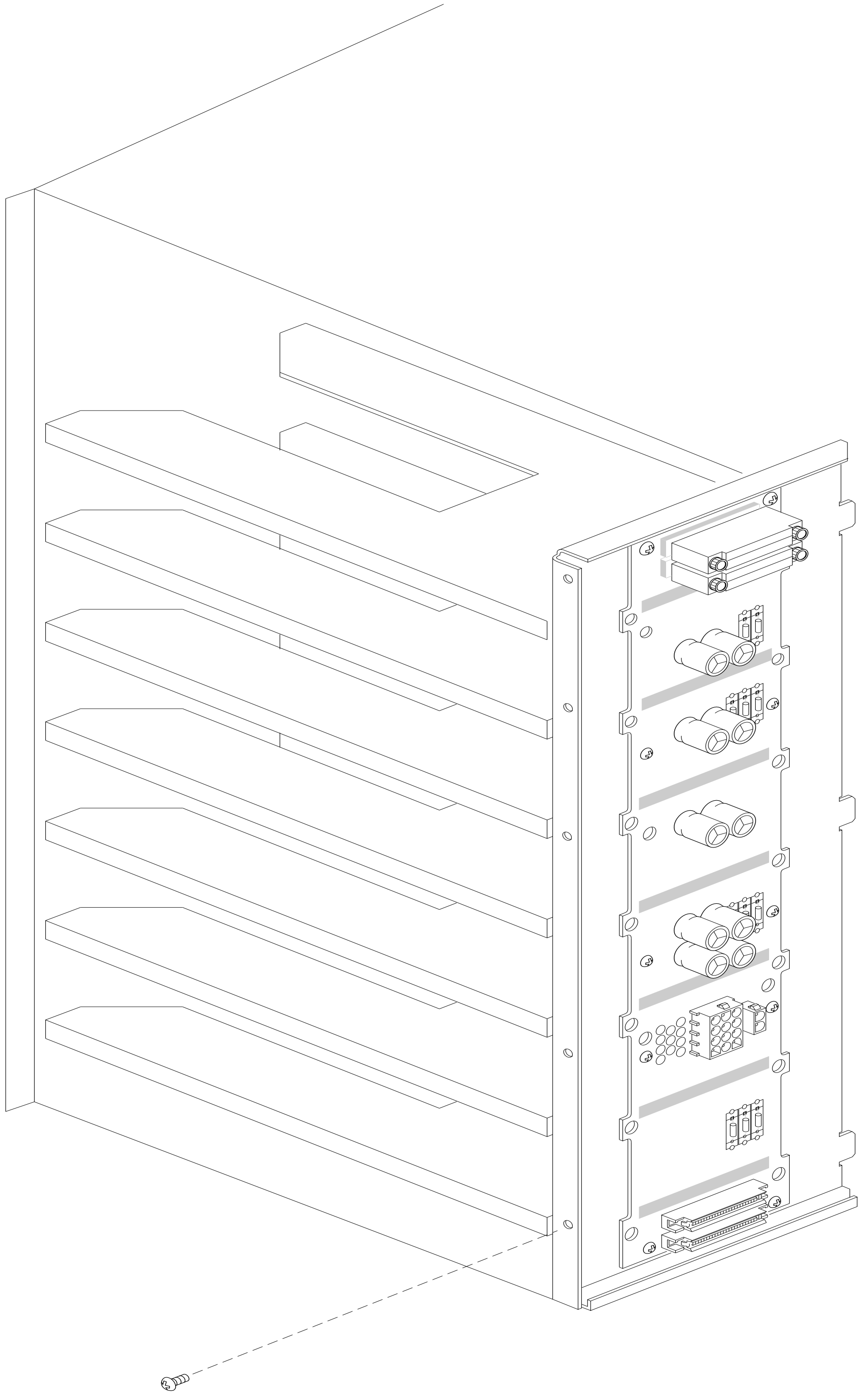


Figure 5-95 Replacing the Drive Bulkhead

5.17.15Replacing the Blower Module

To remove the blower module (P / N 013-0500-*xxx*),

1. Power down the system, as described in Section 5.16.2.
2. Remove the left side panel (the side opposite the drives). See Section 5.16.8.
3. Maker sure that the fans have stopped spinning then remove the three screws that secure the blower module to the sheet-metal housing (see Figure 5-96).
4. Grasp the module and gently pull it out of the chassis.

To install the blower module, reverse steps 1 through 4.

Note: Push the fan module all the way into the housing to ensure proper connection.

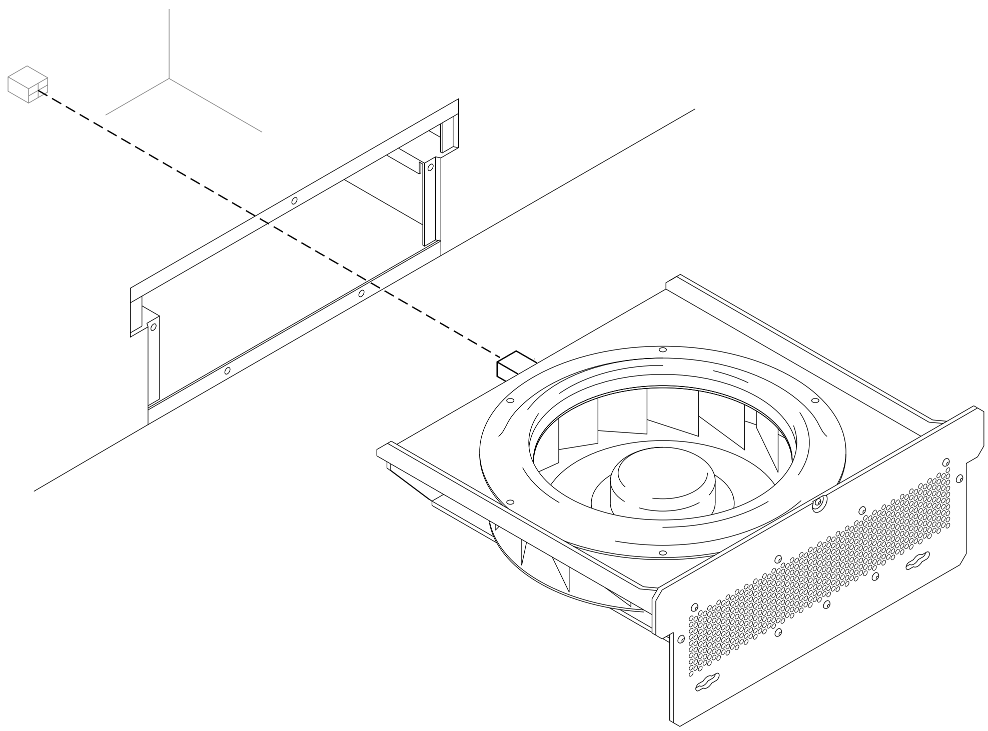


Figure 5-96 Replacing the Fan Module

Appendix A

System Specifications

This appendix lists the specifications for the CHALLENGE/Onyx deskside system (see Table A-1).

Parameter	Specifications
Dimensions (height x width x depth)	26” x 21” x 29“ (66 cm x 54 cm x 74 cm)
Weight	
Minimum	195 lbs (88.45 Kg)
Maximum	300 lbs (112 Kg)
Electrical requirements	
Input voltage	104 V to 132 V, or 200 V to 240 V (both single phase)
Input power	1400 W RMS (max.), 2112 VA (max)
Frequency range	50/60 Hz
Current	115 VAC at 16 amps or 220 VAC at 13 amps
Power consumption	1900 W DC continuous
Connector	IEC320-C20 for 110 and 220 VAC operation
Safety	
UL	Listed under UL 478—Data Processing Equipment, Electronic
Canadian Standards Association (CSA)	Certified under CSA 220-M1986—Information Processing and Business Equipment
TUV	Licensed under CENELEC European Norm EN 60 950/09.87
EMI	FCC Class A, VDE Level A, DOC Class A, VCCI Class 1, CISPR-22, Class 1

Table A-1 CHALLENGE/Onyx Deskside System Specifications

Parameter	Specifications
Environmental	
Operating	5 to 35 degrees C at sea level
Nonoperating	-20 to +60 degrees C at sea level
Heat dissipation	
Chassis	8160 BTU / hour max.
Monitor	512 BTU / hour
Relative humidity	10 to 80%, noncondensing (operating) 10 to 95%, noncondensing (nonoperating)
Noise (acoustics)	57 dBA
Processor	
CPU / FPU	MIPS R4400A (75 MHz external, 150 MHz internal)
Number of CPU boards	1 to 3 (server system) 1 (graphics system) Note: Each CPU board may have two or four R4400A processors
Number of R4400A processors	2 to 12 (server system) 2 to 4 (graphics system)
CPU memory size	64 MB to 2 GB, up to 4 way interleaved, ECC protected
Memory interleave factor	1, 2, or 4 way (server system) 1 or 2 way (graphics system)
Mass storage	
Interfaces	Up to 24 SCSI II channels (server system) Up to 8 SCSI II channels (graphics system) Note: There are eight channels per IO4 board. The server system may have up to three IO4 boards; the graphics system has one IO4 board.
Bandwidth	20 MB / s per channel
Device Capacity	2 GB formatted
Maximum Configuration	14 GB (based on seven half-height SCSI disks)
Communication ports (server system)	The CHALLENGE server can support up to three IO4 boards with up to nine RS232 and three RS422 serial ports, three parallel ports, three AUI Ethernet ports, three sets of internal and external system interrupt jacks. Note: These jacks provide CPU interrupt signals in a multiple system configuration.
Serial ports (server system)	Four serial ports per IO4 board: three 9-pin RS232, one RS422, and two 8-pin DIN power connectors.

Table A-1 (continued) CHALLENGE / Onyx Deskside System Specifications

Parameter	Specifications
Communication ports (graphics system)	Up to four serial ports, one parallel port, one Ethernet port, one AUI Ethernet port, one set of internal, and external system interrupt jacks.
Parallel	25-pin Centronics compatible
VME64 controllers	Ethernet, FDDI, SCSI
I/O system	
I/O bus type	VME64 bus
No. of VME buses	1
VME bus slots	The server configuration has five slots. The graphics configuration has three slots.
I/O bandwidth	64 MBs
Software	
O/S	IRIX release 5.0 (Sherwood)
Compilers	C, Fortran
Graphics	Open GL
Connectivity	DECnet, Ethernet, FDDI, HiPPI, NFS, TCPIP network protocol
User interfaces	X11, Open GL
Graphics	Applicable to Onyx graphics configuration only
Vectors per second	1.5 M
Antialiased vectors per second	1.5 M
Textured polygons per second	400 K
Pixel fill flat rate per second	320 M
Pixel fill texture rate per second	320 M
Geometry board processing power	1200 MFLOPS
Texel storage	4 MB
Colors	64 billion

Table A-1 (continued) CHALLENGE/Onyx Deskside System Specifications

Appendix B

Cabling Local and Peripheral Devices

This chapter describes the signal connectors and cables for local and peripheral devices used with Challenge/Onyx systems.

B.1 Connector Panels

Standard device cabling is supported by one I/O board and its related connectors on a common I/O panel. For graphics systems, a second panel provides video connection. See Figure B-1. Table B-1 through Table B-9 provide a description of the connectors on the main I/O panel and provides a description of the connectors on the video panel.

Table B-18 and Table B-19 lists the signal pinouts for the 68-pin SCSI connectors on the system I/O panel. Table B-20 and Table B-21 provide 50-pin SCSI pinout details for reference information.

To attach more devices than are supported on the main I/O panel, additional hardware is required. Contact your local sales engineer for details.

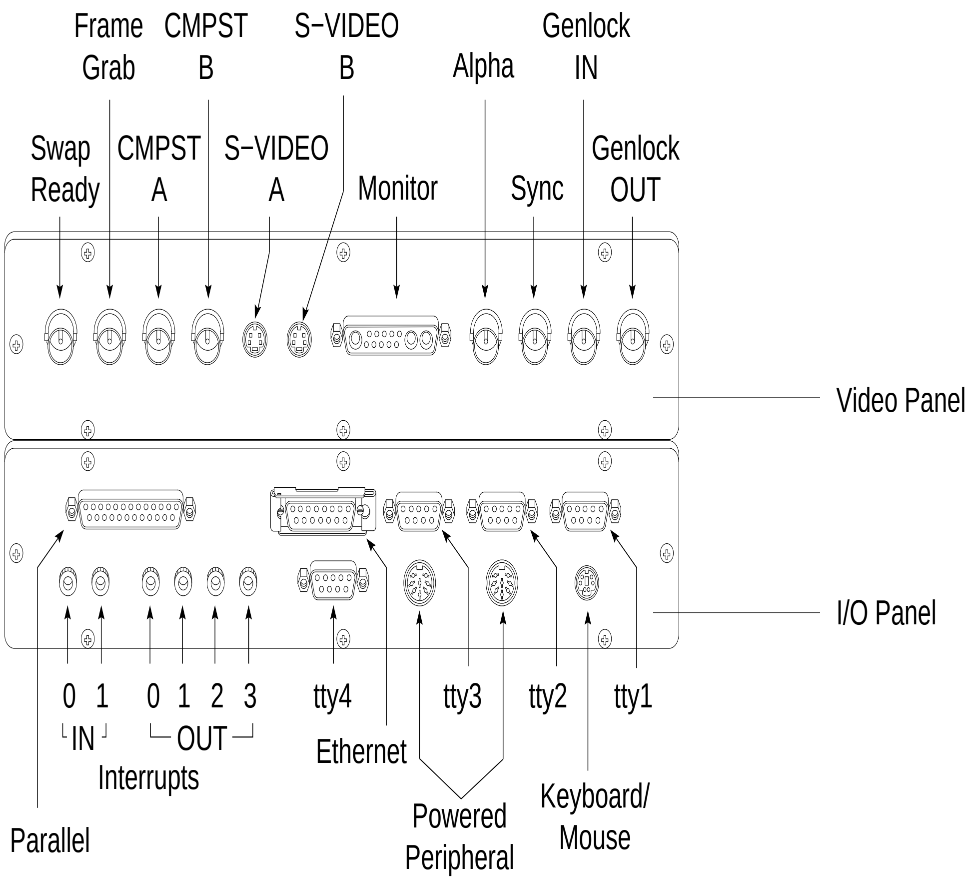


Figure B-1 Challenge / Onyx System Main and Video Connector Panels

Description	Pin	Signal	Flow (from chassis)
Parallel port. See Figure B-2. 25-pin D-sub receptacle.	1	STB (Data Strobe)	
	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	

Table B-1 Parallel Port

Description	Pin	Signal	Flow (from chassis)
	11	Busy	
	12	PE: Paper Empty	
	13	SLCT: Select / Online	
	14	AUTOFD	
	15	ERROR	
	16	INIT (reset)	
	17	SLCTIN	
	18-25	GND	

Table B-1 Parallel Port

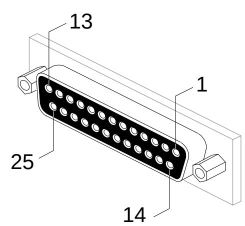


Figure B-2 Parallel Port

Description	Pin	Signal	Flow (from chassis)
Ethernet port. See Figure B-3. 15-pin AUI (attachment unit interface) according to IEEE 802.3 specification. Pin pairs 2:9, 3:10, and 5:12 are twisted pairs. Cabling is 9-conductor.	1	Logic GND	
	2	Collision+	two-way
	3	TXD+	two-way
	4	Logic GND	
	5	RXD+	two-way
	6	Power Return	input
	7	NC	
	8	Logic GND	
	9	Collision–	two-way

Table B-2 Ethernet Port

Description	Pin	Signal	Flow (from chassis)
	10	TXD–	two-way
	11	Logic GND	
	12	RXD–	two-way
	13	Power (+12V)	output
	14	Logic GND	
	15	NC	

Table B-2 Ethernet Port

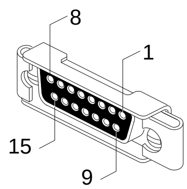


Figure B-3 Ethernet Port

Description	Pin	Signal	Flow (from chassis)
Serial port tty_1. See Figure B-4. 9-pin D-sub receptacle. RS-232 protocol.	1	NC	
	2	TXD	output
	3	RXD	input
	4	RTS	output
	5	CTS	input
	6	GND	
	7	GND	
	8	DCD	input
	9	DTR	output

Table B-3 Serial Port tty_1

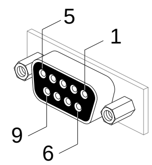


Figure B-4 Serial Port tty_1

Description	Pin	Signal	Flow (from chassis)
Serial ports tty_2, tty_3 for unpowered peripherals. See Figure B-5. 9-pin D-sub receptacle. RS-232 protocol. Serial ports tty_2 and tty_3 provide a choice of 9-pin D-sub or an 8-pin DIN receptacle. (See below.) Only one receptacle from each port can be used at a given time.	1	not used	
	2	TXD	output
	3	RXD	input
	4	RTS	output
	5	CTS	input
	6	GND	
	7	GND	
	8	DCD	input
	9	DTR	output

Table B-4 Serial Ports tty_2, tty_3 for Unpowered Peripherals

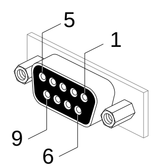


Figure B-5 Serial Ports tty_2, tty_3 for Unpowered Peripherals

Description	Pin	Signal	Flow (from chassis)
Serials ports tty_2, tty_3 for powered peripherals. See Figure B-6. 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 B-5 Serials Ports tty_2, tty_3 for Powered Peripherals

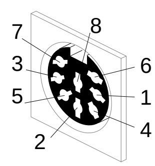


Figure B-6 Serials Ports tty_2, tty_3 for Powered Peripherals

Description	Pin	Signal	Flow (from chassis)
Serial port tty_4 RS-422 protocol. See Figure B-7. 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	TXD high +[c]	two-way
	8	RXD high +[d]	two-way
	9	RTS	output

Table B-6 Serial Port tty_4 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.
c. Pins 2 and 7 must be twisted pair in cable.
d. Pins 3 and 8 must be twisted pair in cable.

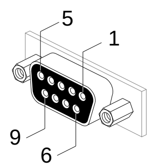


Figure B-7 Serial Port tty_4 RS-422 Protocol

Description	Pin	Signal	Flow (from chassis)
System interrupt IN ports 0, 1. See Figure B-8.	tip	Interrupt	input
	ring	Power +5V	
	sleeve	Shield	

Table B-7 System Interrupt IN

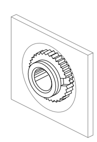


Figure B-8 System Interrupt IN

Description	Pin	Signal	Flow (from chassis)
System interrupt OUT ports 0, 1, 2, 3. See Figure B-9.	tip	Interrupt	output
	ring	Power +5V	
	sleeve	Shield	

Table B-8 System Interrupt OUT

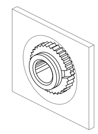


Figure B-9 System Interrupt OUT

Description	Pin	Signal	Flow (from chassis)
Keyboard / mouse port. See Figure B-10. 6-pin receptacle	1	KBD_RXD	input
	2	MOUSE_RXD	input
	3	SIG GND	
	4	Power +12V	output
	5	KBD_TXD	output
	6	NC	

Table B-9 Keyboard / Mouse Port

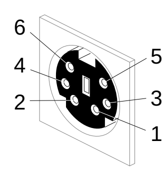


Figure B-10 Keyboard / Mouse Port

Description	Pin	Signal	Flow (from chassis)
Swap Ready port. See Figure B-11. BNC receptacle. Impedance 75 ohms.	center shield	SWAP_READY Chassis GND	two-way

Table B-10 Swap Ready Port

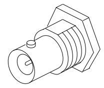


Figure B-11 Swap Ready Port

Description	Pin	Signal	Flow (from chassis)
Frame Grab port. See Figure B-12. BNC receptacle. Impedance 75 ohms.	center shield	FRAME_GRAB Chassis GND	input

Table B-11 Frame Grab Port

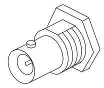


Figure B-12 Frame Grab Port

Description	Pin	Signal	Flow (from chassis)
Composite video ports A, B. See Figure B-13. BNC receptacle. Impedance 75 ohms.	center shield	CMPST_A or CMPST_B Chassis GND	output

Table B-12 Composite Video Ports A, B

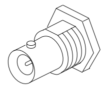


Figure B-13 Composite Video Ports A, B

Description	Pin	Signal	Flow (from chassis)
S-VIDEO ports A, B. See Figure B-14. 4-pin receptacle. NTSC or PAL-compatible.	1	LUMOND	output
	2	CHRMOND	output
	3	LUM	output
	4	CHRM	output

Table B-13 S-VIDEO Ports A, B

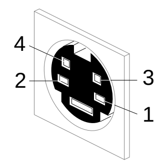


Figure B-14 S-VIDEO Ports A, B

Description	Pin	Signal	Flow (from chassis)
Monitor port. See Figure B-15. 13W3 receptacle.	A1	Red	output
	A2	Green	output
	A3	Blue	output
	1	NC	
	2	Monitor type 0	input
	3	NC	
	4	Stereo Sync[a]	output
	5	[a]Stereo Power +10V	output
	6	Monitor Type 1	input
	7	Monitor Type 2	input
	8	GND	
	9	[a]GND	
	10	[a]GND	

Table B-14 Monitor Port

a. On some cables these signals are NC.

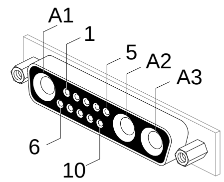


Figure B-15 Monitor Port (13W3 Receptacle)

Description	Pin	Signal	Flow (from chassis)
Alpha port. See Figure B-16. BNC receptacle. Impedance 75 ohms.	center	Alpha	output
	shield	Chassis GND	

Table B-15 Alpha Port

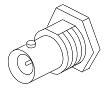


Figure B-16 Alpha Port

Description	Pin	Signal	Flow (from chassis)
Sync port. See Figure B-17. BNC receptacle. Impedance 75 ohms.	center	Sync	output
	shield	Chassis GND	

Table B-16 Sync Port

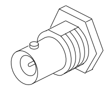


Figure B-17 Sync Port

Description	Pin	Signal	Flow (from chassis)
Genlock IN, Genlock OUT. See Figure B-18. BNC receptacle. Impedance 75 ohms.	center	Genlock loop-through	two-way
	shield	Chassis GND	

Table B-17 Genlock IN, Genlock OUT

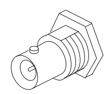


Figure B-18 Genlock IN, Genlock OUT

Signal Name	Pin Number	Pin Number	Signal Name
GND	1	35	-DB(12)
GND	2	36	-DB(13)
GND	3	37	-DB(14)
GND	4	38	-DB(15)
GND	5	39	-DB(P1)
GND	6	40	-DB(0)
GND	7	41	-DB(1)
GND	8	42	-DB(2)
GND	9	43	-DB(3)
GND	10	44	-DB(4)

Table B-18 68-pin, Single-ended, High-density SCSI Pinouts (See Figure B-19.)

Signal Name	Pin Number	Pin Number	Signal Name
GND	11	45	-DB(5)
GND	12	46	-DB(6)
GND	13	47	-DB(7)
GND	14	48	-DB(P)
GND	15	49	GND
GND	16	50	GND
TERMPWR	17	51	TERMPWR
TERMPWR	18	52	TERMPWR
Reserved	19	53	Reserved
GND	20	54	GND
GND	21	55	-ATN
GND	22	56	GND
GND	23	57	-BSY
GND	24	58	-ACK
GND	25	59	-RST
GND	26	60	-MSG
GND	27	61	-SEL
GND	28	62	-C/D
GND	29	63	-REQ
GND	30	64	-I/O
GND	31	65	-DB(8)
GND	32	66	-DB(9)
GND	33	67	-DB(10)
GND	34	68	-DB(11)

Table B-18 68-pin, Single-ended, High-density SCSI Pinouts (See Figure B-19.)

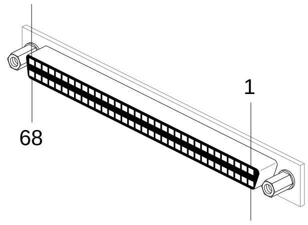


Figure B-19 68-pin Connector on I/O Panel

Note: Read the following information regarding the SCSI signal pinouts.

A hyphen preceding a signal name indicates that the signal is active low.

8-bit devices that connect to the P-cable leave these signals open: -DB(8), -DB(9), -DB(10), -DB(11), -DB(12), -DB(13), -DB(14), -DB(15), -DB(P1). All other signals are connected as shown in this table.

Signal Name	Pin Number	Pin Number	Signal Name
+DB(12)	1	35	-DB(12)
+DB(13)	2	36	-DB(13)
+DB(14)	3	37	-DB(14)
+DB(15)	4	38	-DB(15)
+DB(P1)	5	39	-DB(P1)
GND	6	40	GND
+DB(0)	7	41	-DB(0)
+DB(1)	8	42	-DB(1)
+DB(2)	9	43	-DB(2)
+DB(3)	10	44	-DB(3)
+DB(4)	11	45	-DB(4)
+DB(5)	12	46	-DB(5)
+DB(6)	13	47	-DB(6)
+DB(7)	14	48	-DB(7)
+DB(P)	15	49	-DB(P)
DIFFSENS	16	50	GND

Table B-19 68-pin, Differential, High-density SCSI Pinouts (See Figure B-20.)

Signal Name	Pin Number	Pin Number	Signal Name
TERMPWR	17	51	TERMPWR
TERMPWR	18	52	TERMPWR
Reserved	19	53	Reserved
+ATN	20	54	-ATN
GND	21	55	GND
+BSY	22	56	-BSY
+ACK	23	57	-ACK
+RST	24	58	-RST
+MSG	25	59	-MSG
+SEL	26	60	-SEL
+C/D	27	61	-C/D
+REQ	28	62	-REQ
+I/O	29	63	-I/O
GND	30	64	GND
+DB(8)	31	65	-DB(8)
+DB(9)	32	66	-DB(9)
+DB(10)	33	67	-DB(10)
+DB(11)	34	68	-DB(11)

Table B-19 68-pin, Differential, High-density SCSI Pinouts (See Figure B-20.)

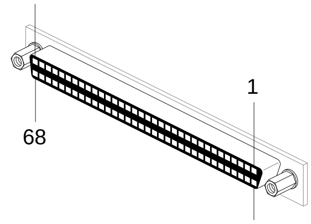


Figure B-20 68-pin Connector on I/O Panel

Note: Read the following information regarding the SCSI signal pinouts.

A hyphen preceding a signal name indicates that the signal is active low.

8-bit devices that connect to the P-cable leave these signals open: -DB(12), -DB(13),

-DB(14), -DB(15), -DB(P1), -DB(8), -DB(9), -DB(10), -DB(11), +DB(12), +DB(13), +DB(14), +DB(15), +DB(P1), +DB(8), +DB(9), +DB(10), and +DB(11). All other signals are connected as shown in this table.

Signal Name	Pin Number	Pin Number	Signal Name
GND	1	26	-DB(0)
GND	2	27	-DB(1)
GND	3	28	-DB(2)
GND	4	29	-DB(3)
GND	5	30	-DB(4)
GND	6	31	-DB(5)
GND	7	32	-DB(6)
GND	8	33	-DB(7)
GND	9	34	-DB(P)
GND	10	35	GND
GND	11	36	GND
GND	12	37	GND
Reserved	13	38	TERMPWR
GND	14	39	GND
GND	15	40	GND
GND	16	41	-ATN
GND	17	42	GND
GND	18	43	-BSY
GND	19	44	-ACK
GND	20	45	-RST
GND	21	46	-MSG
GND	22	47	-SEL
GND	23	48	-C/D
GND	24	49	-REQ
GND	25	50	-I/O

Table B-20 50-pin Single-ended, Standard SCSI Pinouts (See Figure B-21.)

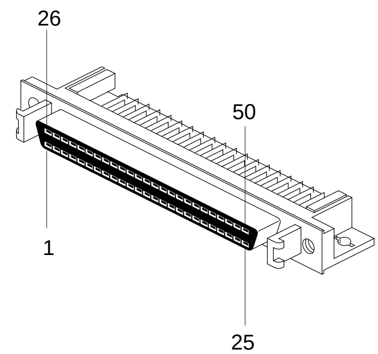


Figure B-21 50-pin Connector on I/O Panel for Older-style Systems

Note: Read the following information regarding the SCSI signal pinouts.

A hyphen preceding a signal name indicates that the signal is active low.

The signal labeled “Reserved” is connected to ground in the bus terminator assemblies or in the end devices on the SCSI cable. The “reserved” line should be open in the other SCSI devices but may be connected to ground.

Note: The 50-pin SCSI connector is not available on the front panel of CHALLENGE/Onyx system. It is listed here for reference only.

Signal Name	Pin Number	Pin Number	Signal Name
GND	1	26	GND
+DB(0)	2	27	-DB(0)
+DB(1)	3	28	-DB(1)
+DB(2)	4	29	-DB(2)
+DB(3)	5	30	-DB(3)
+DB(4)	6	31	-DB(4)
+DB(5)	7	32	-DB(5)
+DB(6)	8	33	-DB(6)
+DB(7)	9	34	-DB(7)
+DB(P)	10	35	-DB(P)
DIFFSENS	11	36	GND

Table B-21 50-pin, Differential, High-density SCSI Pinouts (See Figure B-22.)

Signal Name	Pin Number	Pin Number	Signal Name
Reserved	12	37	Reserved
TERMPWR	13	38	TERMPWR
Reserved	14	39	Reserved
+ATN	15	40	-ATN
GND	16	41	GND
+BSY	17	42	-BSY
+ACK	18	43	-ACK
+RST	19	44	-RST
+MSG	20	45	-MSG
+SEL	21	46	-SEL
+C/D	22	47	-C/D
+REQ	23	48	-REQ
+I/O	24	49	-I/O
GND	25	50	GND

Table B-21 50-pin, Differential, High-density SCSI Pinouts (See Figure B-22.)

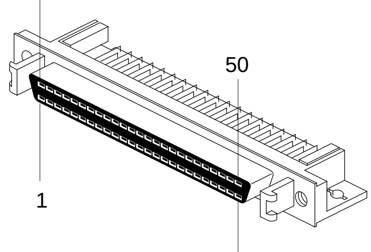


Figure B-22 50-pin Connector on I/O Panel for Older-style Systems

Note: Read the following information regarding the SCSI signal pinouts.

A hyphen preceding a signal name indicates that the signal is active low.

The signals labeled “Reserved” are connected to ground in the bus terminator assemblies or in the end devices on the SCSI cable. The “reserved” lines should be open in the other SCSI devices but may be connected to ground.

Note: The 50-pin SCSI connector is not available on the front panel of CHALLENGE / Onyx system. It is listed here for reference only.

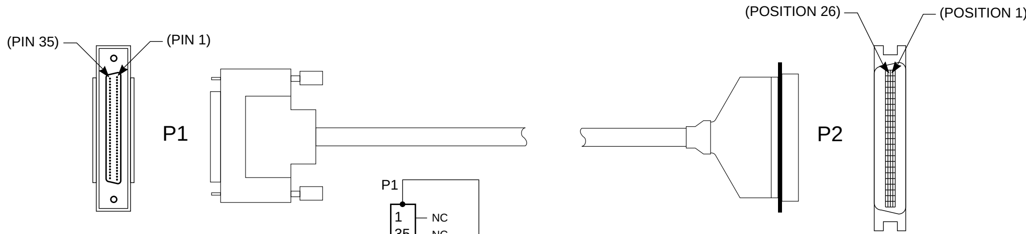
B.2 68-pin to 50-pin SCSI Converter Cables

Table B-22 lists the different 68-pin to 50-pin SCSI converter cables available through Silicon Graphics. Figure B-23 illustrates the connectors for these cables.

Cable Part Number	Cable Type
018-0347-*xxx*	3-ft, external, single-ended SCSI cable
018-0348-*xxx*	15-ft external, single-ended SCSI cable
018-0349-*xxx*	50-ft, external, differential swizzle SCSI cable

Table B-22 68-pin to 50-pin SCSI Converter Cable Types

Caution: The 50-foot external, differential swizzle SCSI cable (P / N 018-0349-*xxx*) should *be used only* when connecting an CHALLENGE / Onyx L or XL system to a SCSIBox 1 (P / N P4-XBXD). Otherwise, damage could result to the SCSI devices, controller, and bus.



	P1	P2	
	1		NC
	35		NC
	2		NC
	36		NC
	3		NC
	37		NC
	4		NC
	38		NC
	5		NC
	39		NC
GND	6	1	GND
DB(0)	40	26	DB(0)
GND	7	2	GND
DB(1)	41	27	DB(1)
GND	8	3	GND
DB(2)	42	28	DB(2)
GND	9	4	GND
DB(3)	43	29	DB(3)
GND	10	5	GND
DB(4)	44	30	DB(4)
GND	11	6	GND
DB(5)	45	31	DB(5)
GND	12	7	GND
DB(6)	46	32	DB(6)
GND	13	8	GND
DB(7)	47	33	DB(7)
GND	14	9	GND
DB(P)	48	34	DB(P)
GND	15	10	GND
GND	49	35	GND
GND	16	11	GND
GND	50	36	GND
NC	17	12	NC
NC	51	37	NC
NC	18	13	NC
TERM PWR	52	38	TERM PWR
RESERVED	19	14	RESERVED
RESERVED	53	39	RESERVED
GND	20	15	GND
GND	54	40	GND
GND	21	16	GND
ATN	55	41	ATN
GND	22	17	GND
GND	56	42	GND
GND	23	18	GND
BSY	57	43	BSY
GND	24	19	GND
ACK	58	44	ACK
GND	25	20	GND
RST	59	45	RST
GND	26	21	GND
MSG	60	46	MSG
GND	27	22	GND
SEL	61	47	SEL
GND	28	23	GND
C/D	62	48	C/D
GND	29	24	GND
REQ	63	49	REQ
GND	30	25	GND
I/O	64	50	I/O
	31		NC
	65		NC
	32		NC
	66		NC
	33		NC
	67		NC
	34		NC
	68		NC

Figure B-23 3-foot and 15-foot Single-ended SCSI Cable and 50-foot Differential Swizzle SCSI Cable

B.3 Monitor Cables

This section identifies the monitor cables provided by Silicon Graphics. See Table B-23 for a summary of monitor cables and Table B-24 through Table B-29 for specific details of each cable.

Description	Length	Connectors	Part Number
Extension cable	15’	13W3 plug, both ends	018-0285-001
Extension cable	15’	13W3 plug 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 plugs, both ends	018-0275-003

Table B-23 Monitor Cable Summary

To attach a second graphics monitor to a Challenge / Onyx chassis, additional hardware is required to provide a second set of signals. Contact your local sales engineer for details.

Part Number	Description
018-0285-001	Monitor extension cable, round, 15’ length, shielded, 13W3 hybrid plugs at each end of cable. See Figure B-24.

Table B-24 Monitor Extension Cable, Round, 15’ Length, Shielded, 13W3 Hybrid Plugs at Each End of Cable

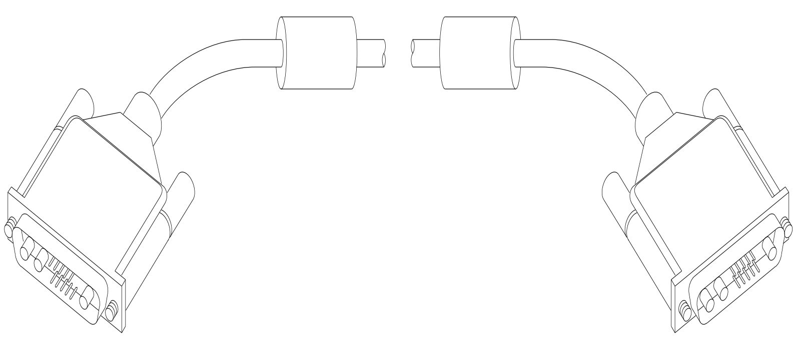


Figure B-24 Monitor Extension Cable, Round, 15’ Length, Shielded, 13W3 Hybrid Plugs at Each End of Cable

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. See Figure B-25.

Table B-25 Monitor Extension Cable, Round, 15’ Length, Shielded, 13W3 Hybrid Plug at Chassis End, 3 BNC Plugs (RGB) at Monitor End

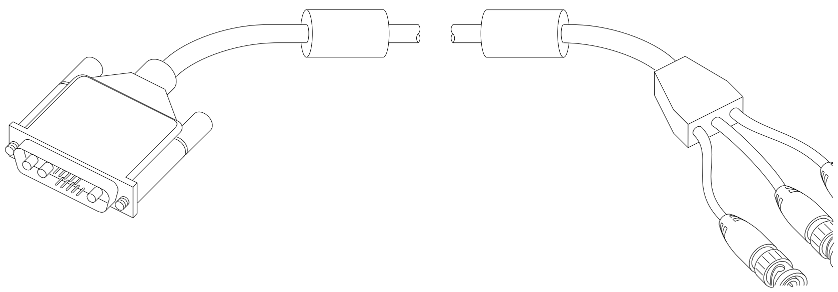


Figure B-25 Monitor Extension Cable, Round, 15’ Length, Shielded, 13W3 Hybrid Plug at Chassis End, 3 BNC Plugs (RGB) at Monitor End

Part Number	Description
018-8094-002	Monitor extension cable, round, 75’ length, shielded, 13W3 hybrid plugs at each end of cable. See Figure B-26.

Table B-26 Monitor Extension Cable, Round, 75’ Length, Shielded, 13W3 Hybrid Plugs at Each End of Cable

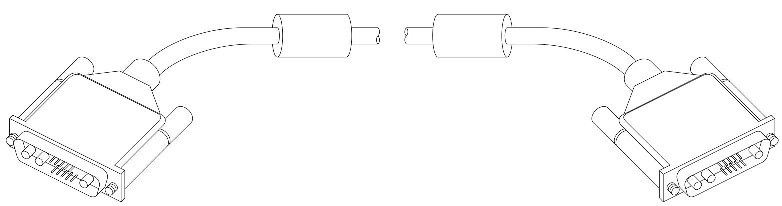


Figure B-26 Monitor Extension Cable, Round, 75’ Length, Shielded, 13W3 Hybrid Plugs at Each End of Cable

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. See Figure B-27.

Table B-27 Monitor Adapter Cable, Round, 1' Length, Shielded, 13W3 Hybrid Receptacle at One End, 3 BNC Plugs (RGB) at Other End

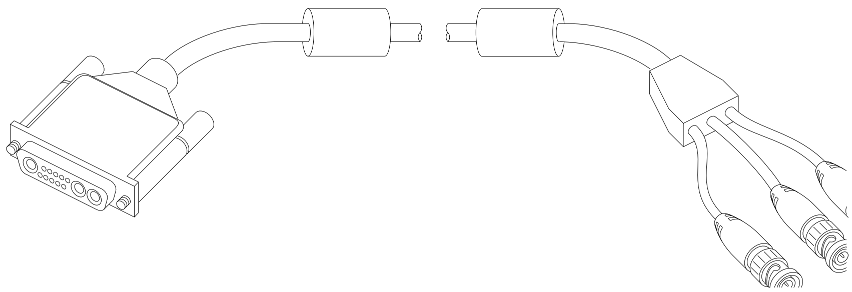


Figure B-27 Monitor Adapter Cable, Round, 1' Length, Shielded, 13W3 Hybrid Receptacle at One End, 3 BNC Plugs (RGB) at Other End

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. See Figure B-28.

Table B-28 Monitor Adapter Cable, Round, 1' Length, Shielded, 13W3 Hybrid Plug at One End, 3 BNC Receptacles (RGB) at Other End

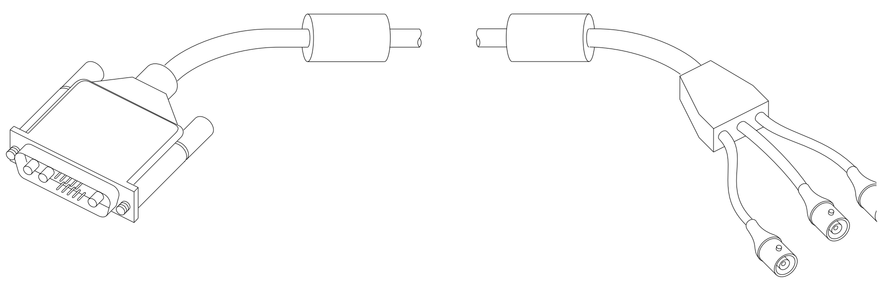


Figure B-28 Monitor Adapter Cable, Round, 1' Length, Shielded, 13W3 Hybrid Plug at One End, 3 BNC Receptacles (RGB) at Other End

Part Number	Description
018-0275-003	Monitor extension cable, round, 75' length, shielded, 3 BNC plugs (RGB) at both ends. See Figure B-29.

Table B-29 Monitor Extension Cable, Round, 75' Length, Shielded, 3 BNC Plugs (RGB) at Both Ends

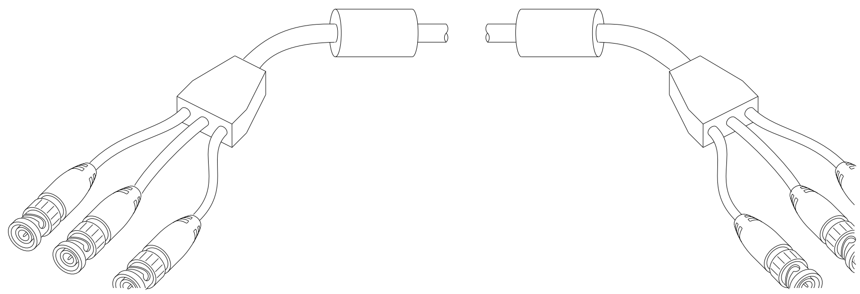


Figure B-29 Monitor Extension Cable, Round, 75' Length, Shielded, 3 BNC Plugs (RGB) at Both Ends

B.4 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. These cables are shown in Table B-30 and Table B-31.

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

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

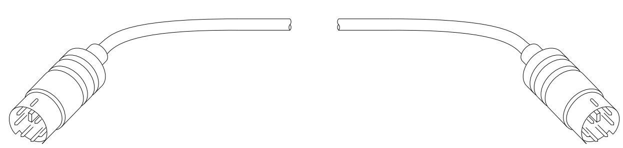


Figure B-30 Keyboard / Mouse Extension Cable, Round, 30' Length, Shielded, 6-pin Circular Mini-DIN Plugs at Both Ends

Part Number	Description
081-0075-001	Keyboard / mouse extension cable, round, 75’ length, shielded, 6-pin circular mini-DIN plugs at both ends. See Figure B-31.

Table B-31 Keyboard / Mouse Extension Cable, Round, 75’ Length, Shielded, 6-pin Circular Mini-DIN Plugs at Both Ends

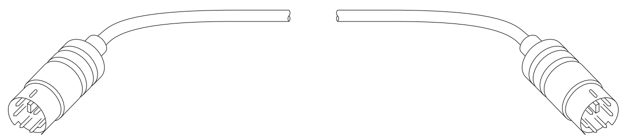


Figure B-31 Keyboard / Mouse Extension Cable, Round, 75’ Length, Shielded, 6-pin Circular Mini-DIN Plugs at Both Ends

All other input devices connect to the chassis using serial ports. For detailed specifications, see Section B.5, “Serial Device Cables.”

B.5 Serial Device Cables

Serial devices connect to the chassis using four serial ports. Two serial ports support either powered devices (through the one of the two circular 8-pin DIN connectors) or unpowered devices (through tty_2 and tty_3). The serial port can support one of these connector types at a time. These two ports use the RS-232 protocol. A third serial port (tty_1) provides an unpowered connection using the RS-232 protocol. A fourth serial port (tty_4) provides connection for devices requiring the RS-422 protocol. See Table B-3 through Table B-6 for detailed specifications for each serial port.

B.6 Parallel Device Cables

The parallel port supports devices requiring a 25-pin Centronics®-compatible connection. See Table B-1 for detailed specifications for the parallel port.

B.7 Network Cables

Network cables can be attached to the network port using a 15-pin AUI receptacle. See Table B-2 for detailed specifications on the network port.

To determine cable lengths and other network details, read the material provided with the networking equipment, or refer to a networking guide.

B.8 Modem Cables

To attach a modem to the system, connect a modem or null modem cable to one of the 9-pin serial connectors located on the I/O panel. If a 9-pin to 25-pin adapter is used, the adapter must be placed at the modem, and a cable with a 9-pin plug must be connected to the I/O panel. Placing an adapter directly on the chassis connector blocks the chassis door, which must be closed for proper operation.

Note: This product requires the use of external shielded cables in order to maintain compliance with Part 15 of the FCC rules. Not all vendor serial cables are compatible with shielding requirements.

Refer to the *IRIX Advanced Site and Server Administration Guide* for more information about modem configuration.

B.9 Rackmount System Interrupt Cables

See Table B-32 for detailed specifications on the rackmount system interrupt cables.

Part Number	Description
9290054	Rackmount system interrupt cable, round, 35' length, 3.5 mm 3-conductor plugs at both ends, wired straight-through. See Figure B-32.

Table B-32 Rackmount System Interrupt Cable

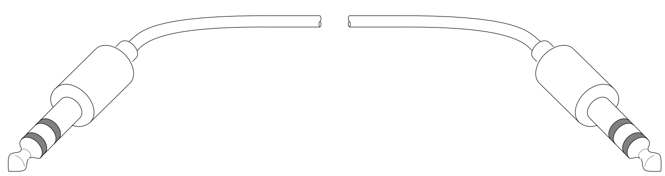


Figure B-32 Rackmount System Interrupt Cable

Appendix C

Memory Upgrade Configurations

Table C-1 and Figure C-1 through Figure C-46 describe the SIMM upgrades required to install additional memory to an existing configuration.

Starting Memory Size	128 MB	256 MB	512 MB	640 MB	1024 MB	1280 MB	2048 MB
64 MB	See Figure C-1.	For Two-way interleaving, see Figure C-2. For Four-way interleaving, see Figure C-3.	For Four-way interleaving, see Figure C-4. For Eight-way interleaving, see Figure C-5.	See Figure C-6.	See Figure C-7.	See Figure C-8.	See Figure C-9.
128 MB	N / A	For Two-way interleaving, see Figure C-10. For Four-way interleaving, see Figure C-11.	For Four-way interleaving, see Figure C-12. For Eight-way interleaving, see Figure C-13.	See Figure C-14.	See Figure C-15.	See Figure C-16.	See Figure C-17.

Table C-1 Memory Upgrade Requirements

Starting Memory Size	128 MB	256 MB	512 MB	640 MB	1024 MB	1280 MB	2048 MB
256 MB	N / A	N / A	From 256 MB (Two-way) to 512 (Two-way), see Figure C-18. From 256 MB (One-way) to 512 MB (Two-way), see Figure C-19. To go from 256 MB (Two-way) to 512 MB (Four-way), see Figure C-20. From 256 MB (Four-way) to 512 MB (Four-way), see Figure C-21.	See Figure C-22.	From 256 MB (One-way) to 1024 MB (Two-way), see Figure C-23. From 256 MB (Two-way) to 1024 MB (Eight-way), see Figure C-24. From 256 MB (Four-way) to 1024 MB (Eight-way), see Figure C-25.	From 256 MB (One-way) to 1280 MB, see Figure C-26. From 256 MB (Two-way) to 1280 MB, see Figure C-27. From 256 MB (Four-way) to 1280 MB, see Figure C-28. .	From 256 MB (Two-way) to 2048 MB (Eight-way) see Figure C-29. From 256 (Four-way) to 2048 MB (Eight-way), see Figure C-30.
512 MB	N / A	N / A	N / A	See Figure C-31.	From 512 MB (Two-way) to 1024 MB (Two-way), see Figure C-32. From 512 MB (Four-way) to 1024 MB (Eight-way), see Figure C-33. From 512 MB (Four-way) to 1024 MB (Four-way), see Figure C-34. From 512 MB (Eight-way) to 1024 MB (Eight-way), see Figure C-35.	From 512 MB (Two-way) to 1280 MB (Four-way), see Figure C-36.	From 512 MB (Four-way) to 2048 MB (Eight-way), see Figure C-37. From 512 MB (Eight-way) to 2048 MB (Eight-way), see Figure C-38.

Table C-1 (continued) Memory Upgrade Requirements

Starting Memory Size	128 MB	256 MB	512 MB	640 MB	1024 MB	1280 MB	2048 MB
640 MB	N / A	N / A	N / A	N / A	See Figure C-39.	See Figure C-40.	See Figure C-41.
1024 MB	N / A	N / A	N / A	N / A	N / A	See Figure C-42.	From 1024 MB (Two-way to 2048 MB (Four-way), see Figure C-43. From 1024 MB (Four-way) to 2048 MB (Four-way), see Figure C-44. From 1024 MB (Eight-way) to 2048 MB (Eight-way), see Figure C-45.
1280 MB	N / A	N / A	N / A	N / A	N / A	N / A	See Figure C-46.

Table C-1 (continued) Memory Upgrade Requirements

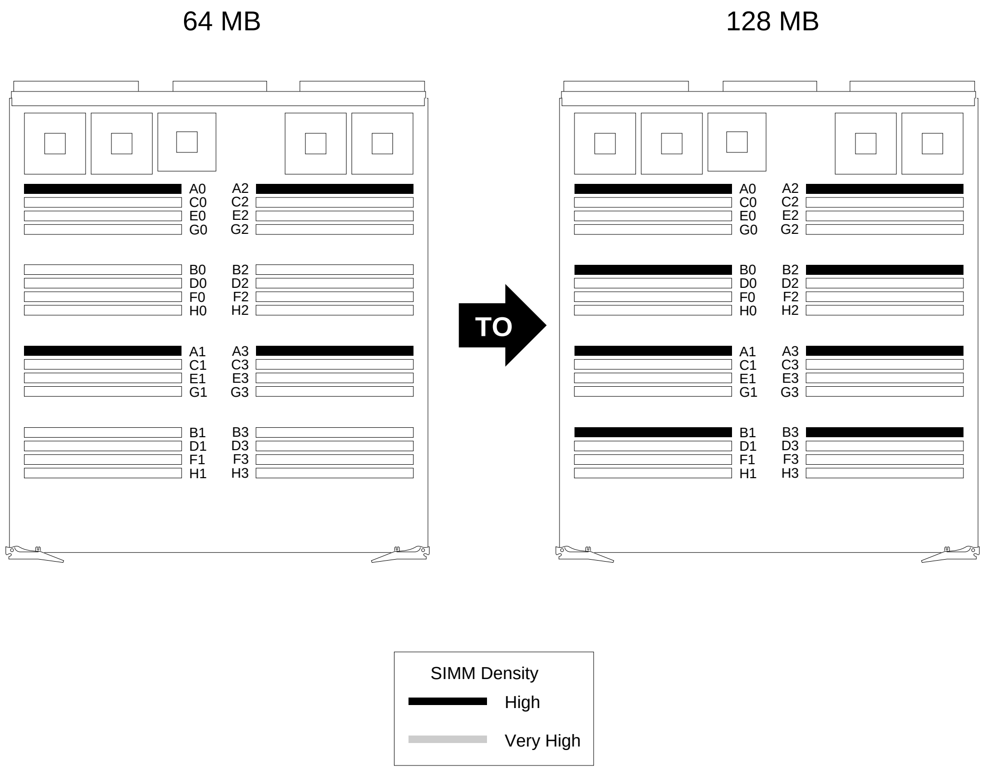


Figure C-1 64 MB to 128 MB (Two-way Interleaving)

Note: Add 64 MB using one bank of high-density SIMMs (4 x 16 MB) into bank B.

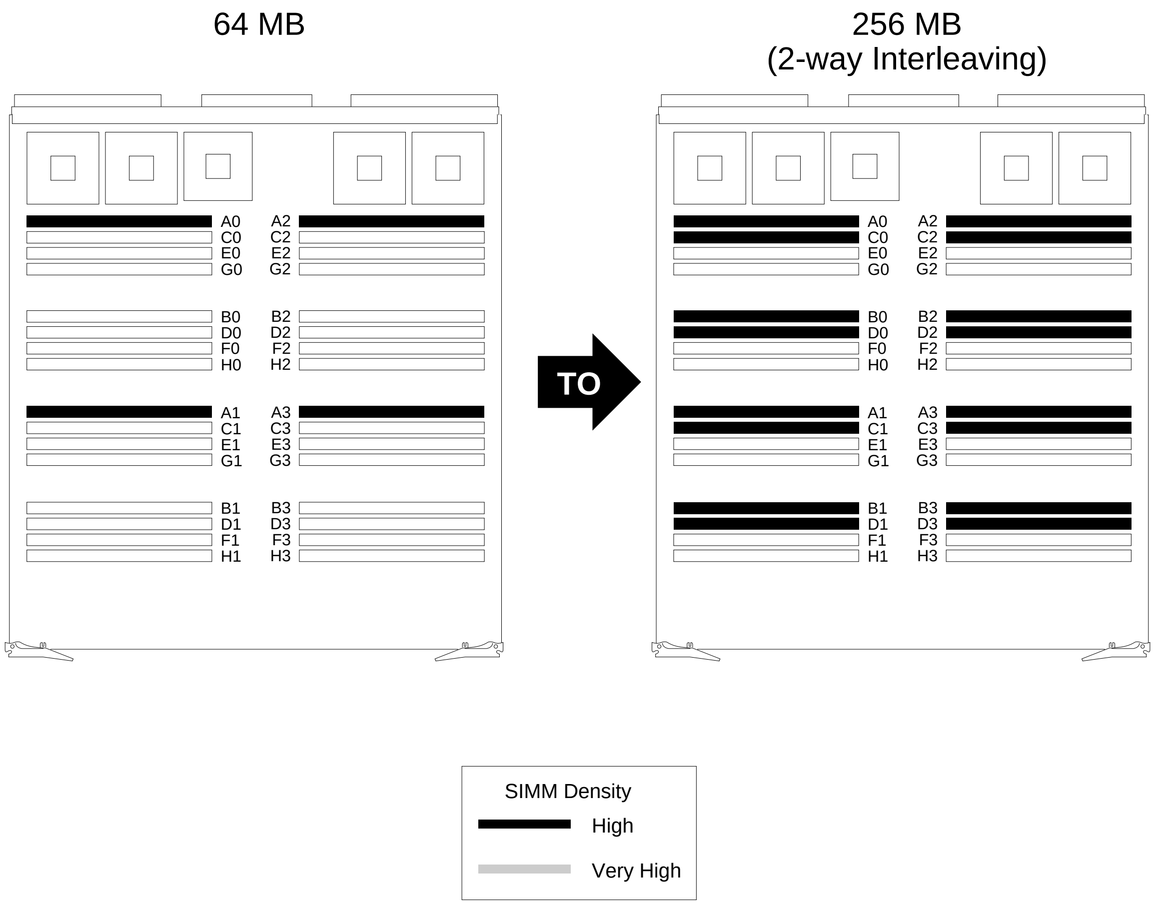


Figure C-2 64 MB to 256 MB (Two-way Interleaving)

Note: Add 192 MB using three banks of high-density SIMMs (12 x 16 MB) into banks B, C, and D.

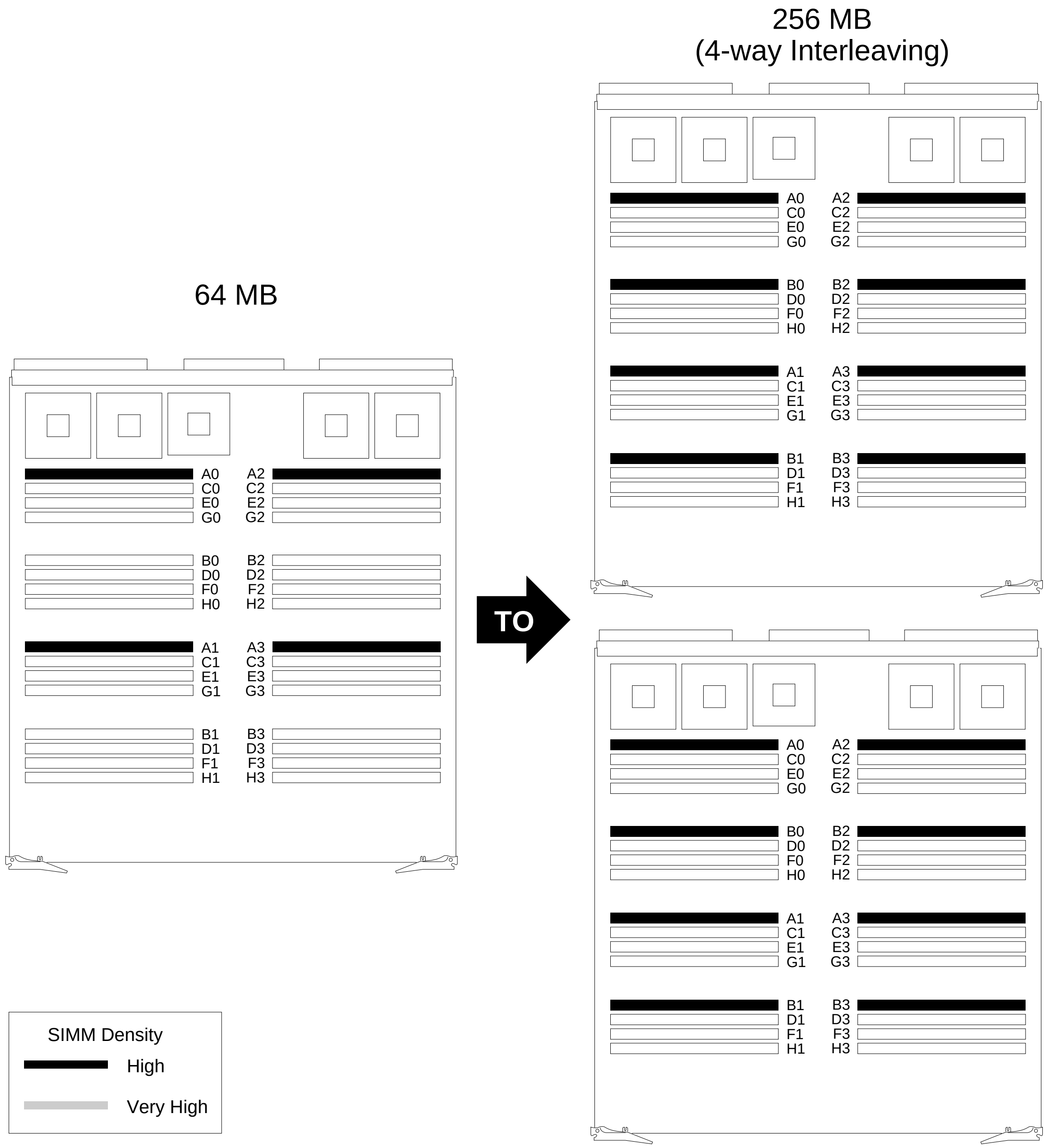


Figure C-3 64 MB to 256 MB (Four-way Interleaving)

Note: Add 192 MB using three banks of high-density SIMMs (12 x 16 MB) into banks A and B on two MC3 boards.

Figure C-4 64 MB to 512 MB (Four-way Interleaving)

Note: Add 448 MB using seven banks of high-density SIMMs (28 x 16 MB) into banks A, B, C, and D on two MC3 boards.

Figure C-5 64 MB to 512 MB (Eight-way Interleaving)

Note: Add 448 MB using seven banks of high-density SIMMs (28 x 16 MB) into banks A and B on four MC3 boards.

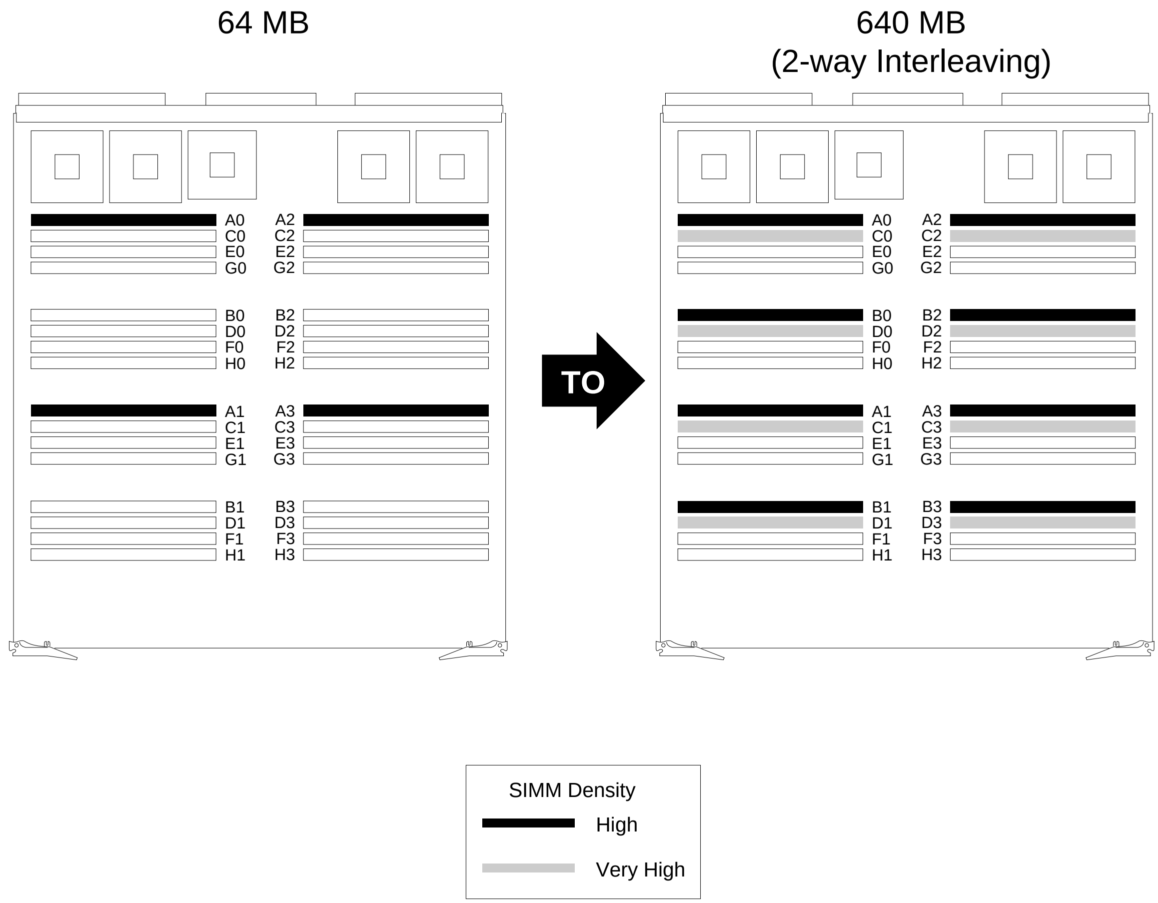


Figure C-6 64 MB to 640 MB (Two-way Interleaving)

Note: Add 576 MB using one bank of high-density SIMMs (4 x 16 MB) into banks A and B *and* two banks of very high-density SIMMS (8 x 64 MB) into banks C and D.

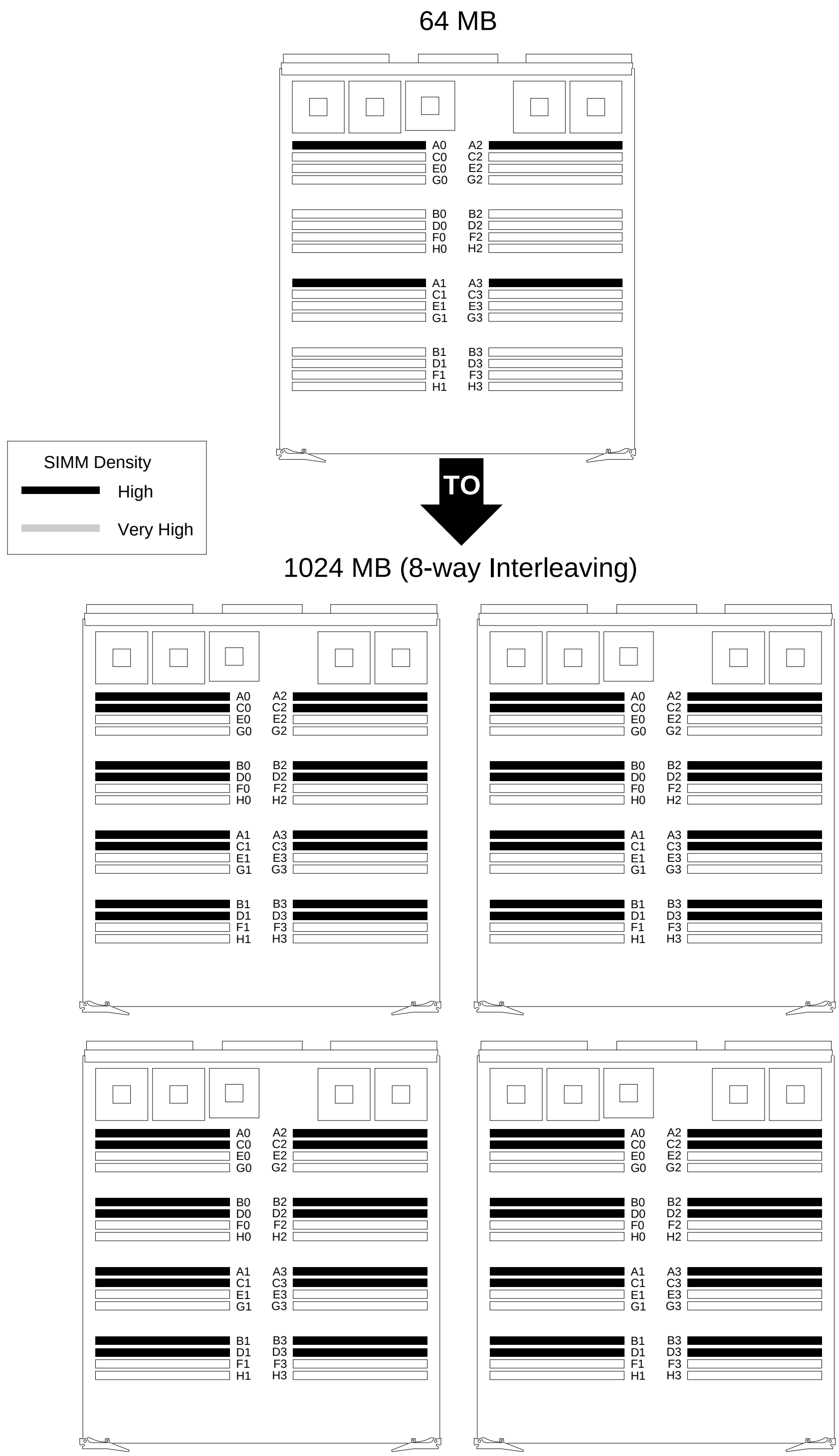


Figure C-7 64 MB to 1024 MB (Eight-way Interleaving)

Note: Add 960 MB using 15 banks of high-density SIMMs (60 x 16 MB) into banks A, B, C, and D on four MC3 boards.

Figure C-8 64 MB to 1280 MB (Four-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 1216 MB using three banks of high-density SIMMs (12 x 16 MB) into bank B of the first MC3 board and into banks A and B on the second MC3 board. Then add four banks of very high-density SIMMs (16 x 64 MB) in banks C and D on the two MC3 boards.

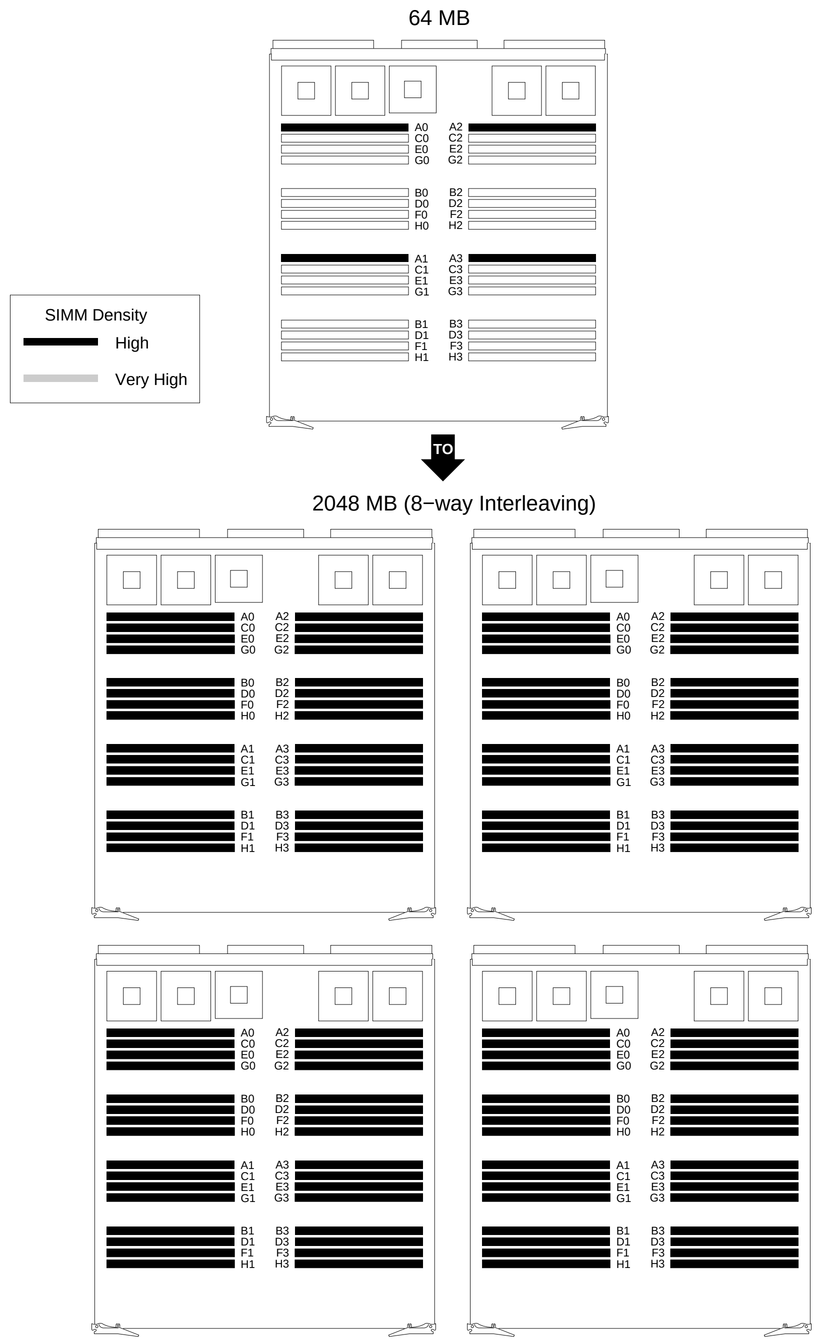


Figure C-9 64MB to 2048 MB (Eight-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 1984 MB using 31 banks of high-density SIMMs (124 x 16 MB) into banks A, B, C, D, E, F, G, and H on four MC3 boards.

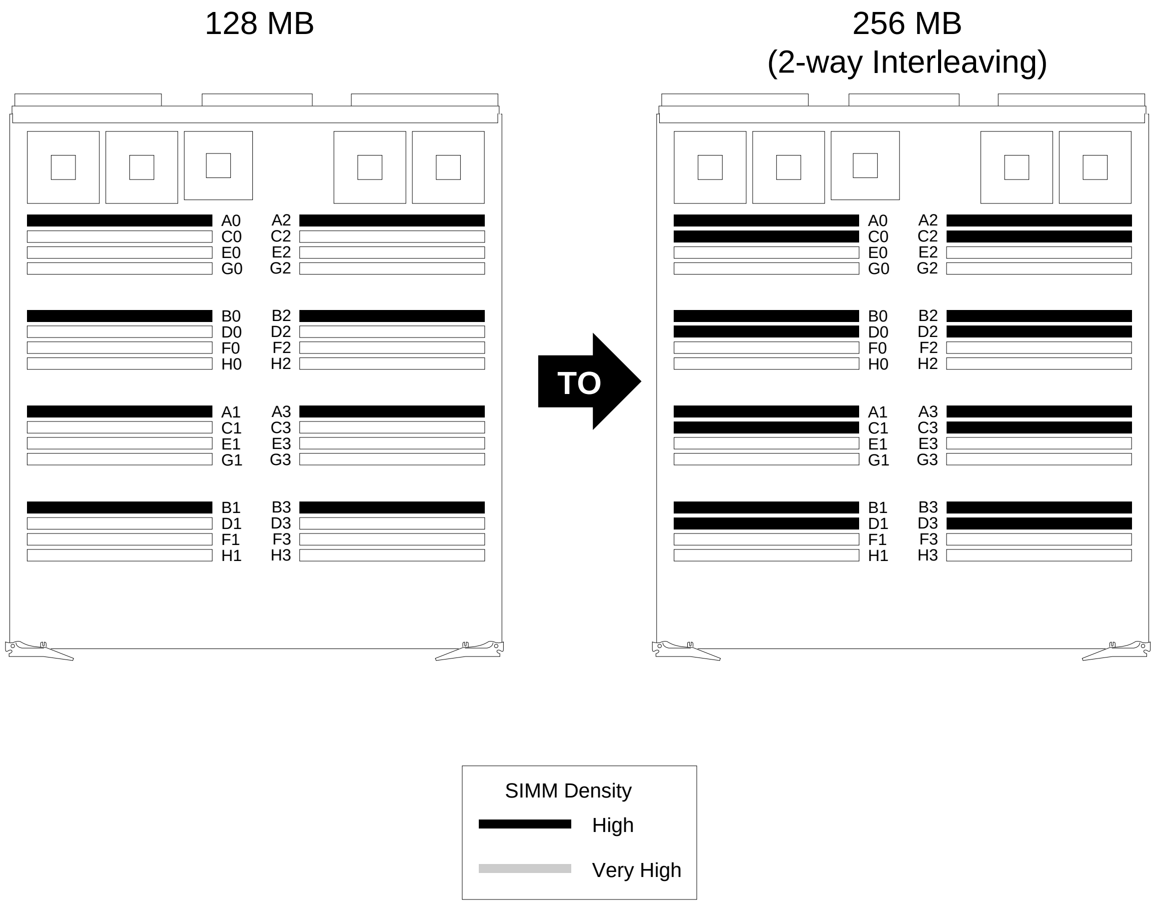


Figure C-10 128 MB to 256 MB (Two-way Interleaving)

Note: Add 128 MB using two banks of high-density SIMMs (8 x 16 MB) into banks C and D.

Figure C-11 128 MB (Two-way Interleaving) to 256 MB (Four-way Interleaving)

Note: Add 128 MB using two banks of high-density SIMMs (8 x 16 MB) into banks A and B on a second MC3 board.

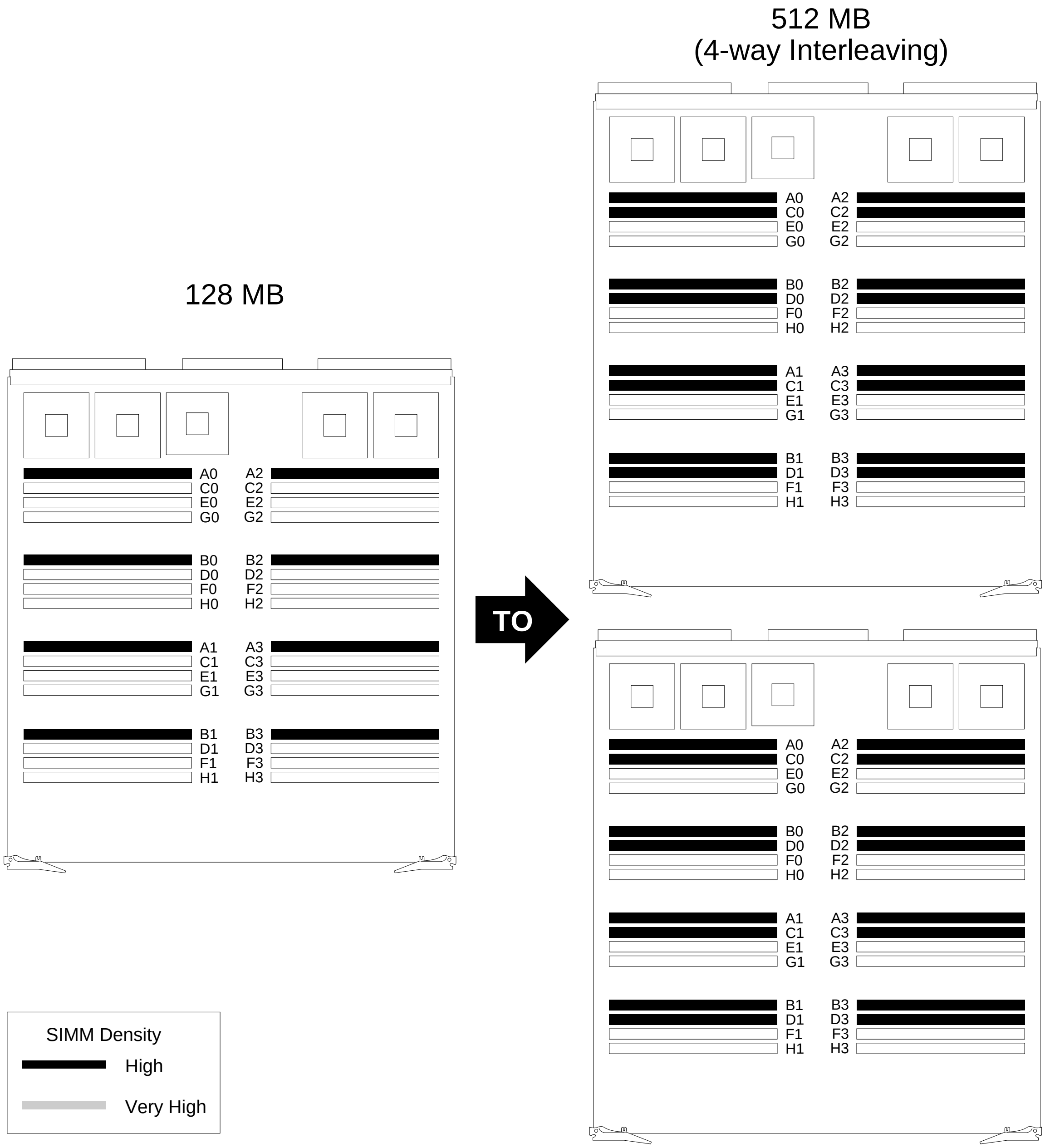


Figure C-12 128 MB (Two-way Interleaving) to 512 MB (Four-way Interleaving)

Note: Add 384 MB using six banks of high-density SIMMs (24 x 16 MB) into banks A, B, C, and D on two MC3 boards.

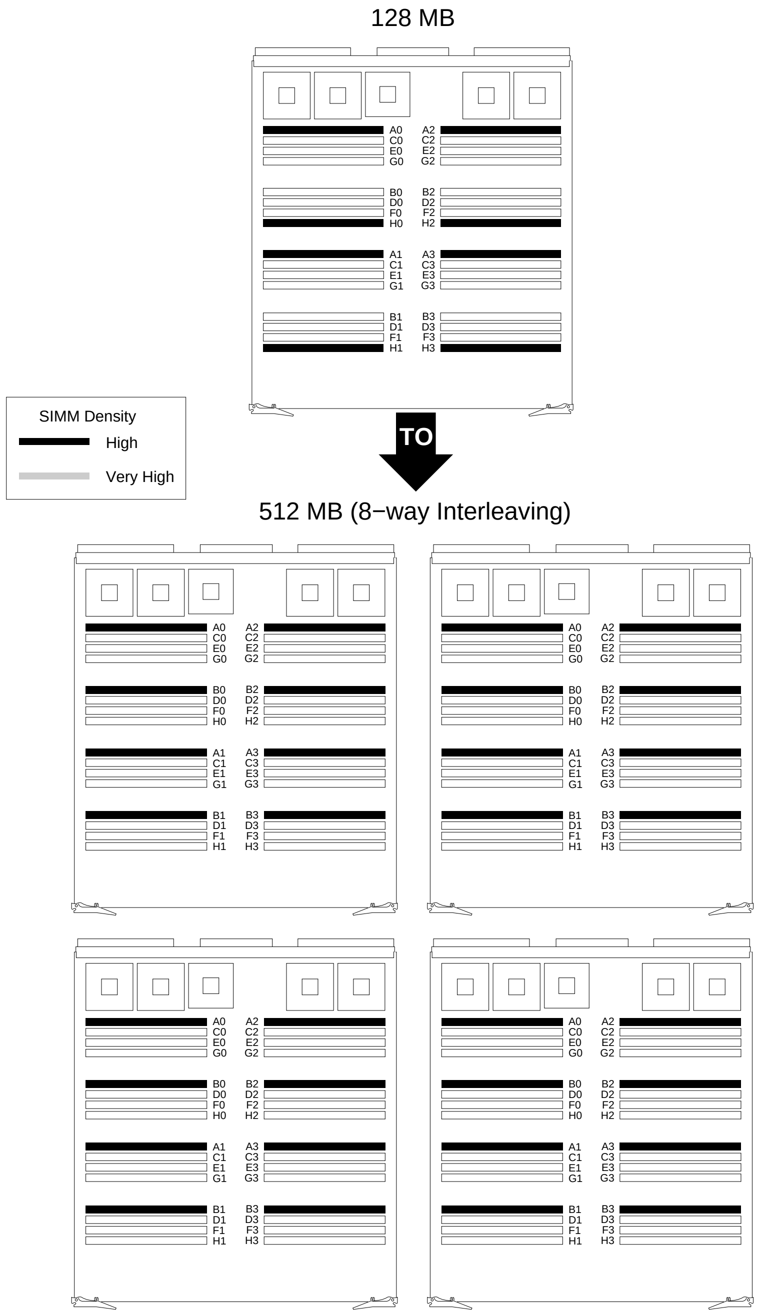


Figure C-13 128 MB (Two-way Interleaving) to 512 MB (Eight-way Interleaving)

Note: Add 384 MB using six banks of high-density SIMMs (24 x 16 MB) into banks A, B, C, and D on three more MC3 boards. Eight-way interleaving requires four MC3s.

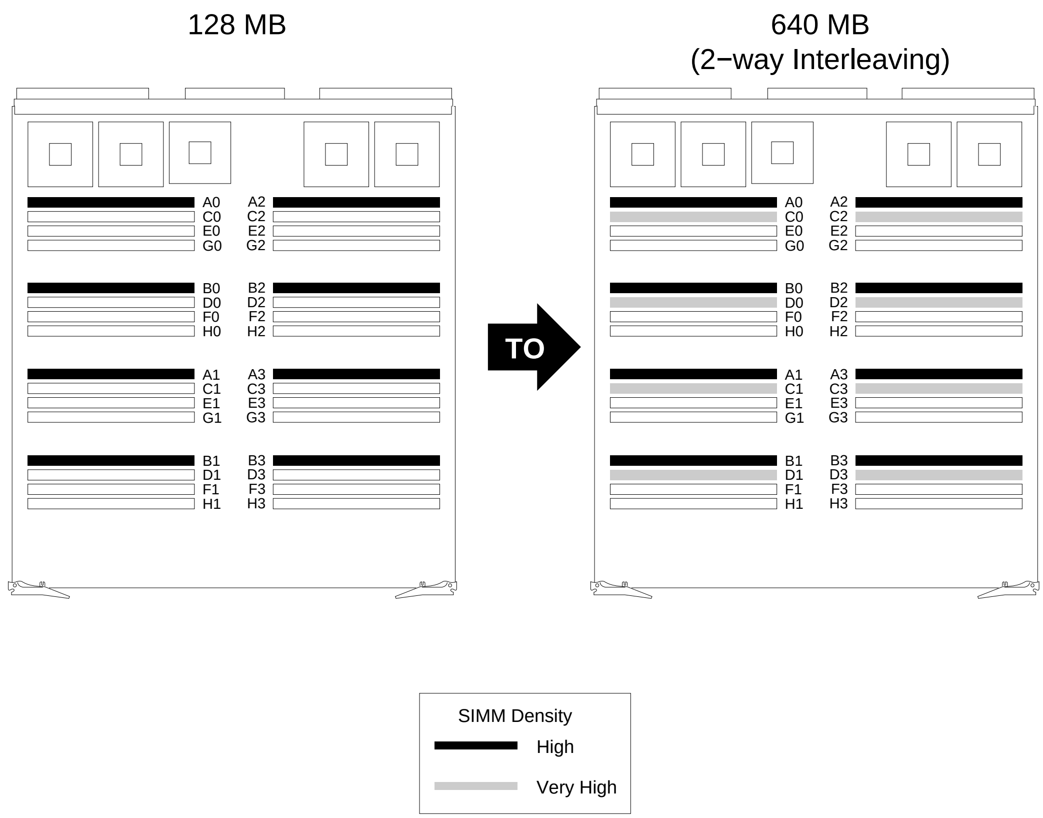


Figure C-14 128 MB to 640 MB (Two-way Interleaving)

Note: Add 512 MB using two banks of very high-density SIMMS (8 x 64 MB) into banks C and D.

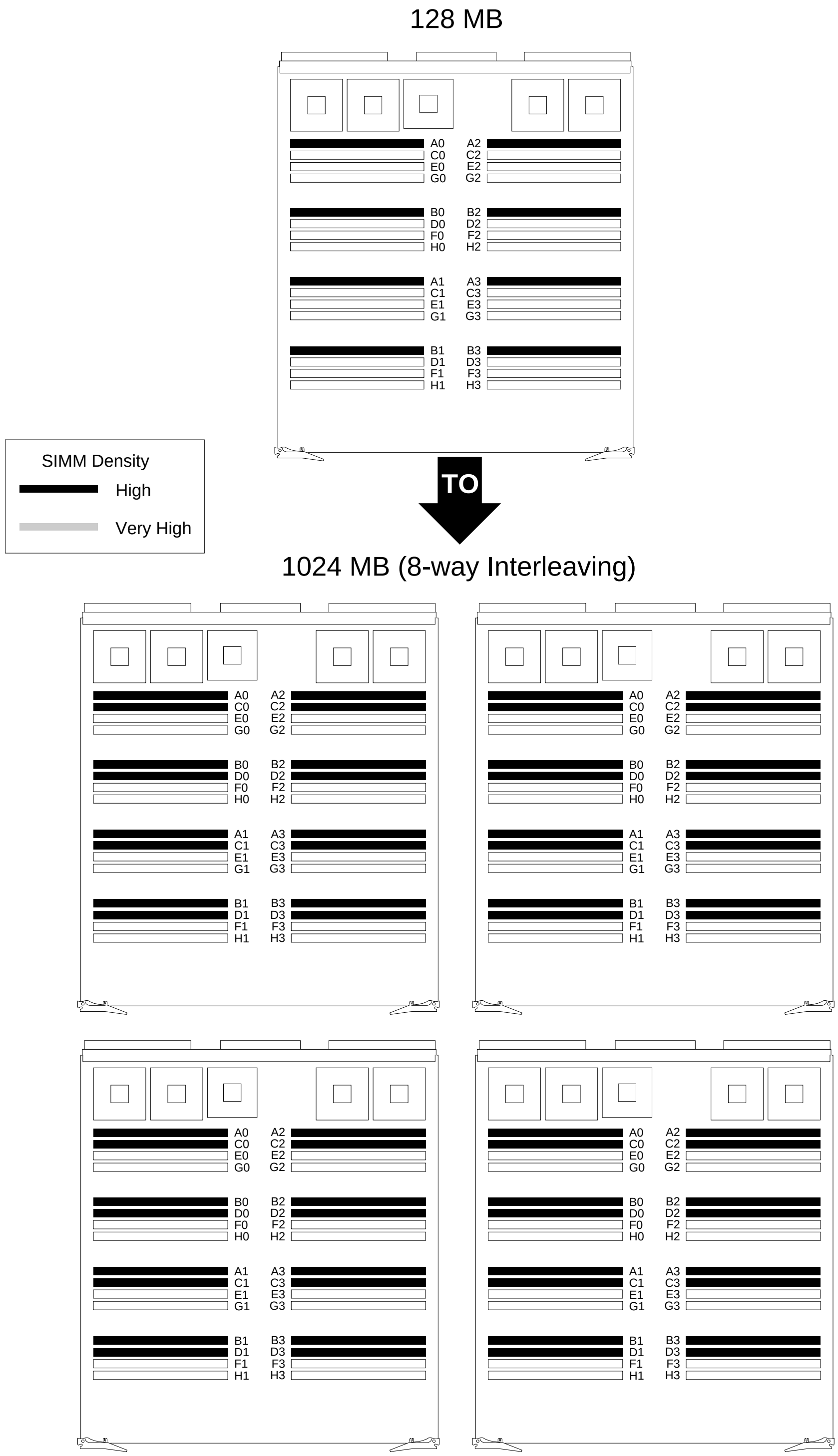


Figure C-15 128 MB to 1024 MB (Eight-way Interleaving)

Note: Add 896 MB using 14 banks of high-density SIMMs (56 x 16 MB) into banks A, B, C, and D on four MC3 boards.

Figure C-16 128 MB to 1280 MB (Four-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 1152 MB using two banks of high-density SIMMs (8 x 16 MB) into banks A and B on a second MC3 board. Then add four banks of very high-density SIMMs (16 x 64MB) into banks C and D of both MC3 boards.

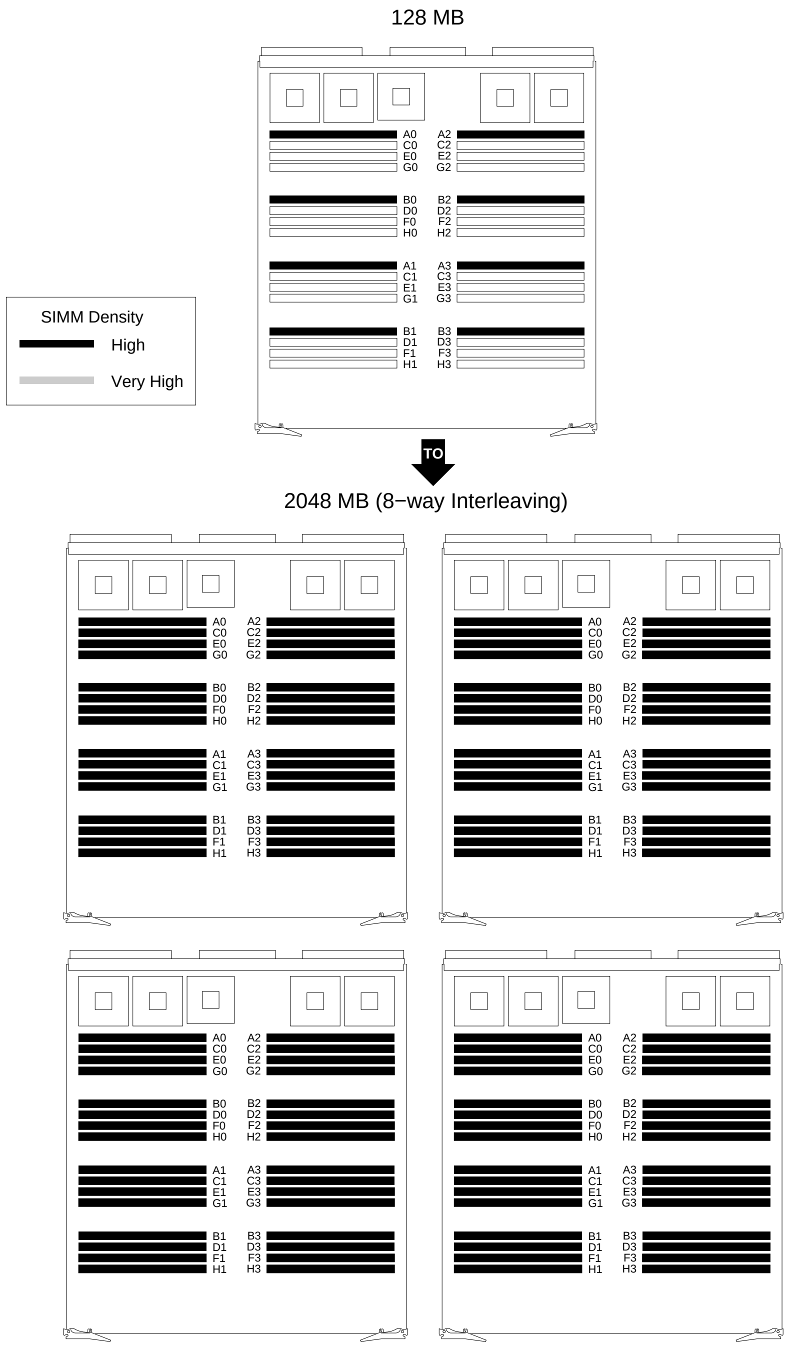


Figure C-17 128 MB to 2048 MB (Eight-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 1920 MB using 30 banks of high-density SIMMs (120 x 16 MB) into all the banks (A through H) on four MC3 boards.

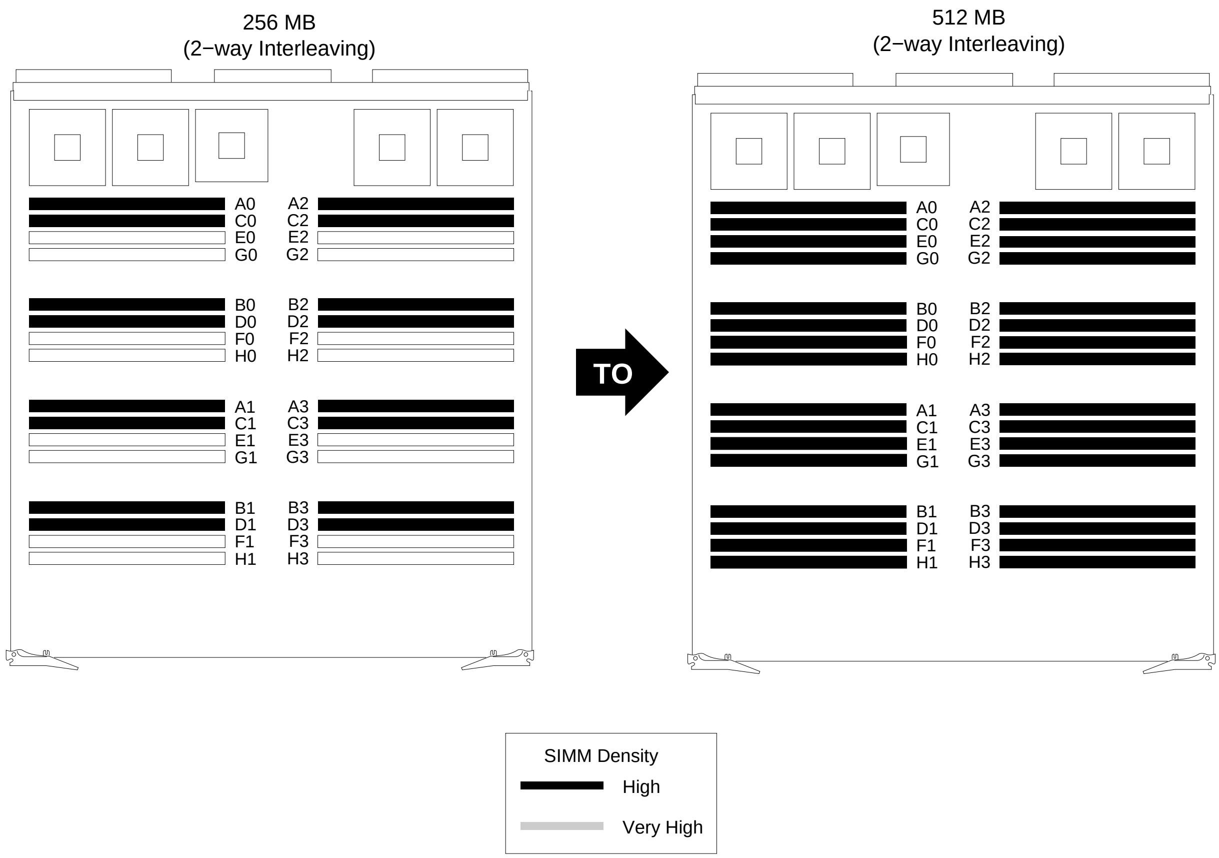


Figure C-18 256 MB (Two-way Interleaving) to 512 MB (Two-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 256 MB using four banks of high-density SIMMs (16 x 16 MB) into the remaining banks (E,F, G, and H) on the MC3 board.

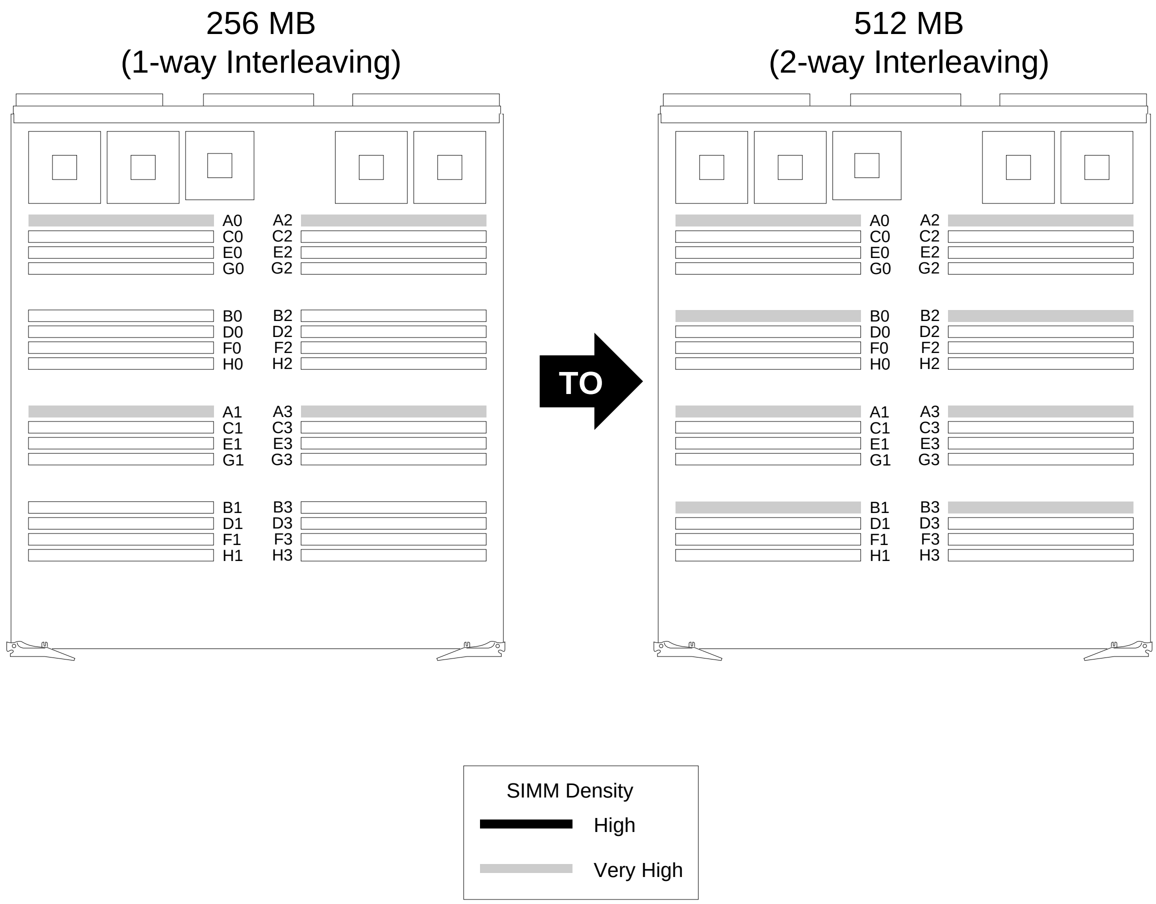


Figure C-19 256 MB (One-way Interleaving) to 512 MB (Two-way Interleaving)

Note: Add 256 MB using one bank of very high-density SIMMs (4 x 64 MB) into bank B.

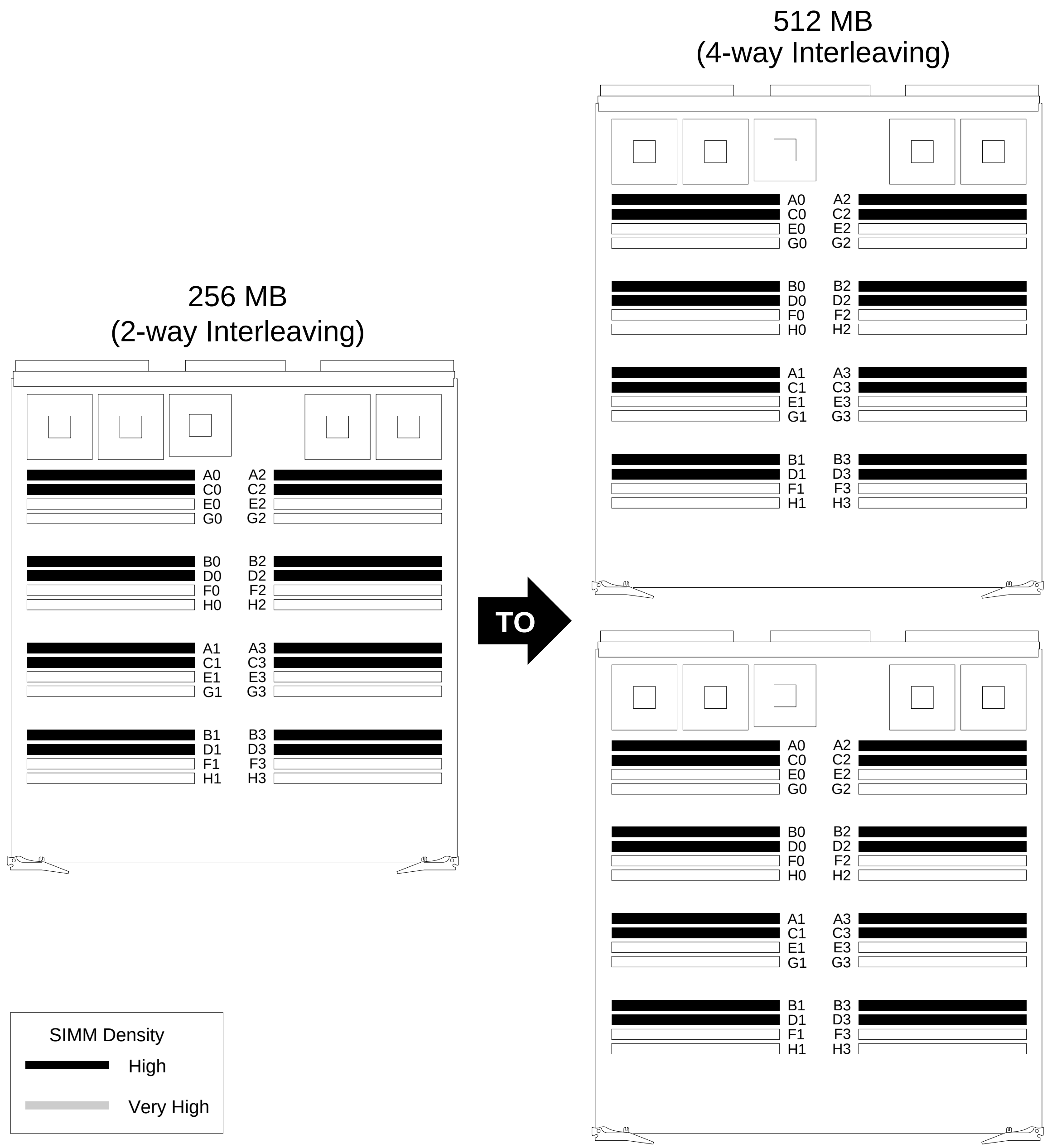


Figure C-20 256 MB (Two-way Interleaving) to 512 MB (Four-way Interleaving)

Note: Add 256 MB using four banks of high-density SIMMs (16 x 16 MB) into banks A and B on a second MC3 board.

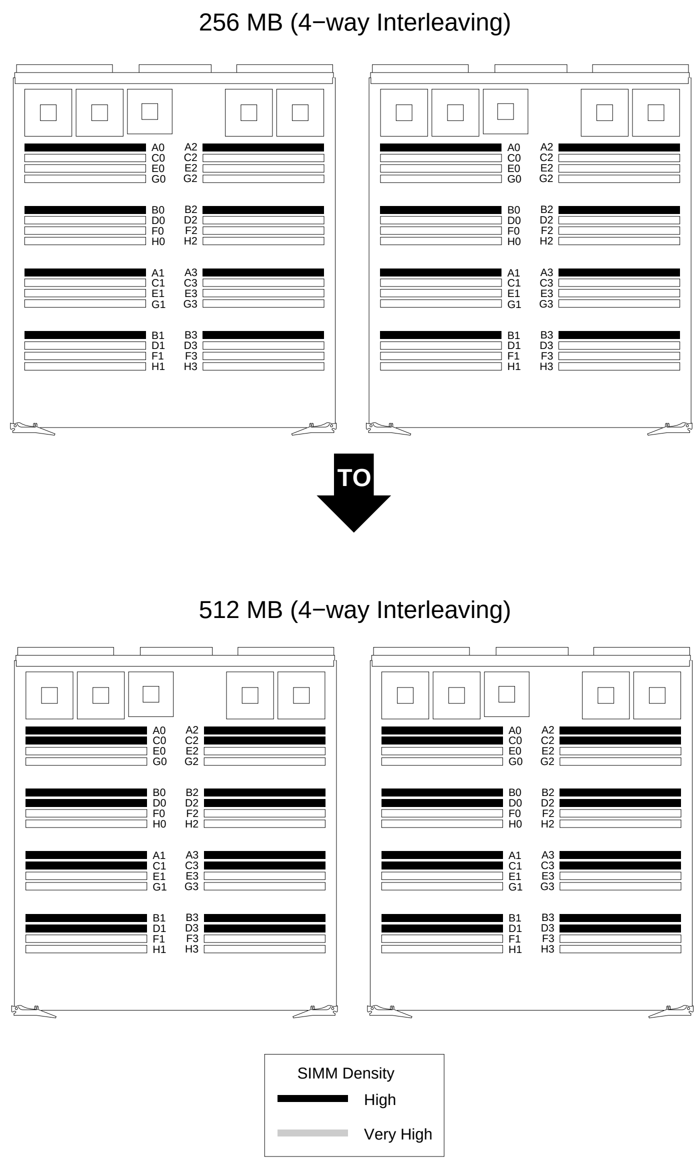


Figure C-21 256 MB (Four-way Interleaving) to 512 MB (Four-way Interleaving)

Note: Add 256 MB using four banks of high-density SIMMs (16 x 16 MB) into banks C and D on two MC3 boards.

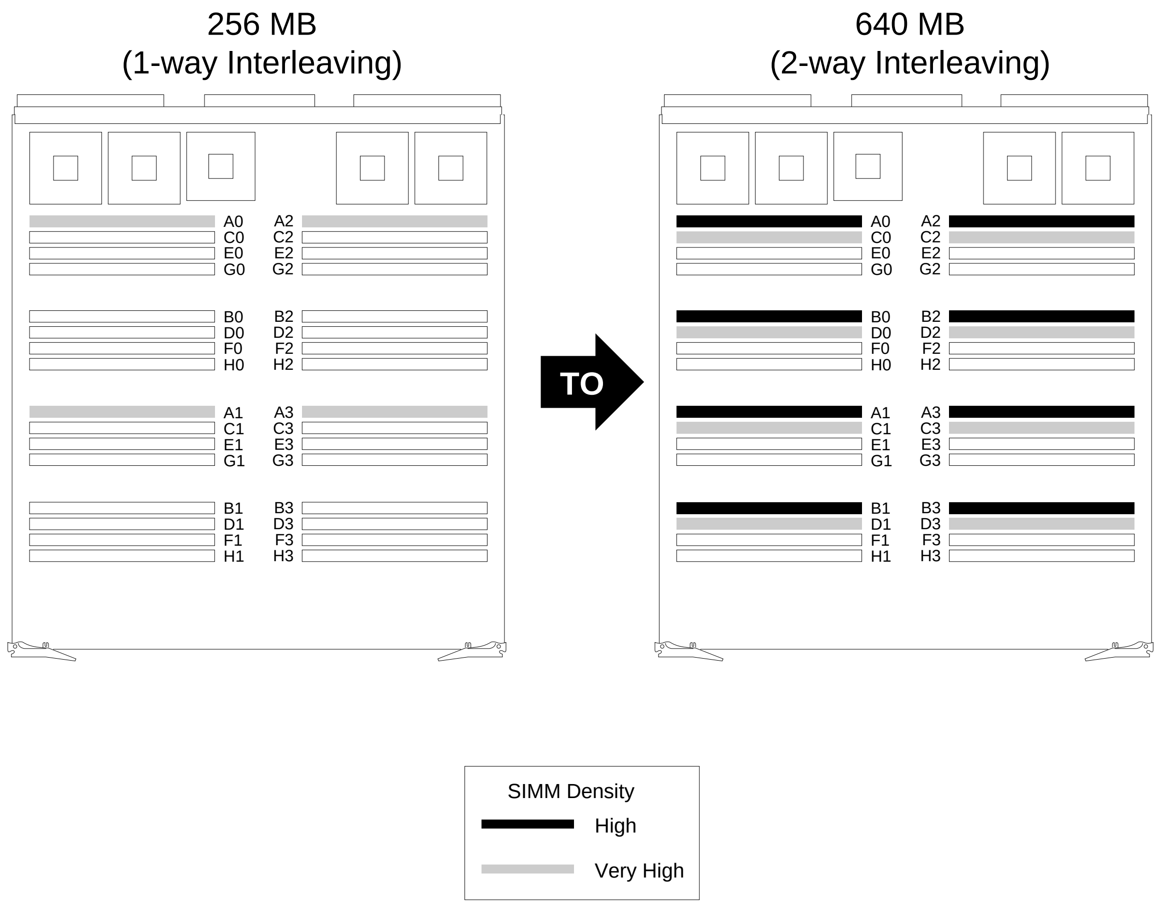


Figure C-22 256 MB (One-way Interleaving) to 640 MB (Two-way Interleaving)

Note: Add 384 MB using one bank of very high-density SIMMS (4 x 64 MB) into bank B and two banks of high-density SIMMs (8 x 16 MB) into banks C and D.

Figure C-23 256 MB (One-way Interleaving) to 1024 MB (Two-way Interleaving)

Note: Add 768 MB using three banks of very high-density SIMMS (12 x 64 MB) into banks B, C, and D.

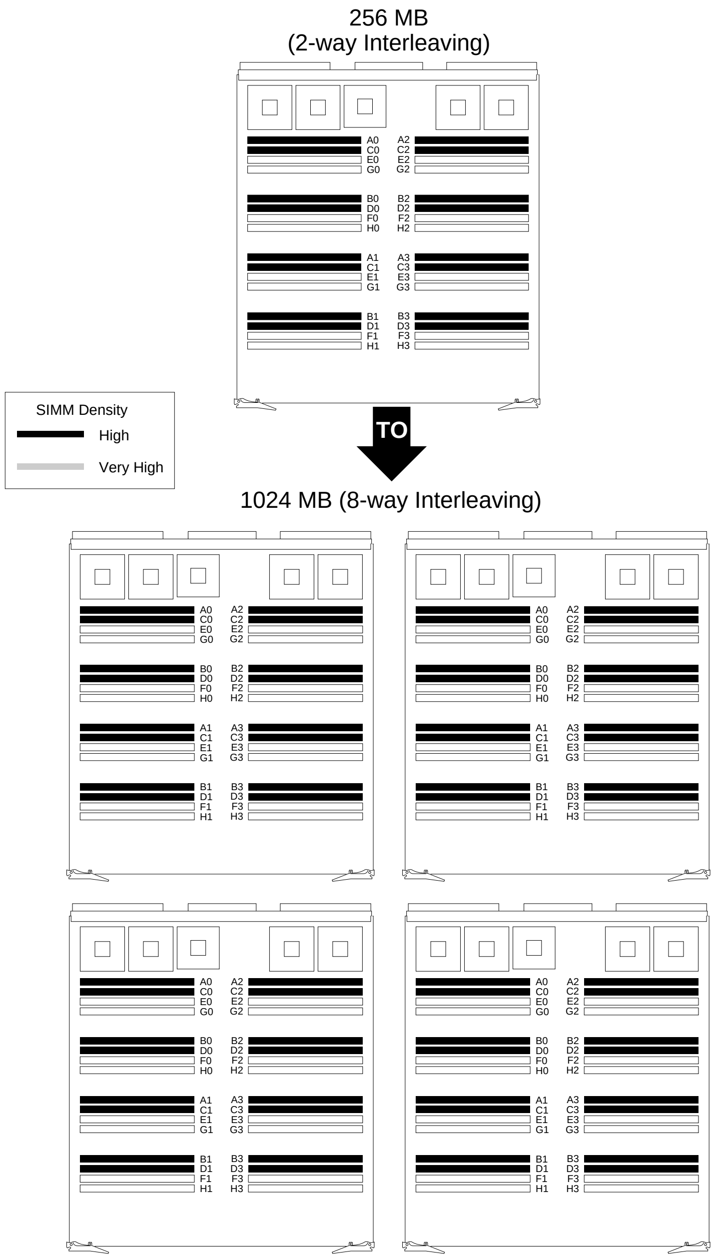


Figure C-24 256 MB (Two-way Interleaving) to 1024 MB (Eight-way Interleaving)

Note: Add 768 MB using 12 banks of high-density SIMMS (48 x 16 MB) into banks A, B, C, and D on three additional MC3 boards. Eight-way interleaving requires four MC3 boards.

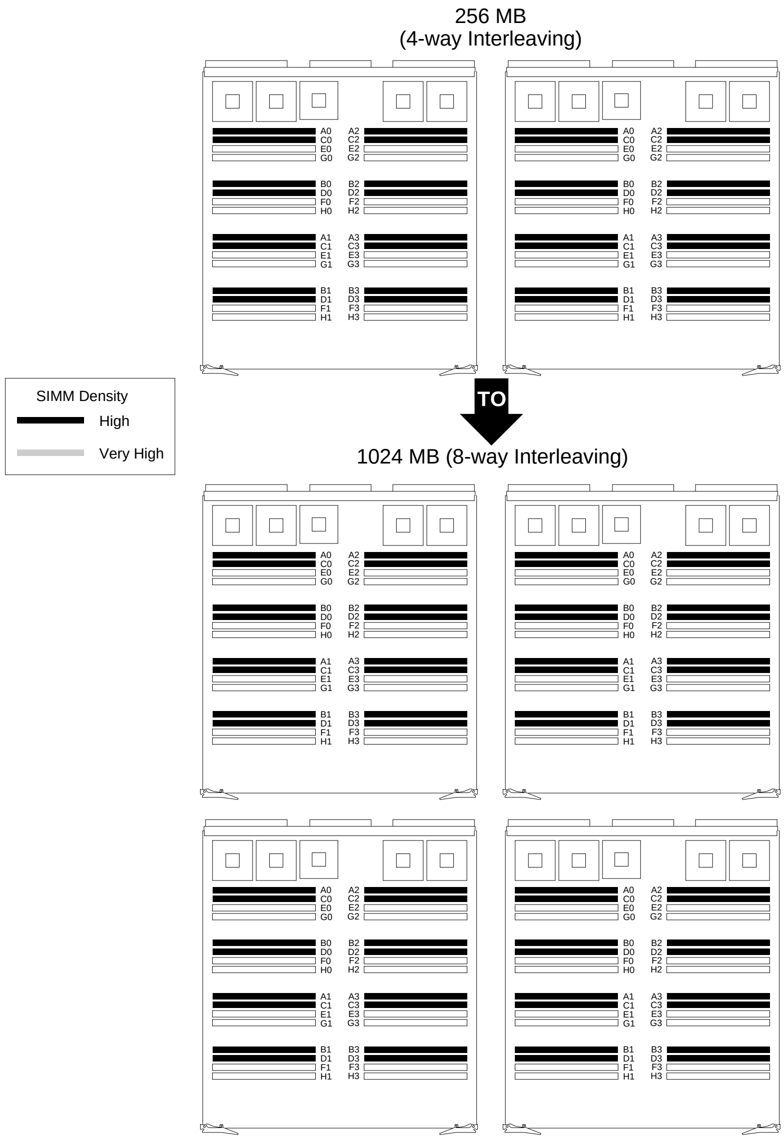


Figure C-25 256 MB (Four-way Interleaving) to 1024 MB (Eight-way Interleaving)

Note: Add 768 MB using 12 banks of high-density SIMMS (48 x 16 MB) into banks A, B, C, and D on two additional MC3 boards. Eight-way interleaving requires four MC3 boards.

Figure C-26 256 MB (One-way Interleaving) to 1280 MB (Four-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 256 MB using four banks of high-density SIMMS (16 x 16 MB) into banks C and D on two MC3 boards. Then add 768 MB using three banks of very high-density SIMMS (12 x 64 MB) into bank B on the first MC3 board and banks A and B on the second MC3 board.

Figure C-27 256 MB (Two-way Interleaving) to 1280 MB (Four-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Remove 128 MB of high-density SIMMs from banks A and B (8 x 16 MB) of the first MC3 board, and add them to Banks C and D on the second MC3 board. Then add 1024 MB using four banks of very high-density SIMMS (16 x 64 MB) into banks A and B of two MC3 boards.

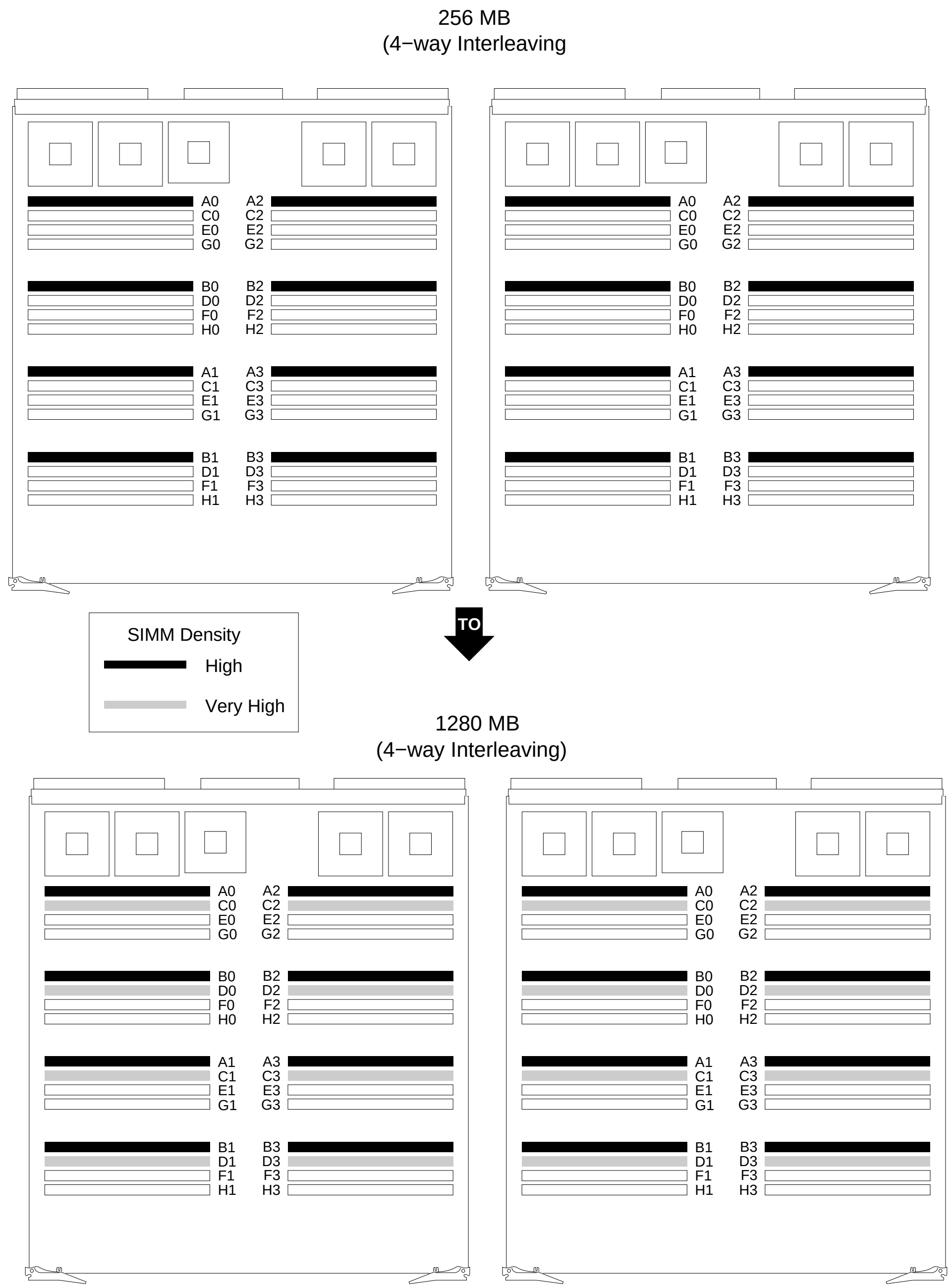


Figure C-28 256 MB (Four-way Interleaving to 1280 MB (Four-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 1024 MB using four banks of very high-density SIMMs (16 x 64 MB) into banks C and D of both MC3 boards.

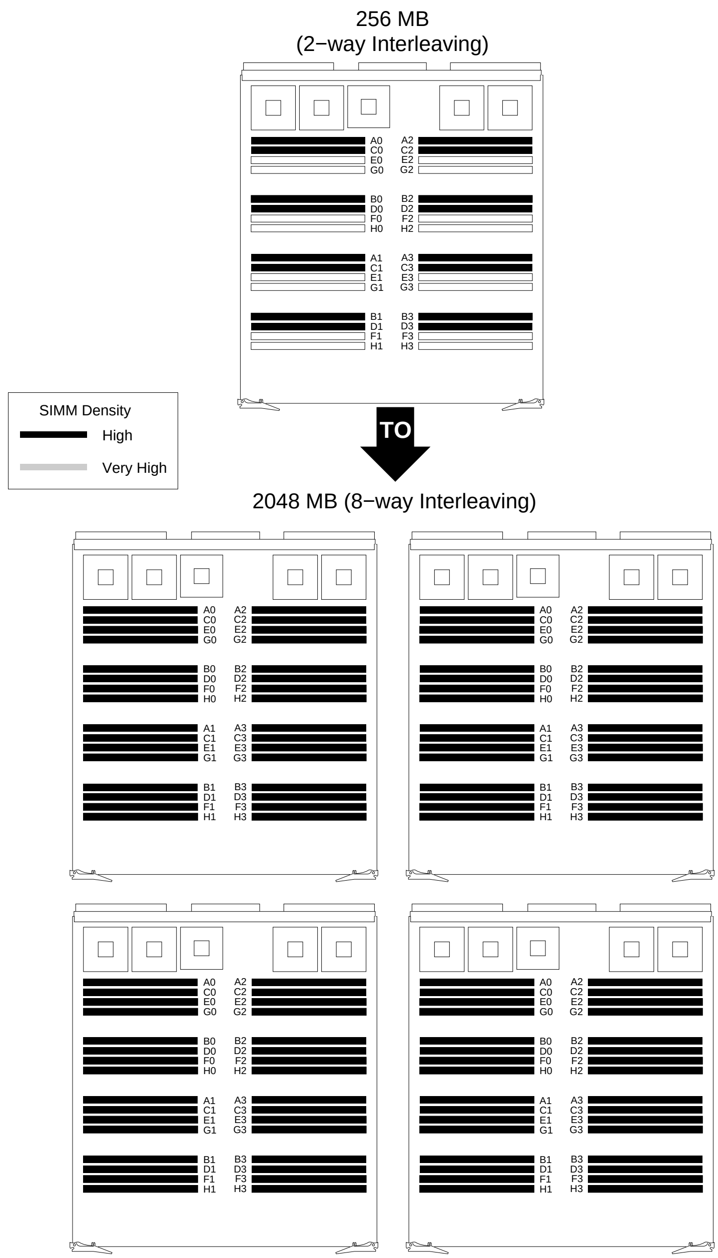


Figure C-29 256 MB (Two-way Interleaving) to 2048 MB (Eight-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 1792 MB of high-density SIMMS into all the available SIMM slots on 4 MC3 boards by adding 256 MB using four banks of high-density SIMMS (16 x 16 MB) into banks E, F, G, and H and the first MC3 board. Then add the remaining 1536 MB using 24 banks of high-density SIMMs (96 x 16 MB) into all the banks (A through H) on three additional MC3 boards.

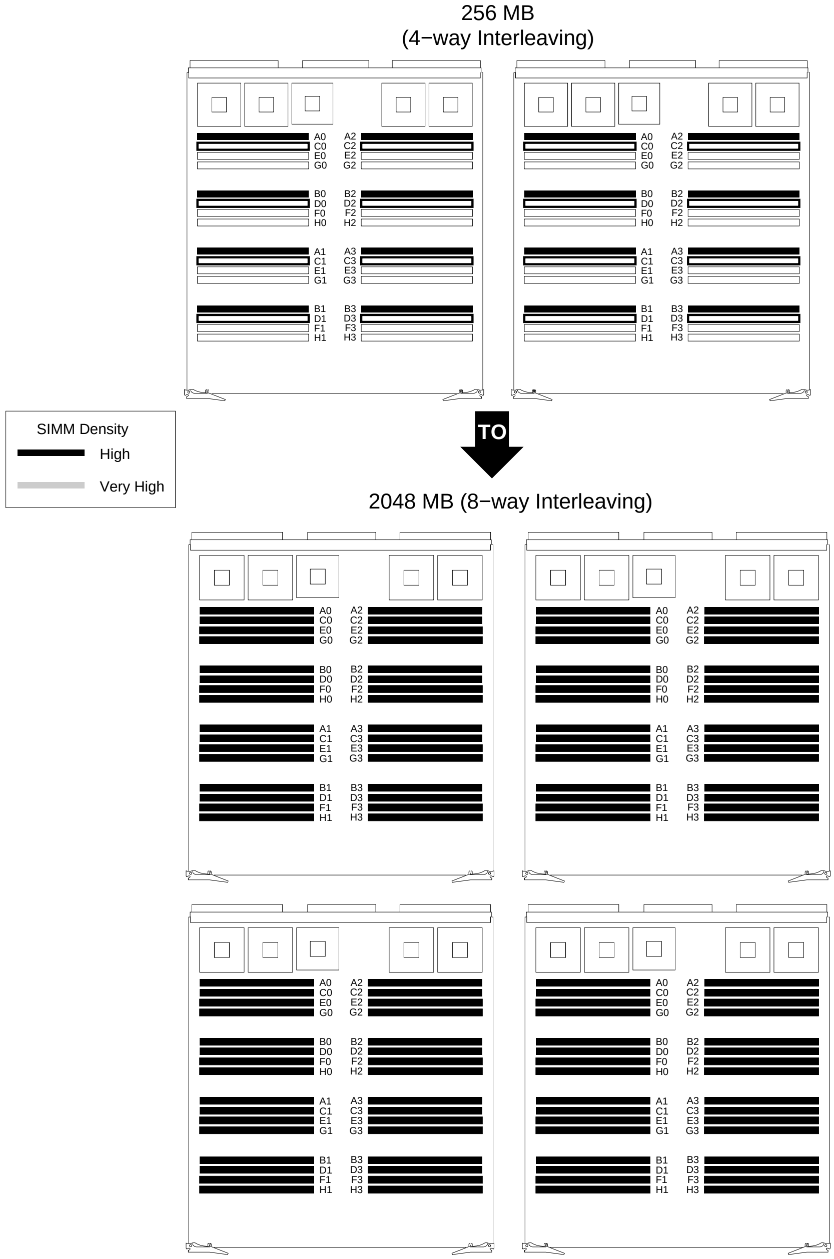


Figure C-30 256 MB (Four-way Interleaving) to 2048 MB (Eight-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 1792 MB of high-density SIMMS into all the available SIMM slots on four MC3 boards by adding 768 MB using 12 banks of high-density SIMMS (48 x 16 MB) into banks C, D, E, F, G, and H on the first two MC3 boards. Then add the remaining 1024 MB using 16 banks of high-density SIMMs (64 x 16 MB) into all the banks (A through H) on two additional MC3 boards.

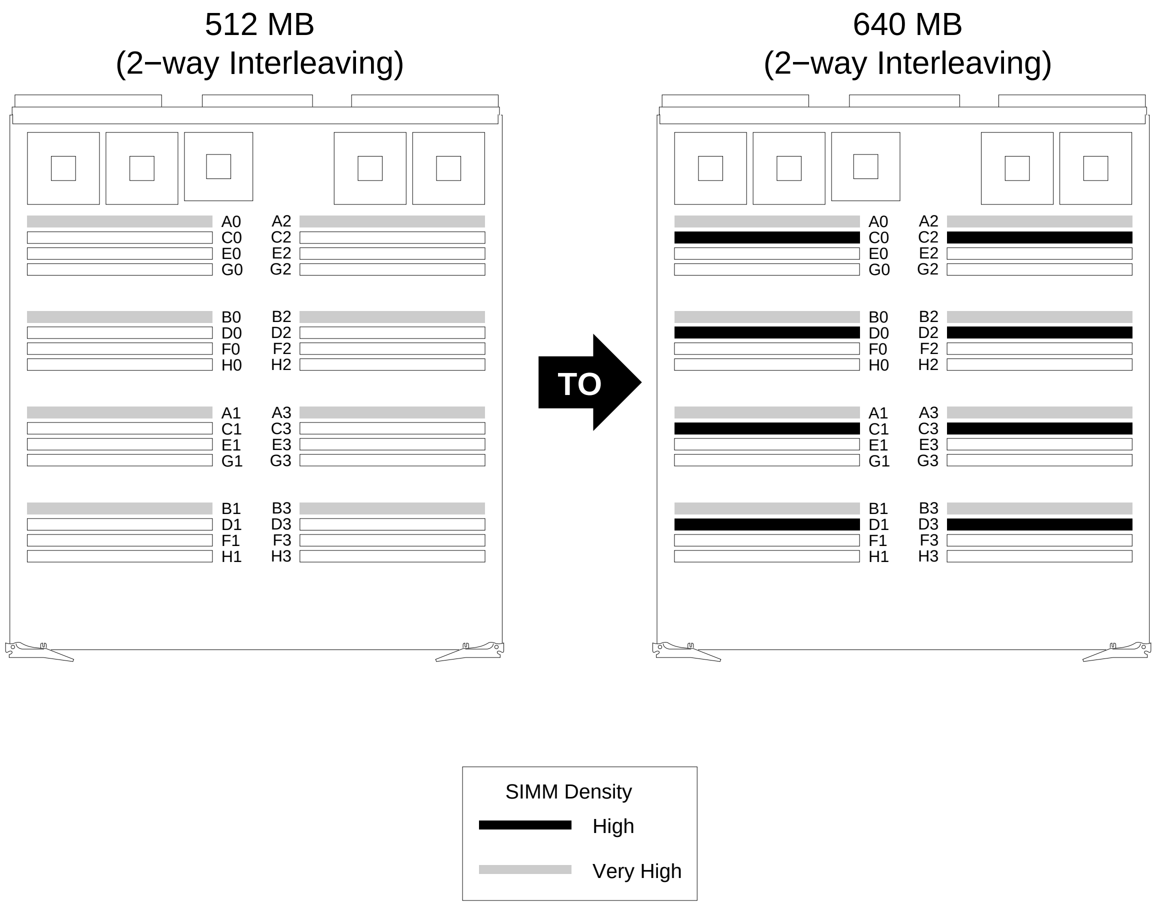


Figure C-31 512 MB (Two-way Interleaving) to 640 MB (Two-way Interleaving)

Note: Add 128 MB using two banks of high-density SIMMS (8 x 16 MB) into banks C and D.

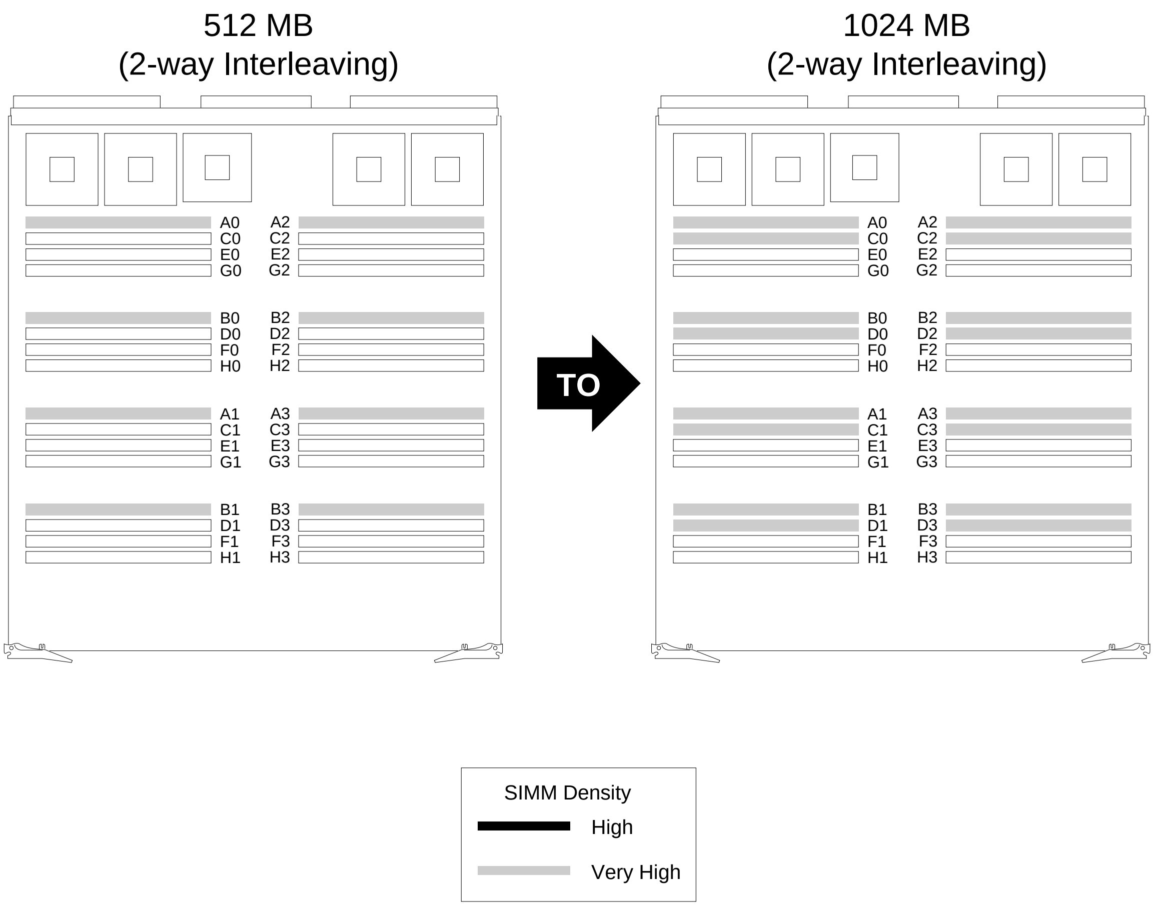


Figure C-32 512 MB (Two-way Interleaving) to 1024 MB (Two-way Interleaving)

Note: Add 512 MB using two banks of very high-density SIMMs (8 x 64 MB) into banks C and D.

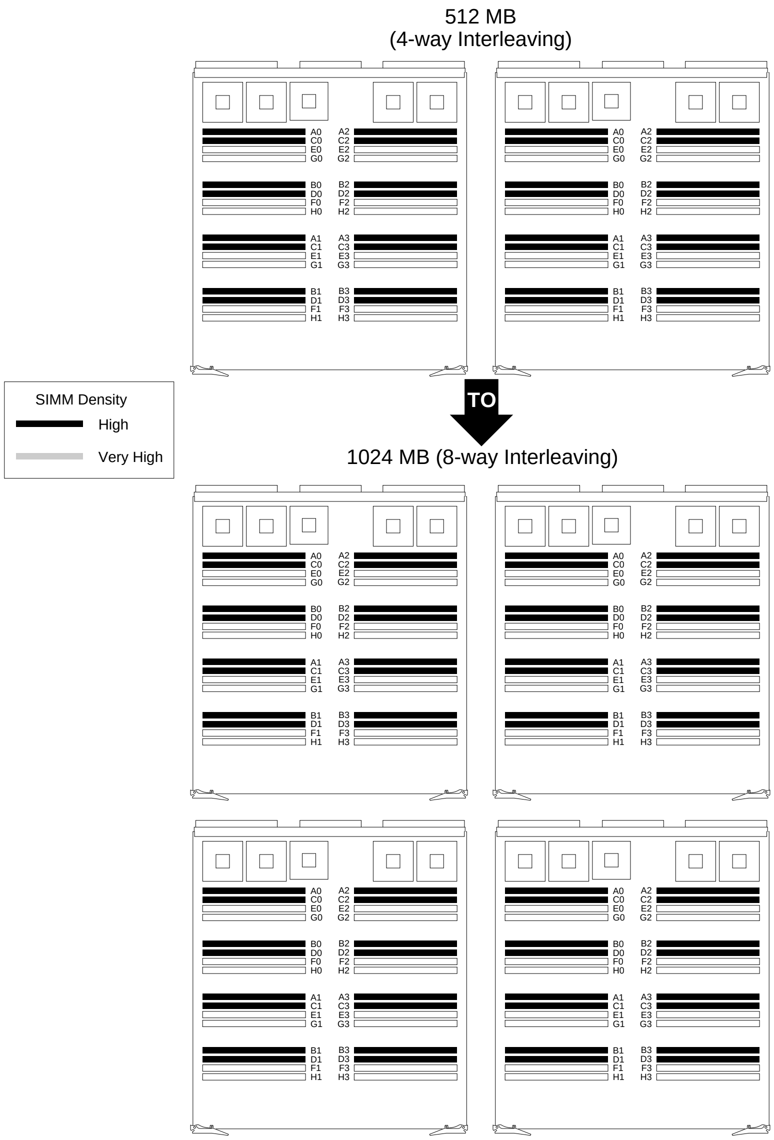


Figure C-33 512 MB (Four-way Interleaving) to 1024 MB (Eight-way Interleaving)

Note: Add 512 MB using sixteen banks of high-density SIMMs (64 x 16 MB) into banks A, B, C, and D on two additional MC3 boards. Eight-way interleaving requires four MC3 boards.

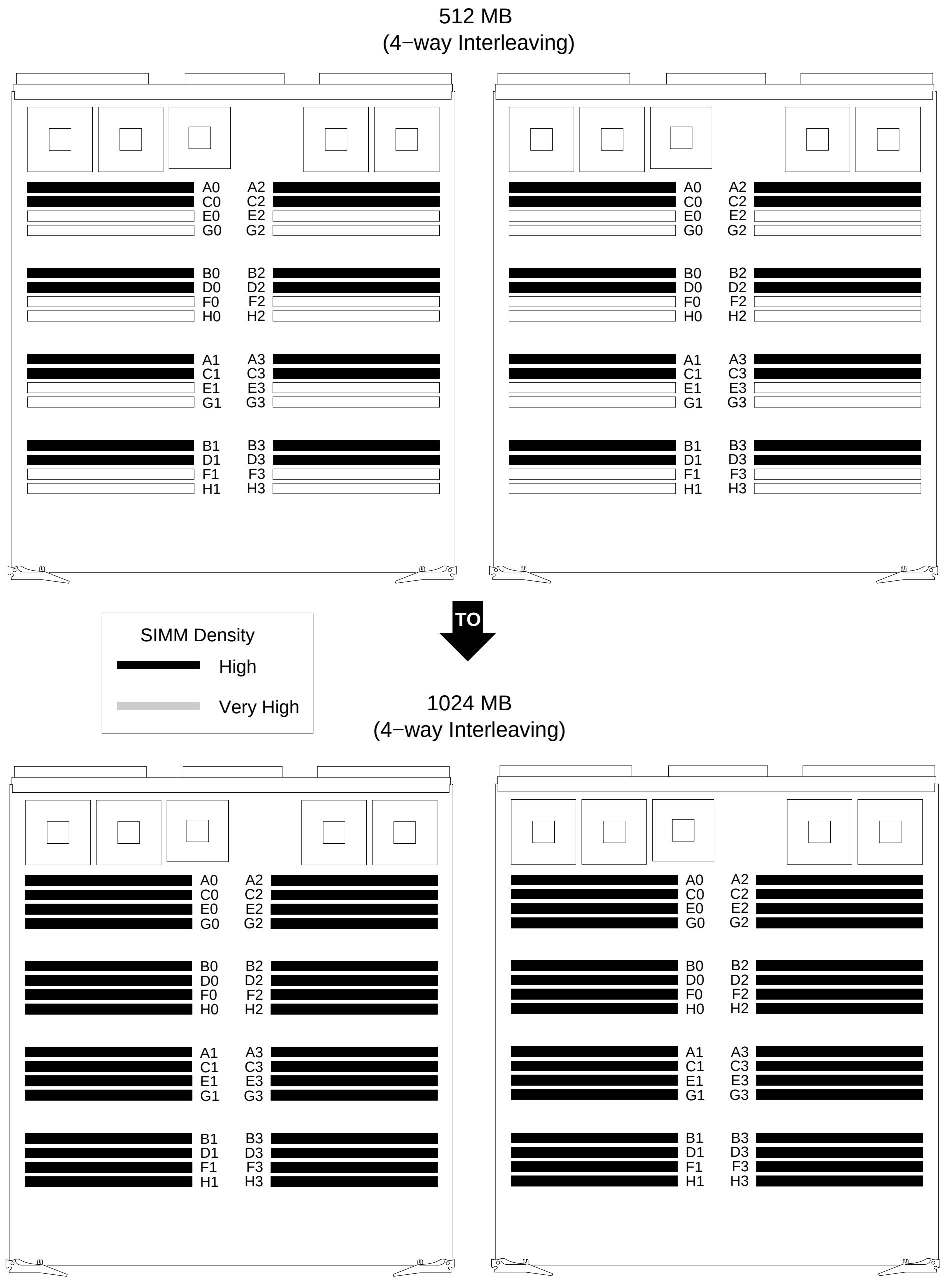


Figure C-34 512 MB (Four-way Interleaving) to 1024 MB (Four-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 512 MB using eight bank s of high-density SIMMs (32 x 16 MB) into the remaining SIMM slots (banks E through H).

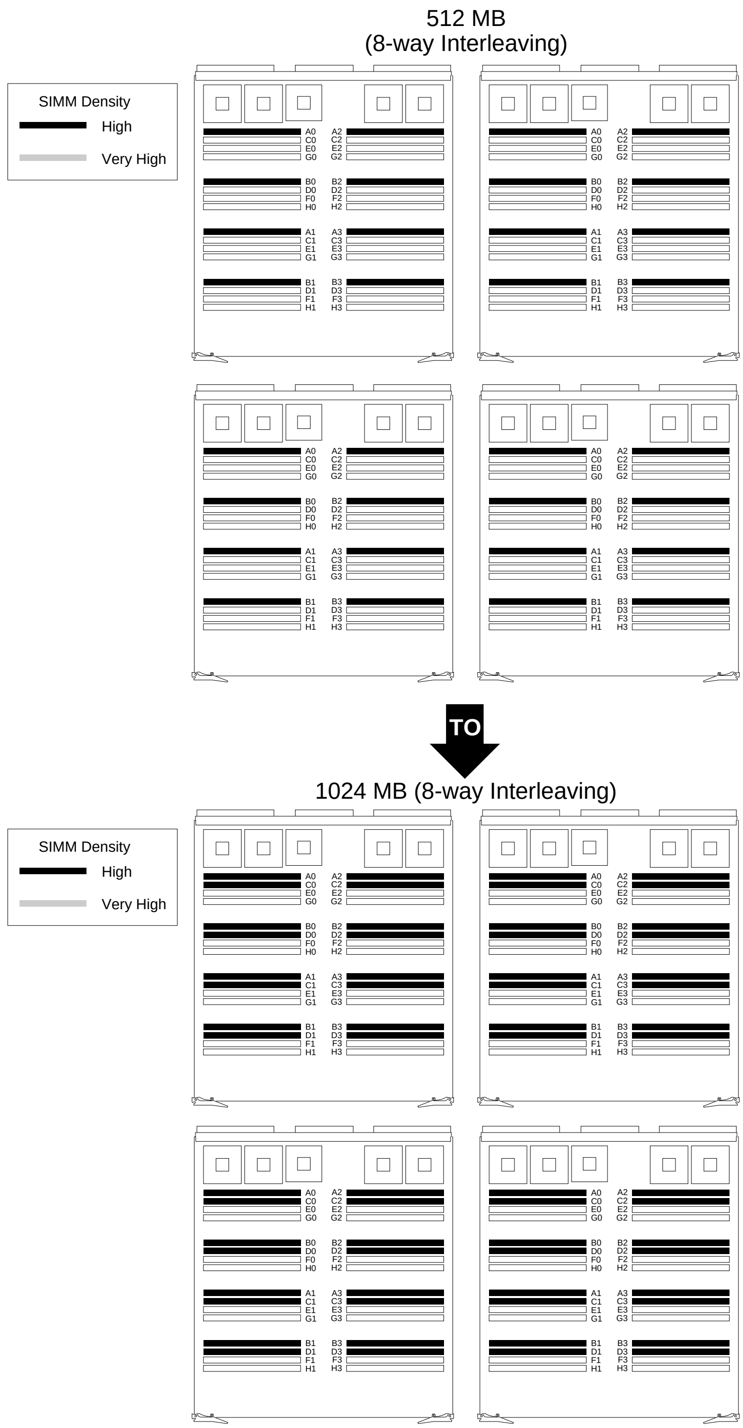


Figure C-35 512 MB (Eight-way Interleaving) to 1024 MB (Eight-way Interleaving)

Note: Add 512 MB using 16 banks (64 SIMMS) of high-density (16 MB) type into banks C and D on all four MC3 boards.

Figure C-36 512 MB (Two-way Interleaving) to 1280 MB (Four-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 768 MB of high-density SIMMS into two MC3 board, by adding 128 MB of high-density SIMMs (8 x 16 MB) into banks C and D on the first MC3 board and another 128 MB of high-density SIMMs (8 x16) into banks C and D on the second MC3 board. Then add two banks of very high-density SIMMs (8 x 64) into banks A and B on the two MC3 boards.

Figure C-37 512 MB (Four-way Interleaving) to 2048 MB (Eight-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 1536 MB of high-density SIMMS into all the available SIMM slots on 4 MC3 boards by adding 512 MB using eight banks of high-density SIMMS (32 x 16 MB) into banks E, F, G, and H and the first two MC3 boards. Then add the remaining 1024 MB using 16 banks of high-density SIMMs (64 x 16 MB) into all the banks (A through H) on two additional MC3 boards.

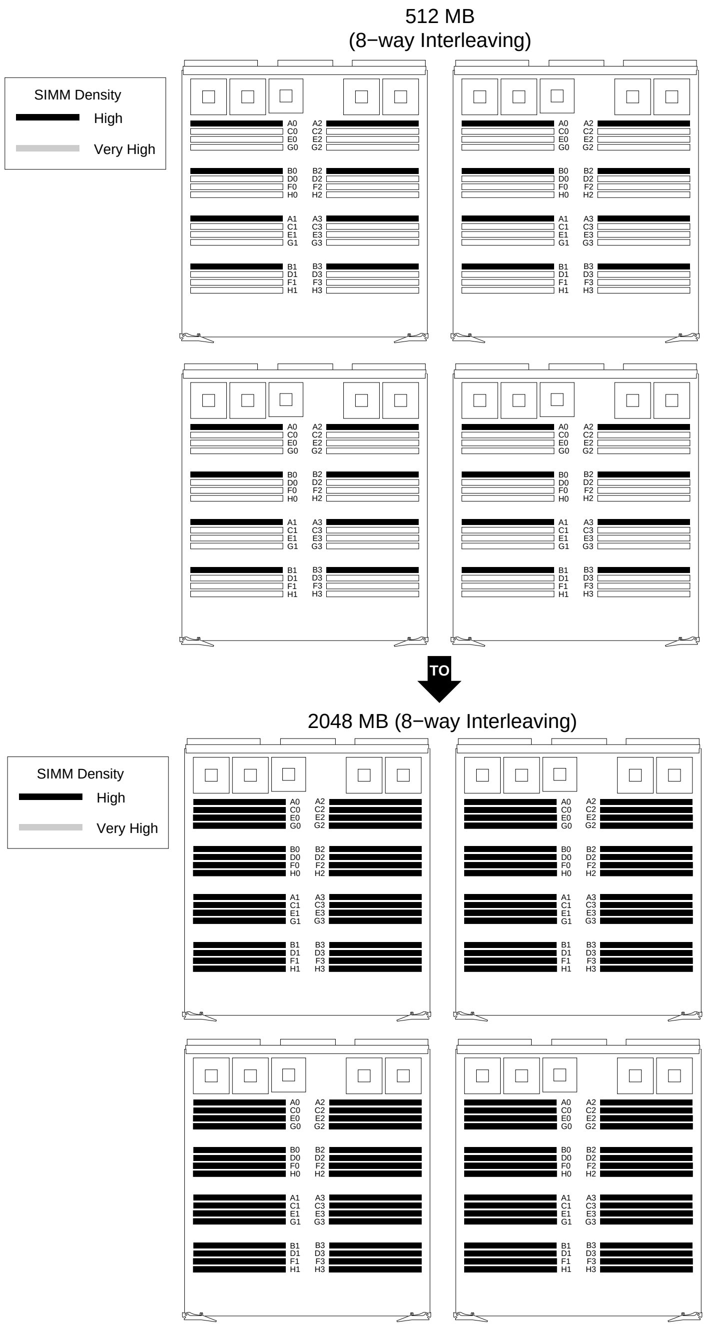


Figure C-38 512 MB (Eight-way Interleaving) to 2048 MB (Eight-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 1536 MB of high-density SIMMS into all the available SIMM slots on four MC3 boards by adding 512 MB using 24 banks of high-density SIMMS (96 x 16 MB) into banks C through H on all four boards.

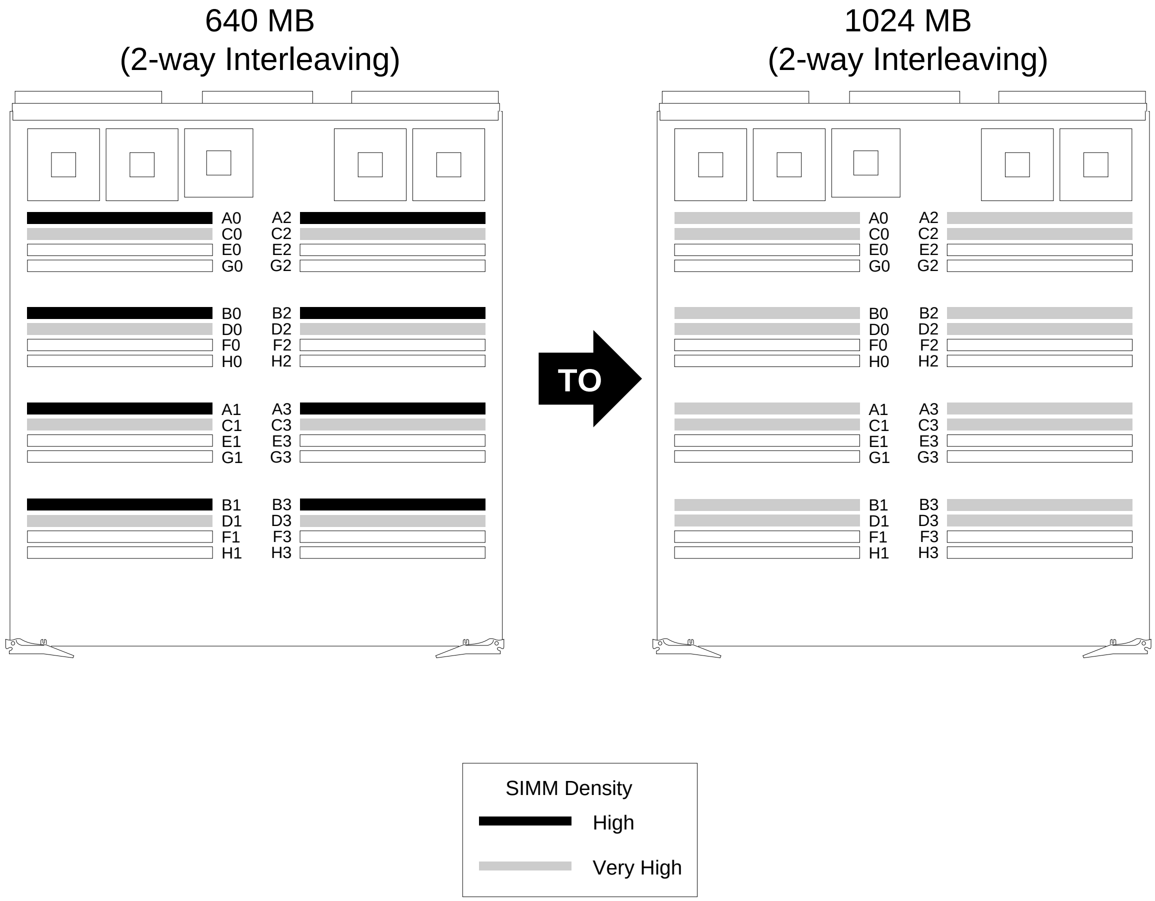


Figure C-39 640 MB to 1024 MB (Two-way Interleaving)

Note: Remove the two banks of high-density SIMMs (8 x 16 MB) and insert two banks of very high-density (8 x 64 MB) SIMMs into banks A and B.

Figure C-40 640 MB to 1280 MB (Four-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 640 MB to a second MC3 board by adding two banks of high-density SIMMs (8 x 16 MB) and two banks of very high-density SIMMs (8 x 64 MB).

Figure C-41 640 MB to 2048 MB (Four-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Remove 128 MB of high-density SIMMs from Banks A and B on the first MC3 board. Add 1536 MB of very high-density SIMMS (24 x 64 MB) on banks A, B, C, and D of two MC3 boards.

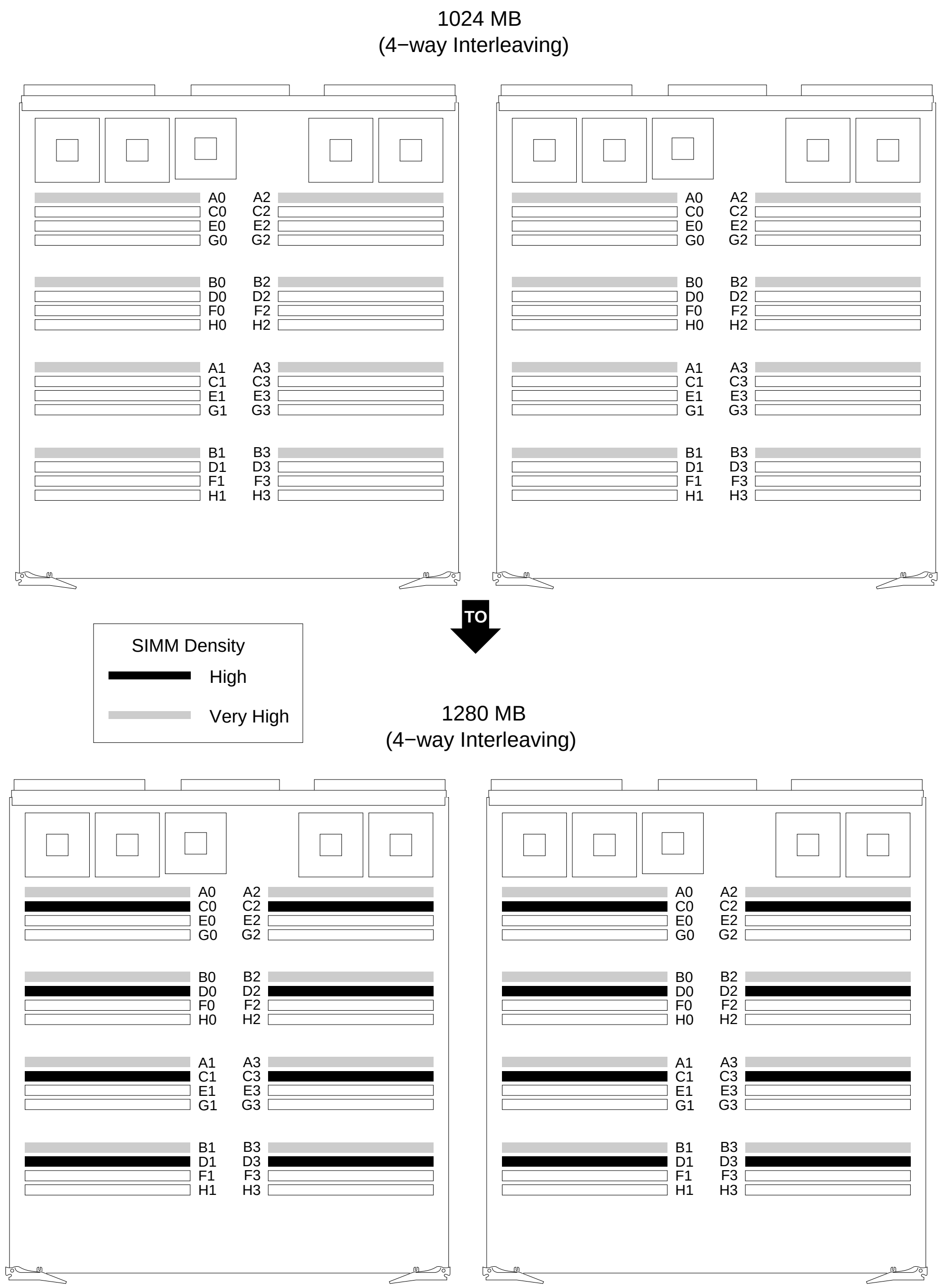


Figure C-42 1024 MB (Four-way Interleaving) to 1280 MB (Four-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 256 MB using four banks of high-density SIMMS (16 x 16 MB) to banks C and D on the two MC3 boards.

Figure C-43 1024 MB (Two-way Interleaving) to 2048 MB (Four-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 1024 MB using four banks of very high-density SIMMs (16 x 64 MB) into banks A and B on a second MC3 board.

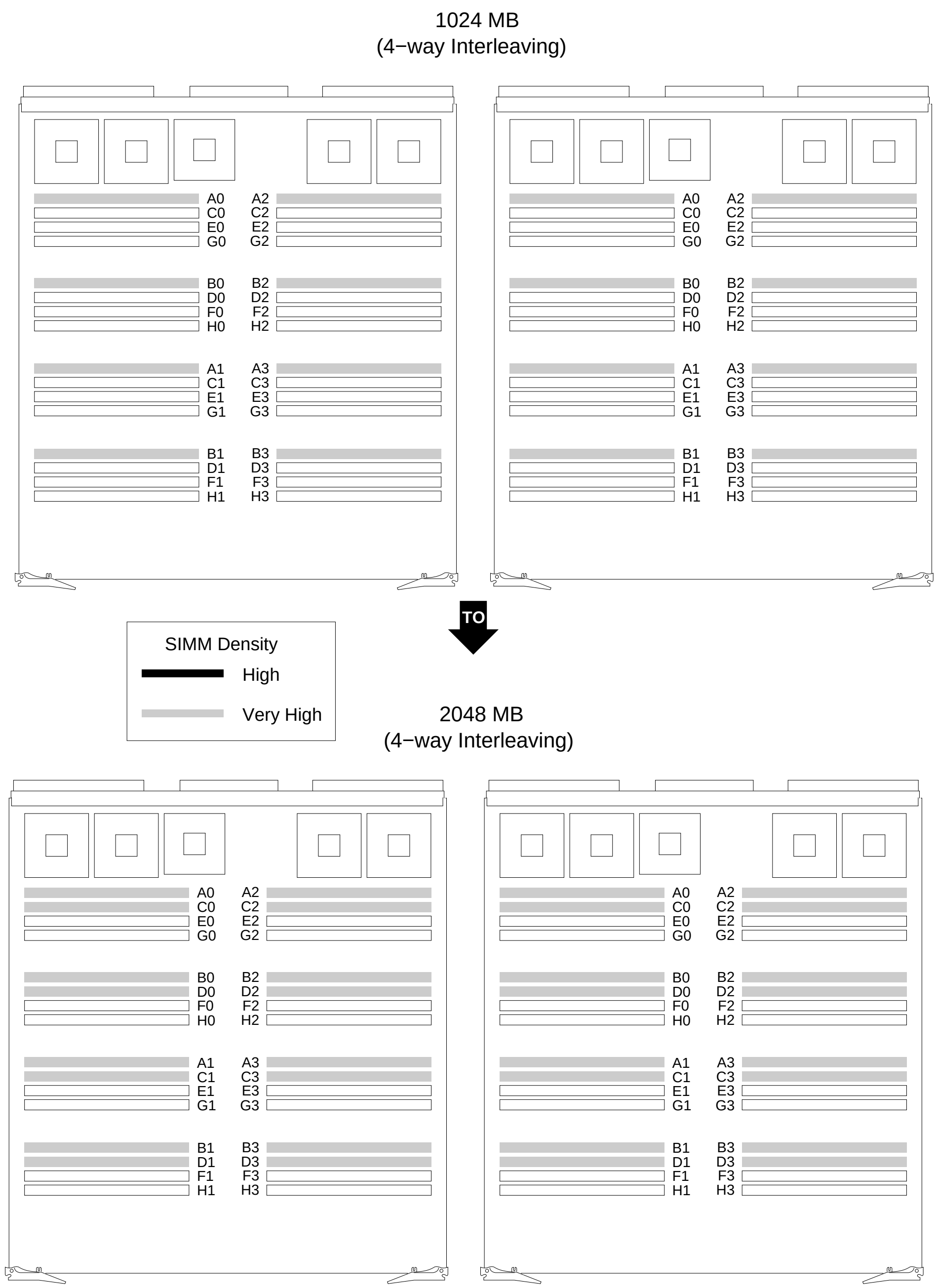


Figure C-44 1024 MB (Four-way Interleaving) to 2048 MB (Four-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 1024 MB using four banks of very high-density SIMMs (16 x 64 MB) into banks B and D on each MC3 board.

Figure C-45 1024 MB (Eight-way Interleaving) to 2048 MB (Eight-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Add 1024 MB using 16 banks of very high-density SIMMs (64 x 16 MB) on the remaining SIMM slots (banks D through H) on all four MC3 boards.

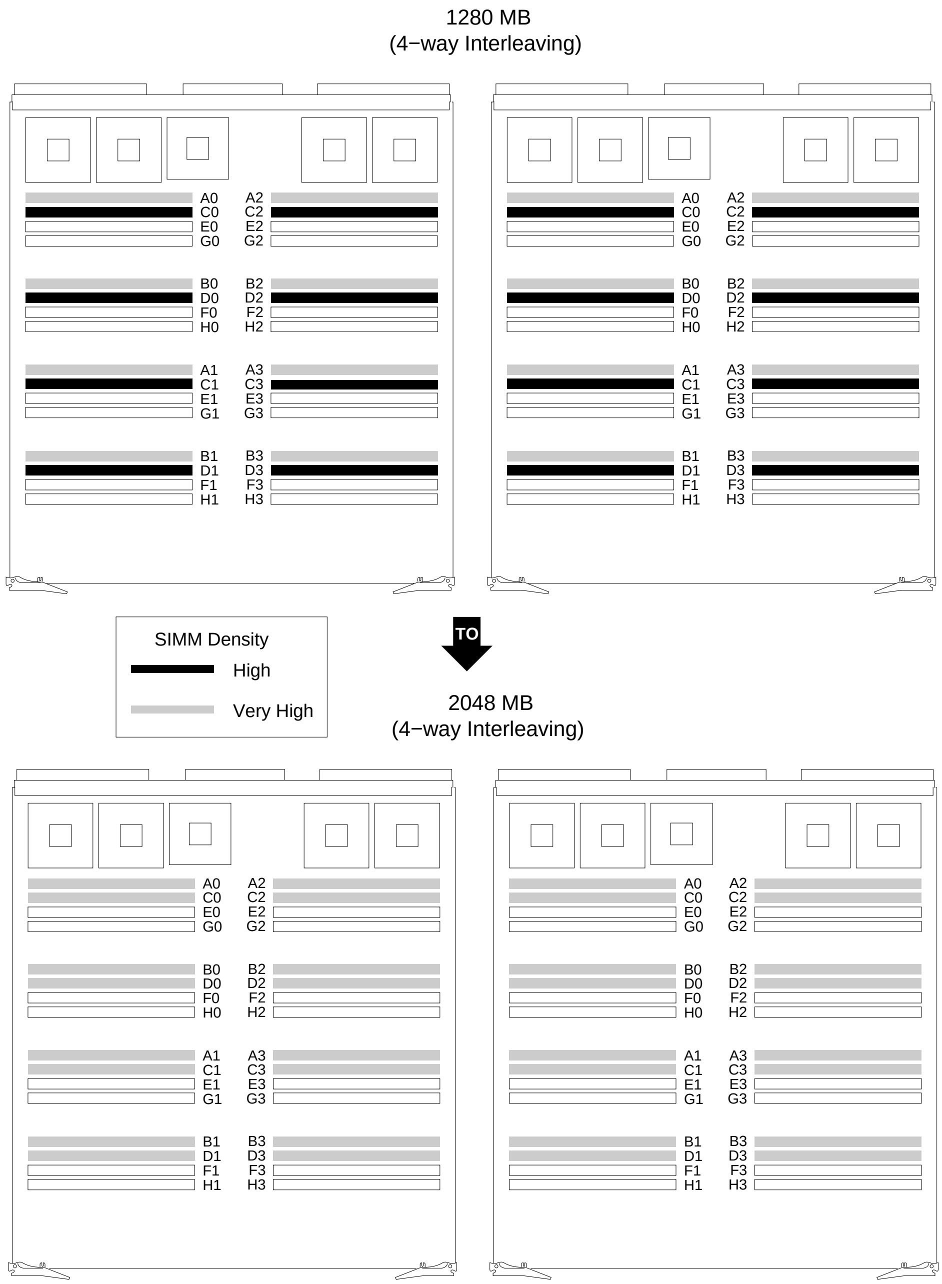


Figure C-46 1280 MB to 2048 MB (Four-way Interleaving)

Caution: This configuration is possible only on an MC3 board with a part number of 030-0245-008 or higher.

Note: Remove the high-density SIMMs (sixteen total) and replace them with sixteen very high-density SIMMS (16 x 64 MB).

Appendix D

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.

D.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 dirty drive heads need cleaning, the units may exhibit either read or write errors.

Use only an approved cleaning kit. A cleaning kit can only be used 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, because those cassettes are not recognized by the drives covered in this guide.

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

The Archive Python 4320 NT provides 1.3 GB 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.

D.2.1 Loading and Unloading Cassettes

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

When you load a cassette, 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.

D.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 the cleaning cassette, and then loads and runs it. 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 up 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.

D.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.

D.2.4 The 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 D-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).

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

LED	Action	Meaning
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 D-1 (continued) 4-mm DAT Drive Front Panel LEDs

D.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.

D.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 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.

D.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.

D.3.3 The 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 D-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 D-2 8-mm Tape Drive Front Panel LEDs

D.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 damage it. 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 D-1). Touching and scratching the bottom of the disc can mar the finish and degrade the optical readability of the medium. Do not write on, label, or mark any surface of the compact disc. An auto-eject occurs when a dirty or scratched disc (or a disc placed in the operating case caddy, label-side down) is inserted.

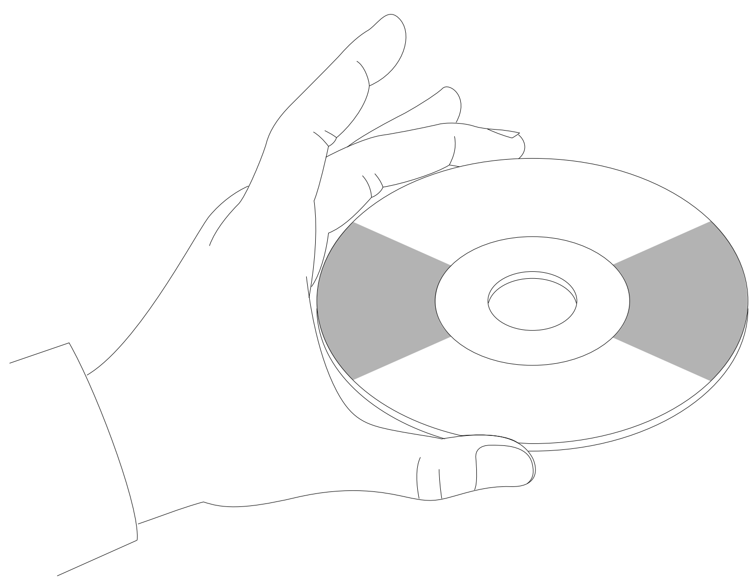


Figure D-1 Handling a Compact Disc

D.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 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

D.4.2 CD-ROM Front Panel Operational Features

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

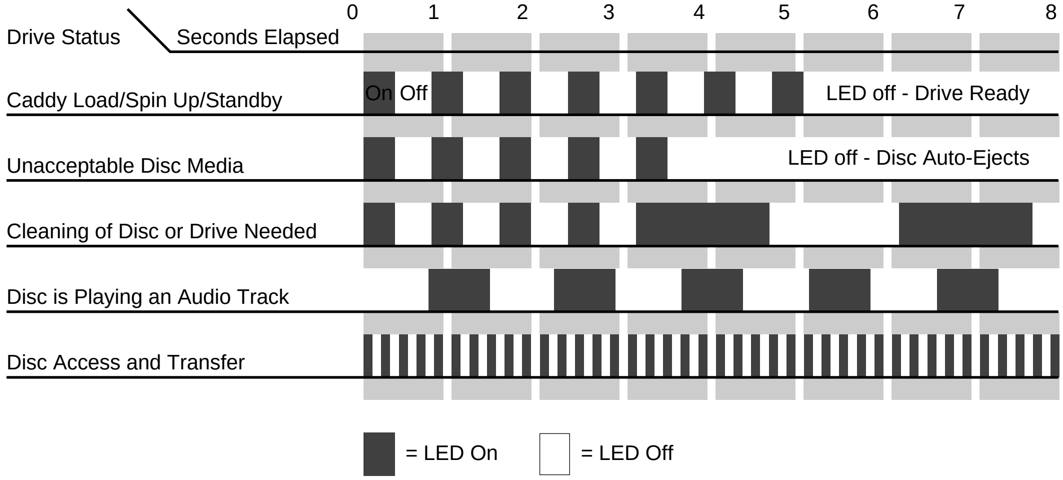
- The *headphone jack* accepts a 3.5-mm-diameter stereo plug. Monitoring of audio signals is available.
- The *volume control knob* (located to the right of the headphone jack) adjusts the sound level of the headphones.
- An *emergency eject hole* (located just above the volume control) ejects the caddy 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 D-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 D-2 CD-ROM Drive LED Status Indicators

D.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, nonfibrous cotton swab in either tape head cleaning fluid or Freon-TF and wipe the tape head (see Figure D-3).
4. Use a second clean swab and wipe the head again to remove any residue.

Caution: Do not use cotton swabs with wooden stems. The tip of the swab can break off and become lodged in the tape drive.

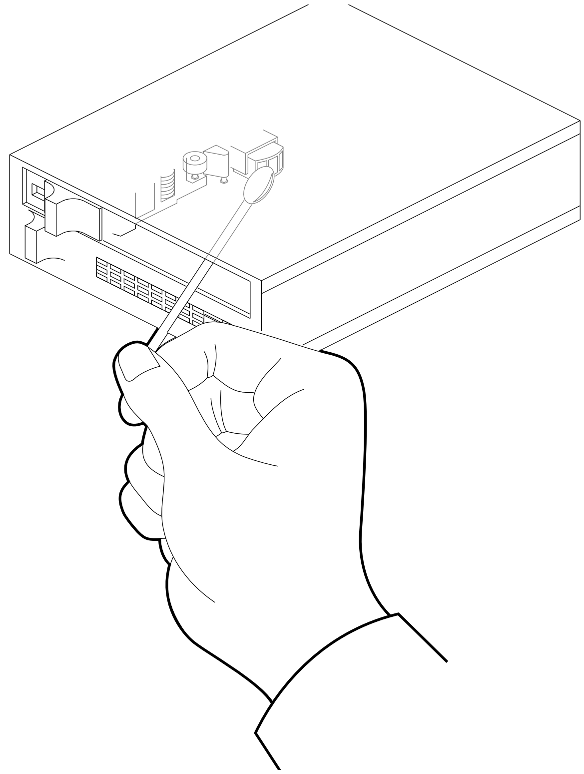


Figure D-3 Tape Head Cleaning

Numbers

A

B

C

D

E

F

S

T

U

V