Origin™ FibreVault and Fibre Channel RAID Installation Instructions

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Document Number 108-0154-003

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About This Guide

The FibreVault and Fibre Channel RAID (redundant array of independent disks) enclosure storage systems provide a compact, high-capacity, high-availability source of disk storage for Silicon Graphics Origin2000 servers and Onyx2 supercomputing graphics workstations. The fibre channel enclosures mount in deskside towers or rack systems.

The fibre channel storage system uses disk technology that allows you or the customer to replace a disk while the system and enclosure(s) continue to run. This type of "hot swapping" must be done only under controlled circumstances.

The enclosures in a Fibre Channel Rack can be connected to one or more host system fibre channel XIO boards separately or in combination (loop). Support for RAID functionality levels in this release depend on hardware and software configurations ordered by the customer.

A command-line interface is used to administer and monitor the non-RAID fibre channel disk (also known as JBOD) arrays. A JBOD ("just a bunch of disks") array has no RAID abilities or restrictions. In addition to a command-line interface, a graphical user interface is also available for administering fibre channel RAID disk arrays. For complete information on these command line interfaces, see the *Origin FibreVault and Fibre Channel RAID Administrator's Guide* (007-3715-*xxx*).

Audience

This document is for use by Silicon Graphics trained and authorized service personnel only. The information is structured for an installer with knowledge of the Origin2000 and Onyx2 product lines. For detailed installation information on the host systems, see the *Origin2000 and Onyx2 Deskside and Rackmount Installation Instructions* (108-0155-004 or later).

Installers interested in additional information regarding fibre channel technology should read the *Origin FibreVault and Fibre Channel RAID Owner's Guide* (007-3428-*xxx*).

Structure of This Document

This guide contains the following chapters and appendixes:

- Chapter 1, “Fibre Channel Components,” illustrates and describes all field-replaceable (FRU) fibre channel components.
- Chapter 2, “Installing a Fibre Channel Option Board in a Host,” explains how to install the Fibre Channel XIO and peripheral connector interface (PCI) option boards in an Origin2000 or Onyx2 host system.
- Chapter 3, “Setting Up a Fibre Channel Rack,” describes how to set up a Fibre Channel Rack and how to add or replace enclosures in a rack.
- Chapter 4, “Setting Up a FibreVault or Fibre Channel RAID Deskside System,” explains how to unpack and set up these systems.
- Chapter 5, “Checking the Installation and Installing and Configuring the Software,” explains how to install the software, start the RAID and JBOD agents, and enable command-tagged queuing.
- Chapter 6, “Installing and Replacing Components in Rackmount and Deskside DAEs and DPEs,” explains how to add and replace components of rack-mounted and deskside fibre channel enclosures.
- Chapter 7, “Installing and Replacing Components in a Fibre Channel Rack,” describes remove and replace procedures for the Fibre Channel Rack’s standby power supply (SPS) and its power distribution unit (PDU).
- Chapter 8, “Installing a Non-RAID FibreVault in the Origin Rack,” describes FibreVault installation in an Origin data rack. Configuration and cabling information is provided.
- Chapter 9, “Upgrading Licensed Internal Code and PROM Code,” explains how to upgrade the licensed internal code and PROM code.
- Appendix A, “Technical Specifications,” summarizes technical and site installation information for the fibre channel disk modules, enclosures, and rack.
- Appendix B, “Error Recovery and Event Log Error Codes,” gives instructions on restarting the agent, re-establishing communication with an array, and recovering from an incorrect bind, and explains the error codes that appear in the SP event log.
- Appendix C, “Measuring Templates for NEMA Units,” contains templates for measuring the spaces required for fibre channel enclosures in the Fibre Channel Rack.

An index completes this guide.

Other Documentation

Configuring (binding) disks into RAID types is explained in the *Origin FibreVault and Fibre Channel RAID Administrator's Guide*, which is included in Fibre Channel enclosure shipments. You must have access to this manual to bind disks for the customer.

If possible, you should also bring the *Origin2000 and Onyx2 Deskside and Rackmount Installation Instructions* (108-0155-004 or later) to the installation site; procedures in that manual are referenced here, such as installing a PCI board.

To install Fibre Channel XIO or PCI boards in an OCTANE workstation, use the manuals included with the board shipment: *OCTANE XIO Standalone Option Board Installation Guide* (007-3518-001) and *OCTANE Frontplane Upgrade Information* (007-3718-001).

The customer manual Fibre Channel XIO and PCI Option Board Owner's Guide (007-3633-002) is also included with these boards.

Customer manuals included with the Origin FibreVault and Fibre Channel RAID storage systems are

- *Origin FibreVault and Fibre Channel RAID Administrator's Guide* (document number 007-3715-001 or later)
- *Origin FibreVault and Fibre Channel RAID Owner's Guide* (document number 007-3428-003 or later)

Note: The last three digits of the part number indicate the version of the manual. These numbers might not be the latest versions.

Many current Silicon Graphics documents are available in PostScript form from *guest@comrade.engr:/usr/people/guest/docdist*. On the Web, you can access the Technical Publications library:

- inside the firewall: http://techpubs.engr.sgi.com/library/
- outside the firewall: http://techpubs.sgi.com/library/

Conventions

These type conventions and symbols are used in this guide:

- In command syntax descriptions and examples, square brackets ([ ]) or angle brackets (< >) surrounding an argument indicate an optional argument. Variable parameters are in *italics*. Replace these variables with the appropriate string or value.
- Command-line flags and switches are in **boldface regular type**; these are preceded with dashes or with a plus or minus, for example, **-e**.
- Commands, IRIX filenames, and document titles are in *italics*.
- Labels on hardware are indicated with **Helvetica Bold**.
- Messages and prompts that appear onscreen are shown in `fixed-width type`. Entries that are to be typed exactly as shown are in **`boldface fixed-width type`**.
- Names of buttons in the RAID GUI are shown in *italics*. Menu selections are indicated with this convention: Array > Write Cache State > Disable means choose Write Cache State in the Array menu, and then choose Disable in the popup menu that appears.

Chapter 1

Fibre Channel Components

This chapter describes the components used when installing, repairing, or replacing a fibre channel storage system. This chapter is organized as follows:

- Section 1.1, “Fibre Channel Enclosures”
- Section 1.2, “FibreVault Enclosures (DAEs)”
- Section 1.3, “Fibre Channel RAID Enclosures (DPEs)”
- Section 1.4, “Fibre Channel Rack”
- Section 1.5, “Disk Modules”
- Section 1.6, “Cables”

For more details on FC system components, see the *Origin FibreVault and Fibre Channel RAID Owner’s Guide.*

Table 1-1 lists field-replaceable units (FRUs) that trained service personnel are qualified to replace. (Some items in this table are CRUs.)

Table 1-1 Fibre Channel Marketing Codes and Part Numbers

Item	Marketing Code	Part Number
Fibre Channel RAID (8.8 GB) disk module (520 bytes / sector); see Note below	F-RAID-9	9470192
FC disk module (9.1 GB), non-RAID (512 bytes / sector); see Note below table	P-F-9	9470140
Second enhanced (Thor) FC RAID storage processor controller board (SP), LCC, power supply, and standby power supply (SPS), rackmount version	F-RAID-SP-T-HA	9470213
Second Thor 8-MB SP, LCC, SPS, and 1, 2, or 4 128-MB DIMMs, respectively; varying read and write cache per marketing code	F-RAID-SP256-HA F-RAID-SP512-HA F-RAID-SP1GB-HA	9470212 9470211 9470210
Thor upgrade RAID SP (no memory)	F-RAID-SP-T-UPG	9470207
FibreVault link controller card (LCC) and power supply (with cord)	P-F-HA	9470195
Additional Fibre Channel RAID SP, LCC, and power supply	F-RAID-SP-HA	9470193
Additional FibreVault RAID expansion LCC and power supply	F-RAID-E-HA	9470194

Table 1-1 (continued) Fibre Channel Marketing Codes and Part Numbers

Item	Marketing Code	Part Number
Standby power supply (SPS, also known as battery backup unit (BBU))	F-RAID-SPS	9470208
SPS with tray and hardware for installing in rack	F-RAID-SPS-R	9470209
Second power distribution unit (PDU) for deskside FibreVault and FC RAID	P-F-PDU	9470199
Cache DIMM, 8 MB Cache DIMM, 128 MB	N / A F-RAID-C128	9470150 9470152
Second Fibre Channel link controller card (LCC)	P-F-RAID-LCC	9470144
Destination kit for export Fibre Channel RAID deskside Destination kit for export Fibre Channel Rack	DK-P4-00X P-F-DEST-KIT	9470160
FiberVault or Fibre Channel RAID enclosure front door	N / A	9470187
Fibre channel rack rear door	N / A	9470188
Fibre Channel RAID software, v. 2.0, including customer manuals	SC4-FC-RAID-3.0	

Note: The FC-AL disk modules and Ultra SCSI Origin2000 or Onyx2 chassis disk modules are not interchangeable and cannot be substituted for each other. Fibre Channel RAID and non-RAID disks also are not interchangeable and cannot be substituted for each other.

Table 1-2 lists cable options.

Table 1-2 Fibre Channel Cabling Options: Codes and Part Numbers

Cable	Marketing Code	Part Number
0.3-m FC copper cable with 9-pin DIN	X-F-COP-0.3M	9470156
0.5-m FC copper cable with 9-pin DIN (included in Origin FibreVault option kit)	X-F-COP-0.5M	N / A
10-m FC copper cable with 9-pin DIN	X-F-COP-10M	018-0570-00x
25-m FC copper cable with 9-pin DIN	X-F-COP-25M	018-0571-00x
3-m FC optical cable for FibreVault in Origin	X-F-OPT-3M	018-0742-001
3-m FC optical cable (uses X-F-OE-KIT)	X-F-OPT-3M	018-0656-001
10-m FC optical cable (uses X-F-OE-KIT)	X-F-OPT-10M	018-0656-101
25-m FC optical cable (uses X-F-OE-KIT)	X-F-OPT-25M	018-0656-201
100-m FC optical cable (uses X-F-OE-KIT)	X-F-OPT-100M	018-0656-301
300-m FC optical cable (uses X-F-OE-KIT)	X-F-OPT-300M	018-0656-401
Two media interface adapter (MIA) modules (FC copper-to-optical)	X-F-OE-KIT	9980952

1.1 Fibre Channel Enclosures

Silicon Graphics offers these basic Fibre Channel storage options:

- disk processor enclosure (DPE): Fibre Channel RAID enclosure with one or two storage processors (SPs) that control the RAID functionality

  The Fiber Channel RAID must contain only RAID disks; it can be rackmount or deskside.

- disk array enclosure (DAE), containing no SPs; it can be either a
  - Fibre Channel RAID expansion enclosure containing RAID disk modules, cabled to a Fibre Channel RAID DPE
  - FibreVault enclosure containing non-RAID disk modules, also known as “just a bunch of disks” (JBOD) with no RAID abilities or restrictions

  Either type of DAE can be rackmount or deskside.

- Fibre Channel Rack, which accommodates DPE and DAE rackmount enclosures

Table 1-3 summarizes some current Silicon Graphics Fibre Channel storage system offerings.

Table 1-3 Fibre Channel Storage Options

Marketing Code[a]	Part Number	Model	Disk Type
F-RAID-B5X9T-R F-RAID-B10X9T-R	9470217 9470216	Rackmount Fibre Channel RAID enclosure (disk processor enclosure, or DPE) with five or ten 8.8-GB FC RAID disk modules and enhanced (“Thor”) SP	RAID
F-RAID-B10X9-R	9470189	Rackmount Fibre Channel RAID enclosure with ten RAID disk modules and older version of SP	RAID
F-RAID-E5X9-R F-RAID-E10X9-R	9470197 9470190	Rackmount FibreVault expansion option (DAE) with five or ten RAID disk modules; connects to a DPE that contains at least nine FC RAID disk modules	RAID
P-F-B10X9-R	9470125	Rackmount FibreVault expansion option (DAE) with ten non-RAID 9.1-GB disk modules (JBOD)	Non-RAID
F-RAID-B5X9T-DS F-RAID-B20X9T-DS	9470214 9470215	Deskside (tower) Fibre Channel RAID, also known as the widebody, with five or 20 FC RAID disk modules	RAID
P-F-B10X9-DS	9470128	Deskside (tower) FibreVault DAE (JBOD) with ten non-RAID disk modules	Non-RAID
P-F-BOX-R P-F-VAULT-DS P-F-RACK	9470123 9470126 9470157	Empty rackmount FibreVault Empty deskside FibreVault Empty Fibre Channel Rack	

a. For latest marketing codes, call up P-F- and F-RAID in the internal Part Query web site.

The outside front and rear of both types of DAE—Fibre Channel RAID expansion enclosure and JBOD enclosure—look identical; the only way to tell them apart is to check the part numbers of the disk modules inside them, which can require powering down the DAE. Each fibre channel disk module has an identifying sticker with its part number:

- 9470192: 8.8-GB RAID drives (520-byte sectors)
- 9470140: 9.1-GB non-RAID drives (512-byte sectors)

1.2 FibreVault Enclosures (DAEs)

Figure 1-1 shows the rackmount FibreVault, also known as the DAE.

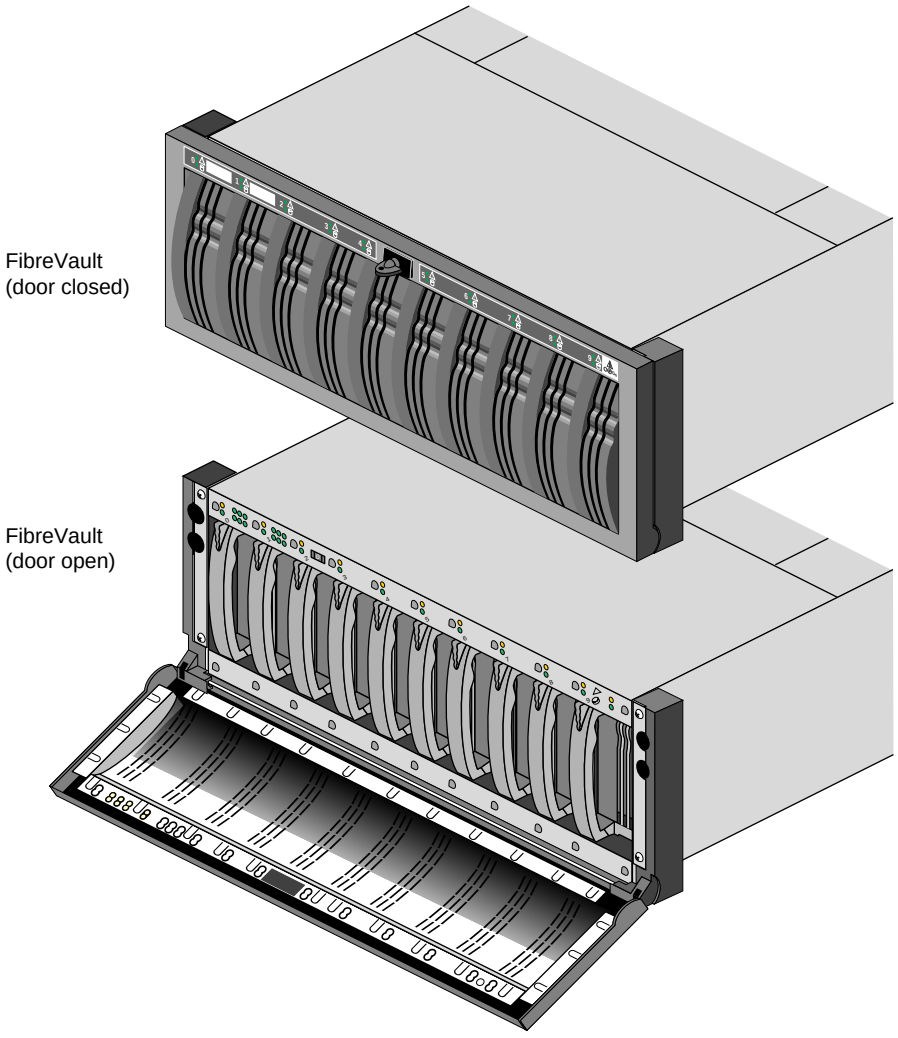


Figure 1-1 FibreVault (Front View)

The rackmount FibreVault consists of

- the rackmount enclosure
- one to ten fibre channel disk modules
- one or two power supplies (autoranging)
- one or two link controller cards (LCCs), each with two 9-pin connectors
- one fan module containing three fans (the enclosure can operate with one fan offline)

The deskside (tower) version of the FibreVault enclosure (see Figure 1-2) is a standalone, vertically oriented non-RAID disk enclosure.

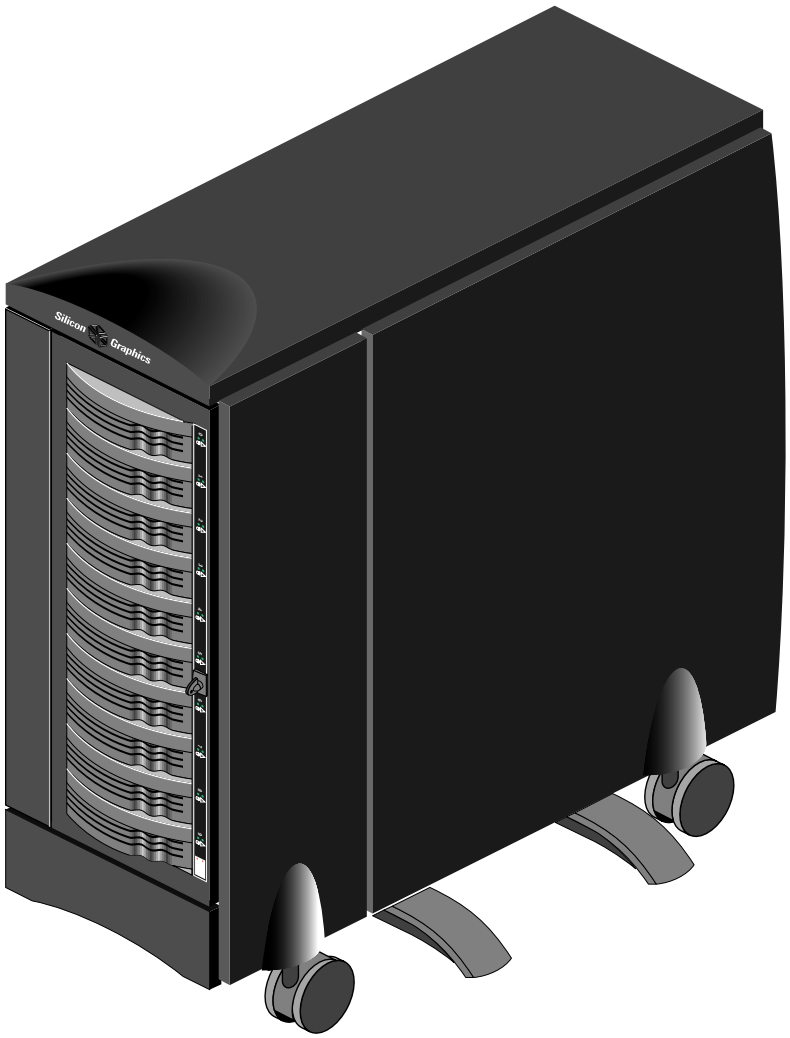


Figure 1-2 Deskside FibreVault (Tower)

The deskside FibreVault (tower) system has most of the same components the rackmount FibreVault has. It is essentially a FibreVault on its side, with skins, wheels, and a power distribution unit attached. The deskside FibreVault consists of

- the front door
- the main enclosure (mounted on wheels, with anti-tip side legs)
- one to ten fibre disk modules
- one or two link control cards (LCCs)
- one or two power supplies
- one drive fan pack
- one power distribution unit (PDU)

Figure 1-3 shows the front panel control and status LEDs.

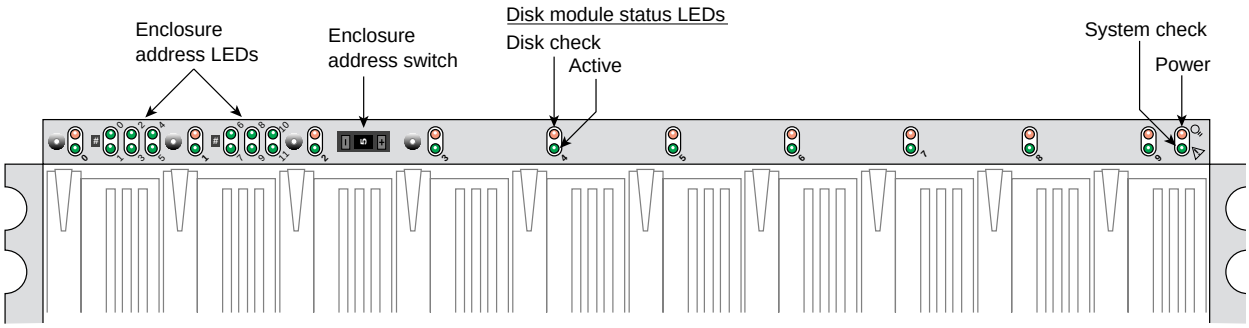


Figure 1-3 FibreVault Front Panel Features

1.3 Fibre Channel RAID Enclosures (DPEs)

The Fibre Channel RAID enclosure (also known as a DPE) contains one or two storage processor (SP) RAID controller boards that provide RAID functionality.

Figure 1-4 shows a front view of the rackmountable Fibre Channel RAID enclosure.

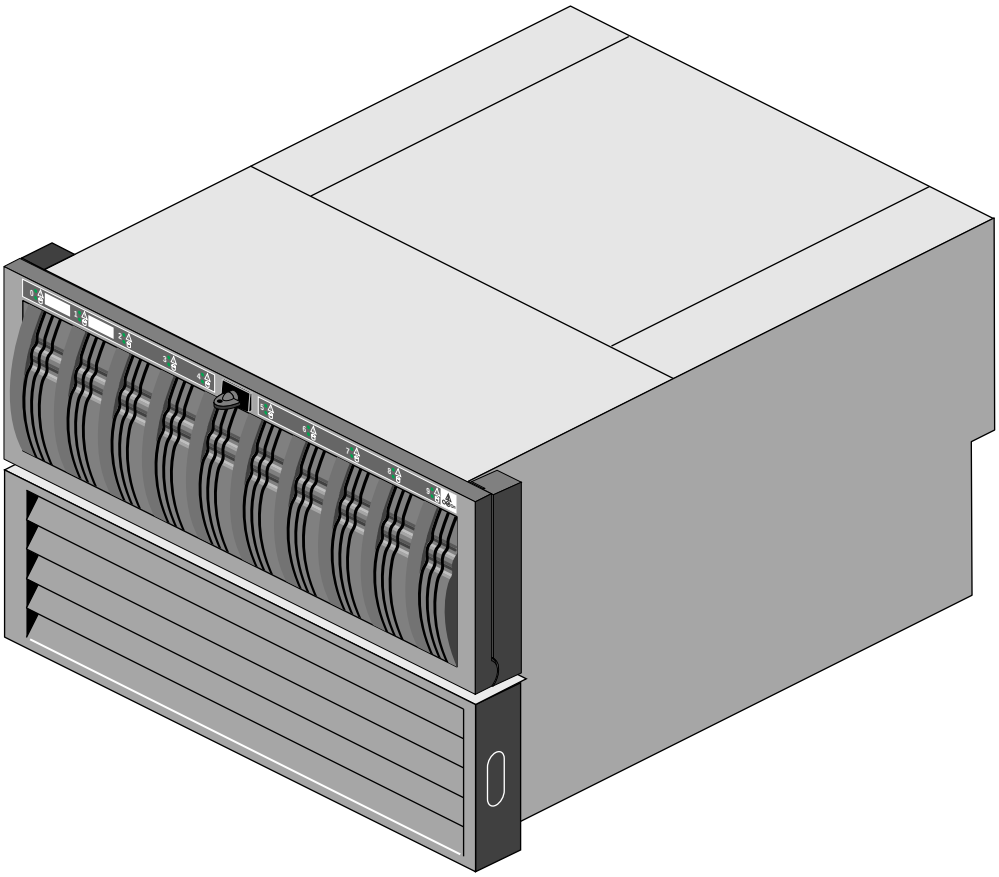


Figure 1-4 Fibre Channel RAID Rackmount Enclosure (Front View)

The Fibre Channel RAID enclosure consists of

- the rackmount enclosure
- one to ten fibre channel disk modules
- one or two power supplies (auto-ranging)
- one or two LCCs with one 9-pin expansion (**EXP**) connector on each board
- one or two storage processor (SP) RAID controller boards
- one disk fan module containing three fans (this component is interchangeable with the fan module in the FibreVault enclosure)
- one SP fan module containing three fans

The Fibre Channel RAID enclosure shares a number of functionally similar components with the FibreVault enclosure, including the LCC and power supply. Note that although the function and appearance of the LCCs and power supplies is similar between FibreVault and Fibre Channel RAID, they are not interchangeable.

The RAID deskside tower (also known as the widebody) holds one Fibre Channel RAID enclosure. The RAID disk enclosure is turned on its side. Next to it is a FibreVault RAID expansion enclosure (DAE), described in “FibreVault Enclosures (DAEs).” Figure 1-5 shows the deskside Fibre Channel RAID tower.

Figure 1-5 Deskside Fibre Channel RAID Deskside (Widebody)

Note: The base model of the RAID deskside comes with no LCC or drives installed in the RAID expansion enclosure. The marketing configuration model presumes that the main enclosure will be filled with nine or ten drives before the expansion enclosure is used.

Figure 1-6 shows a rear view of the Fibre Channel RAID widebody.

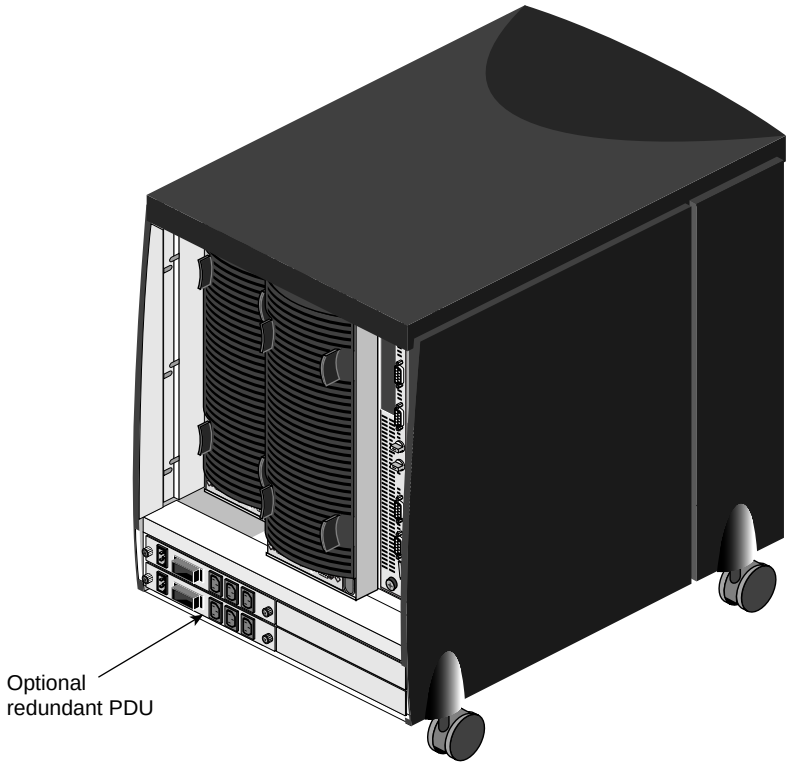


Figure 1-6 Fibre Channel RAID Deskside (Widebody) Rear View

The Fibre Channel RAID deskside holds a minimum of five disk drives and a maximum of 20 disk drives. The deskside unit is capable of full RAID redundancy operation using optional dual power sources and redundant internal power supplies, LCCs, and SPs. The tower enclosure assembly consists of a sheet-metal housing, front panel, and one or two power distribution units.

The Fibre Channel RAID tower is oriented so that link controller card A (LCC A) is always at the top (in both enclosures). Note that disks and an LCC are optional components in the RAID deskside's expansion enclosure; not every unit has them.

General unpacking and installation for the Fibre Channel RAID deskside are covered in Chapter 4, "Setting Up a FibreVault or Fibre Channel RAID Deskside System." For remove and replace information on the enclosure and tower components, see Chapter 6, "Installing and Replacing Components in Rackmount and Deskside DAEs and DPEs."

1.4 Fibre Channel Rack

The Fibre Channel Rack holds up to 11 FibreVault disk enclosures. Although it is physically possible to fit up to five Fibre Channel RAID enclosures in the rack, the recommended maximum configuration is three DPE units. Such a configuration allows room for Fibre Channel RAID expansion enclosures, non-RAID enclosures, and for standby power supplies, fibre channel hubs, or other options.

You can mix RAID and non-RAID enclosures in the rack as long as each type is on a separate fibre cable (loop), that is, cabled to a different FC port in the host.

The Fibre Channel Rack uses two power distribution units to supply the fibre enclosures with power. The rack has the (high-availability) feature of two separate 200–240 VAC power cables to supply independent power to each PDU.

Figure 1-7 shows a front external view of the Fibre Channel Rack.

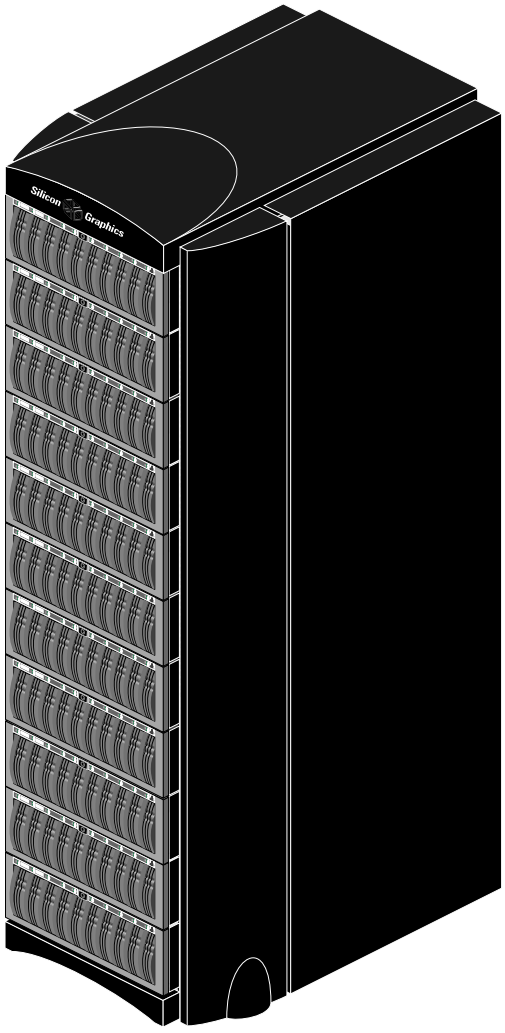


Figure 1-7 Fibre Channel Rack, Front View

1.5 Disk Modules

As noted, RAID and non-RAID disk modules are different. Each drive module has an identifying sticker with its part number:

- 9470192 for 8.8 GB RAID drives (520-byte sectors)
- 9470140 for 9.1 GB non-RAID drives (512-byte sectors)

Figure 1-8 shows both sides of the fibre channel disk module and carrier.

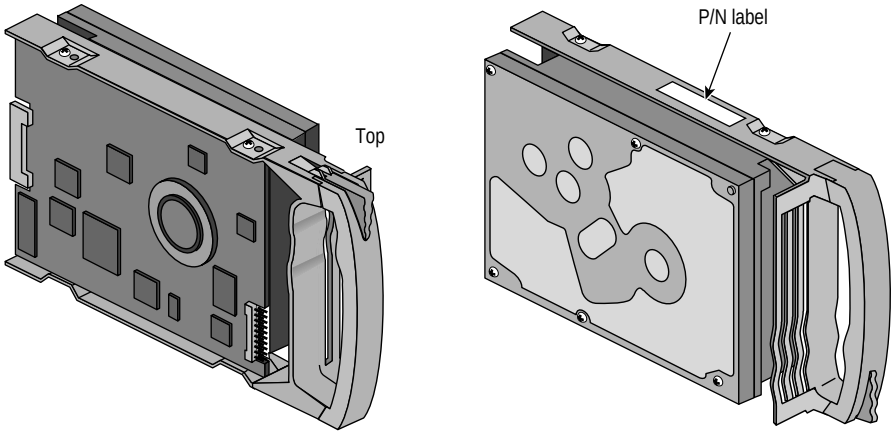


Figure 1-8 Fibre Channel Disk Module

Note the following:

- The FC RAID disks are not interchangeable with SCSI RAID disks.
- The FC non-RAID disks are not interchangeable with regular SCSI disks.
- The FC RAID and FC non-RAID disks are not interchangeable with each other and cannot be converted to the other type in the field.
- All disks in an FC enclosure must be either RAID or non-RAID. Disks in a DPE must be RAID.

1.6 Cables

This section is organized as follows:

- Section 1.6.1, “Fibre Channel Cables”
- Section 1.6.2, “Cable Labels”
- Section 1.6.3, “Power Cord”

1.6.1 Fibre Channel Cables

Silicon Graphics fibre channel storage uses two types of cable, copper (standard) and optical (optional). These cables are further categorized by two fibre channel arbitrated loop (FC-AL) functions:

- host-to-fibre enclosure cabling (copper or optical)
- enclosure-to-enclosure cabling (always copper, always short)

The cables that link enclosures together are always copper and are always short. The optional host-to-enclosure optical cables are longer (minimum of 25 meters). Table 1-1 provides some examples.

Note that a single FC-AL supports enclosures in a single Fibre Channel Rack. You cannot extend the loop to another rack (even when fewer than 110 drives are installed in a Fibre Channel Rack).

1.6.2 Cable Labels

Each fibre channel XIO board ships with at least one 10-meter copper cable and a label kit for identifying fibre channel connection cables.

Cable labels identify which controller on which XIO fibre board is supporting a particular enclosure, Fibre Channel Rack, or loop.

1.6.3 Power Cord

The Fibre Channel Rack power cable destination kit is PF-DEST-KIT. All fibre channel enclosures in the rack use the same three-prong connector to plug into the rack's power distribution units (PDUs).

All Fibre Channel Racks come equipped with two single-phase cables and L6-30P connectors.

Always consult your local site electrician for proper electrical connection and wiring requirements. See Appendix A for technical specifications.

Chapter 2

Installing a Fibre Channel Option Board in a Host

This chapter describes how to install the fibre channel XIO and PCI option boards in the XIO in PCI slots of Origin2000 and Onyx2 systems. For information on installing these boards in other Silicon Graphics host systems, see the owner's guide for that system.

Note: To install the boards in an OCTANE workstation, use the *OCTANE XIO Standalone Option Board Installation Guide* (007-3518-001) and *OCTANE Frontplane Upgrade Information* (007-3718-00), which are included with the board shipment.

This chapter is organized as follows:

- Section 2.1, "Installing the Fibre Channel XIO Board"
- Section 2.2, "Fibre Channel PCI Board Installation and Configuration"
- Section 2.3, "Fibre Channel Option Board Cabling"
- Section 2.4, "Chassis Grounding"
- Section 2.5, "Restarting the Fibre Channel Host System"
- Section 2.6, "Checking the Installation"

The procedures in this chapter require a Phillips-head and a medium or thin flat-blade screwdriver.

The FC boards are described in the *Fibre Channel XIO and PCI Option Board Owner's Guide* (007-3633-002), included in the board shipment.

2.1 Installing the Fibre Channel XIO Board

Figure 2-1 shows main components of the Fibre Channel XIO board.

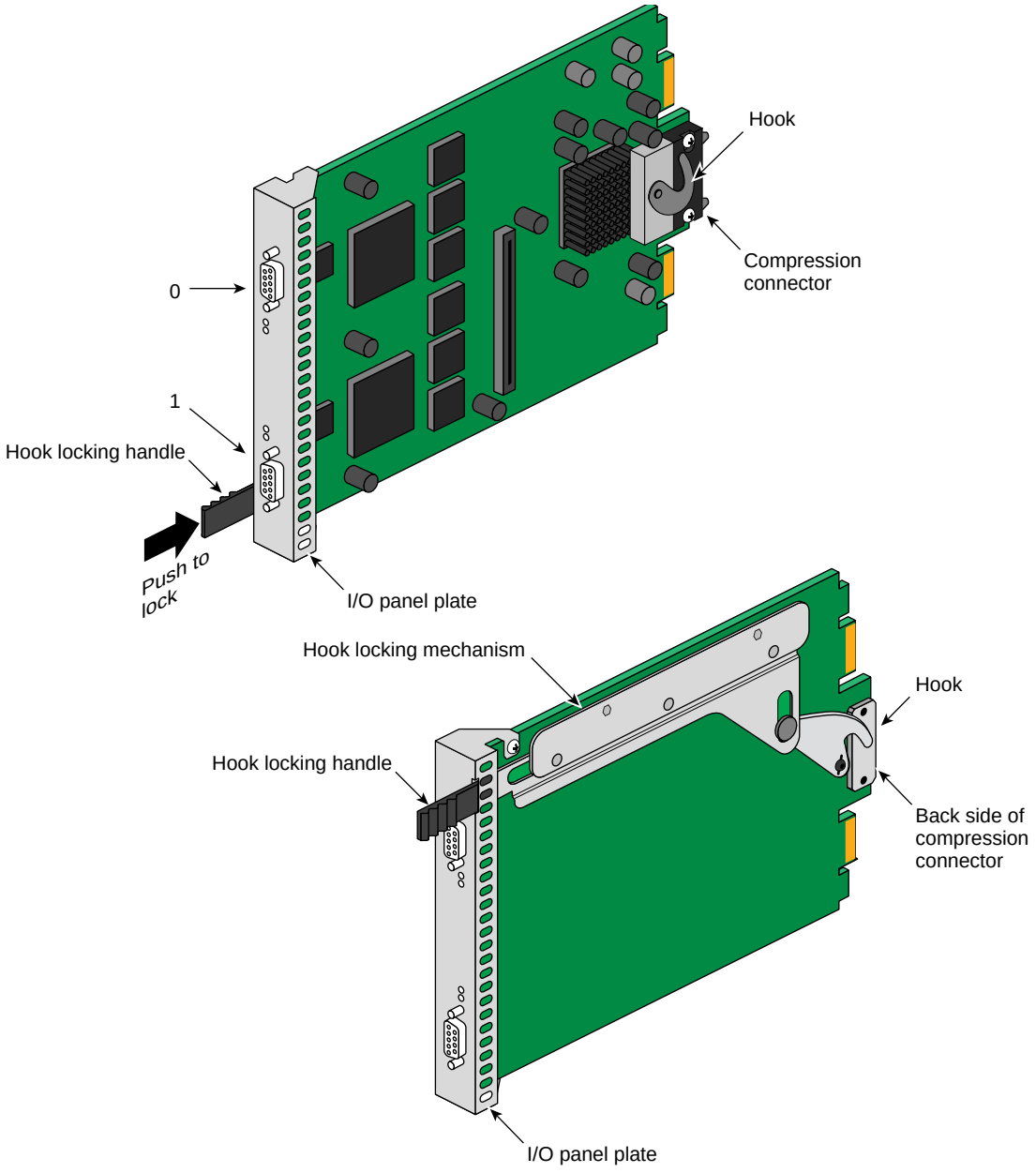


Figure 2-1 Fibre Channel XIO Board

Note: The Fibre Channel XIO board for the OCTANE workstation uses a different hook locking mechanism from that for the XIO board for the Origin2000/Onyx2 systems. Do not install a Fibre Channel XIO board for the Origin2000/Onyx2

systems in an OCTANE workstation; the board may not come out and partial disassembly of the OCTANE workstation may be required to remove it. The boards are functionally identical in all other respects.

This section is organized as follows:

- Section 2.1.1, “FC Board Configuration Limits”
- Section 2.1.2, “XIO Board Compression Connector”
- Section 2.1.3, “Preparing the Host System”
- Section 2.1.4, “Installing an FC XIO Board in the Host System”

2.1.1 FC Board Configuration Limits

IRIX release 6.4.1, with the November 1, 1997 patch set or later, and IRIX 6.5 support a maximum of 44 MSCSI and fibre channel XIO boards in a host system (not per module). The limit is a function of both SCSI and FC, because both have SCSI target devices that use the same space for kernel configuration issues.

Note the following:

- In a module with the IO6 board, the maximum number of FC XIO cards is 11; in other modules, it is 12.
- In a module with the IO6 board, the maximum number of MSCSI cards is 10; in other modules, it is 11.

For later OS versions, check release notes to determine whether this maximum number has increased.

2.1.2 XIO Board Compression Connector

Note the compression connector on the XIO board; see Figure 2-2.

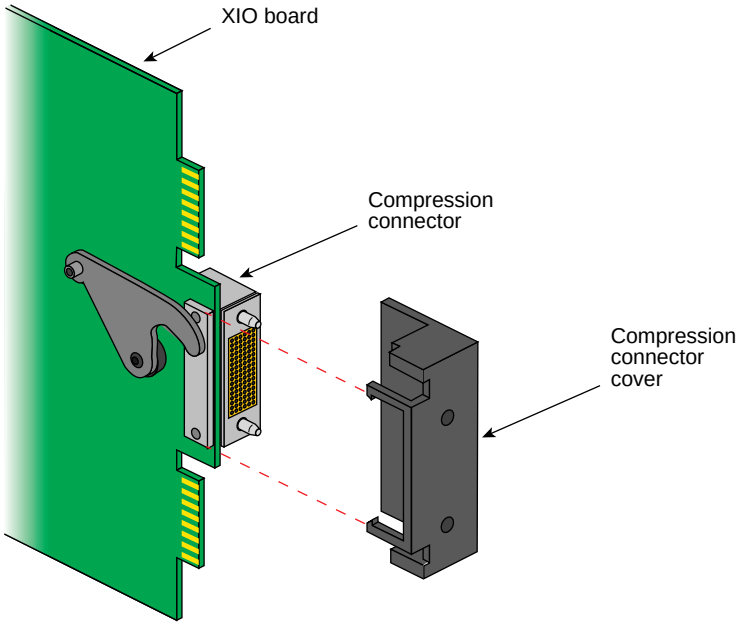


Figure 2-2 FC XIO Compression Connector and Cover

For compression connectors, observe these caveats:

- Do not wipe or touch the pads of the board's compression connector.
- Take the board out of its antistatic bag and remove the compression connector cover only when you are ready to install it.
- When removing a board, immediately install the connector cover and place the board assembly in an antistatic container.
- Use all standard electrostatic discharge avoidance guidelines when handling the fibre XIO board(s).

The lever (handle) on the XIO board is pulled or pushed to work the compression connector's hook:

- Pushing the handle engages the hook and seats the compression connector to the midplane.
- Pulling the handle releases the hook in preparation for removing the board.

2.1.3 Preparing the Host System

Follow these steps to prepare the host system for XIO installation:

1. Shut down the system:

   ```
   % su
   Password: password
   # sync
   # /etc/halt
   ```

2. When the message appears indicating that it is safe to power off the system, turn the key switch on the system controller to the STANDBY position.
3. At the rear of the system, flip the power switch (circuit breaker) Off (down). Do not disconnect the power plug.
4. Wait two full minutes (after turning off the power) to allow the system's stored electrical charge to dissipate.

Caution: Failure to properly shut down the host system may cause damage to equipment and expose the XIO board installer to risk of electric shock.

2.1.4 Installing an FC XIO Board in the Host System

XIO boards are inserted at the rear of the chassis (module), on the right side. Where a slot is not populated, a baffle board is installed to ensure proper airflow. As a general rule, fill available odd-numbered XIO slots before filling even-numbered ones, and fill lower-numbered slots before higher-numbered ones.

Note: The Fibre Channel XIO board for the OCTANE workstation uses a different hook locking mechanism from that for the XIO board for the Origin2000/Onyx2 systems. Do not install a Fibre Channel XIO board for the Origin2000/Onyx2 systems in an OCTANE workstation; the board may not come out and partial disassembly of the OCTANE workstation may be required to remove it. The boards are functionally identical in all other respects.

This procedure requires a #2 Phillips screwdriver and a grounding (wrist) strap.

To remove a blank panel and insert the new FC XIO board, follow these steps:

1. Remove the new board from its packaging and lay it on an antistatic work surface.
2. If you have not already done so, power off the system. At the back of the chassis, ground yourself and follow other ESD procedures.
3. Locate the panel plate containment bar, loosen each of the bar's screws with the #2 Phillips screwdriver, and pull it so that the panel plates are fully accessible. You must slide the bar over some rivets. The bar snaps into a holding position so that it stays out of the way.
4. Remove the panel plate and XIO air baffle board from the selected slot and lay it aside.

5. Remove the protective cap from the new FC board's compression connector (if you have not already done so) as illustrated in Figure 2-2. Save this cap for the customer to store, to cover the compression connector if the board is removed for any reason.

   Caution: Failure to install the protective cap on the compression connector when the board is removed from the host system can result in irreparable damage to the connector's pads.

6. Orient the board depending on the slot it is to occupy, as diagrammed in Figure 2-3 and Figure 2-4.

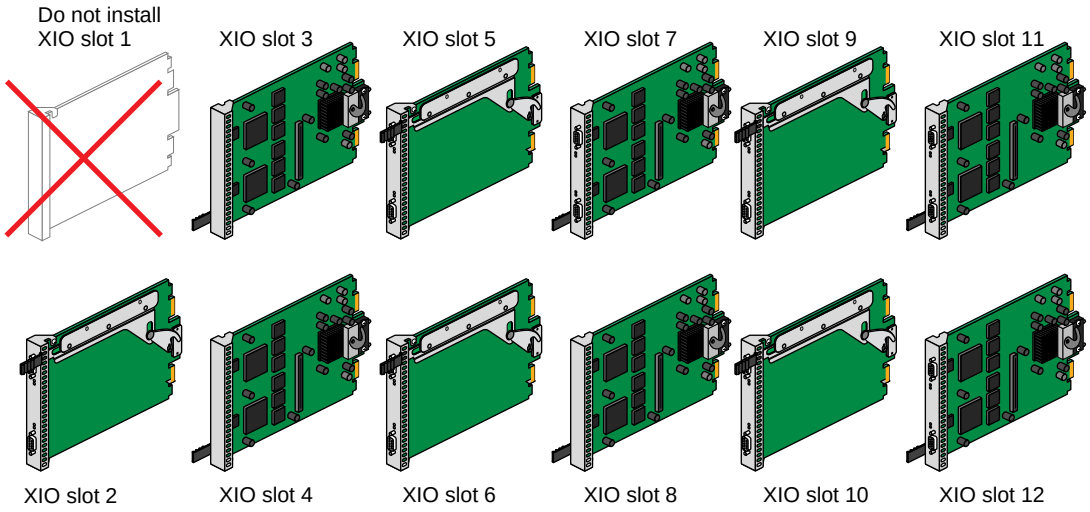


Figure 2-3 Board Orientation for Origin2000 Systems and Onyx2 Rackmount

The Onyx2 deskside system has a different board orientation scheme (see Figure 2-4).

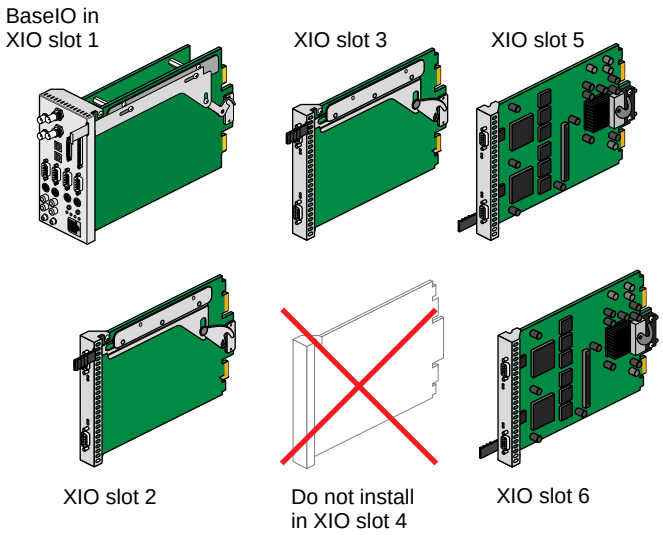


Figure 2-4 Board Orientation for Onyx2 Deskside

Note: In the Onyx2 deskside, slot 4 has no midplane connector.

7. Slide the XIO board into the chassis until it is snug against the midplane, and press evenly on the panel plate until the board comes to a stop. If the board's panel plate is not flush with the other panel plates, continue pressing until it is.
8. Lock the board to the midplane by firmly pushing the handle of the engagement lever until it stops. Pushing in on this handle presses the compression connector's hook into its receiver on the midplane.
9. Slide the containment bar back into place so that it holds the panel plates. Tighten its screws.

Reverse the previous steps to remove an FC XIO board.

If the fibre channel storage system is already set up, go to Section 2.3, "Fibre Channel Option Board Cabling," and cable the board; otherwise, use other chapters in this guide as appropriate. Do not power the system on until all the fibre channel components are installed and powered on.

2.2 Fibre Channel PCI Board Installation and Configuration

The Fibre Channel PCI board is a half-size PCI option board that provides a high-performance interface between the host system and one FC-AL interface. Figure 2-5 shows the PCI board.

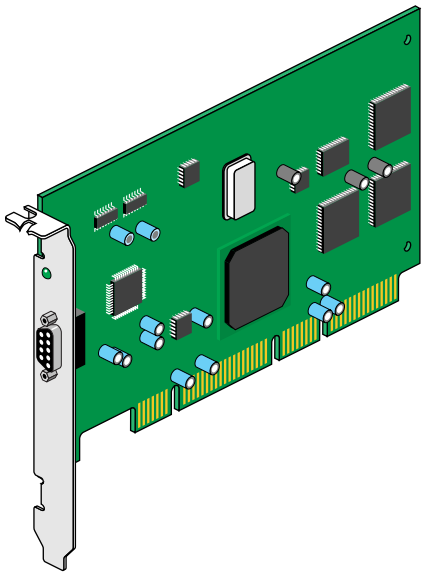


Figure 2-5 Fibre Channel PCI Board

You can install this board into the PCI module of an Origin2000 or Onyx2 chassis, as well as into the OCTANE PCI module and Origin200 chassis. To install the fibre Channel PCI board in an Origin2000 or Onyx2 system, follow procedures for PCI boards explained in

Chapter 10 of the latest version of the *Origin2000 and Onyx2 Deskside and Rackmount Installation Instructions.*

A customer with an Origin200 server should follow the installation and configuration instructions in the latest version of the *Origin200 Owner's Guide.* A customer with an OCTANE workstation must follow instructions in the *OCTANE PCI Module Installation Guide* or *OCTANE Workstation Owner's Guide.*

IRIX release 6.4.1, with the November 1, 1997 patch set or later, and IRIX 6.5 support a maximum of 44 PCI buses with fibre channel and SCSI PCI boards. You can configure a maximum of four Fast-20 SCSI buses or two FC loops on a single PCI bus; this limit is a function of both SCSI and FC, because both have SCSI target devices that use the same space for kernel configuration issues. To avoid interaction of 32-bit and 64-bit operation, FC and SCSI PCI cards should not be on the same PCI bus.

For later OS versions, check release notes to determine whether these restrictions have changed.

2.3 Fibre Channel Option Board Cabling

This section describes how to connect the XIO board's external cables.

1. Locate the fibre channel connection cable(s). The cable(s) can be copper or (optionally) fiber optic. Refer to Table 1-1 in Chapter 1 for a list of applicable cables.
2. Attach labels on the panel plate and cable(s).
3. If you are installing an optical FC cable, remove the protective cap from the cable's connectors, and place the media interface adapters (MIAs) on the each end of the optical cable.

   Note: Do not touch the tips of the fiber optic cable connections.

4. If the fiber optic cable tips becomes dirty, clean and dry the tip of each fiber within the cable by gently rubbing the tip with a soft, lint-free cloth that has been moistened with reagent grade isopropyl alcohol. If you do not have the proper equipment, skip this step.

   Note: Do not use prepared cleaning compounds, such as tape-head cleaner or denatured (rubbing) alcohol.

5. Attach the cable(s) to the appropriate ports, as shown in Figure 2-6.

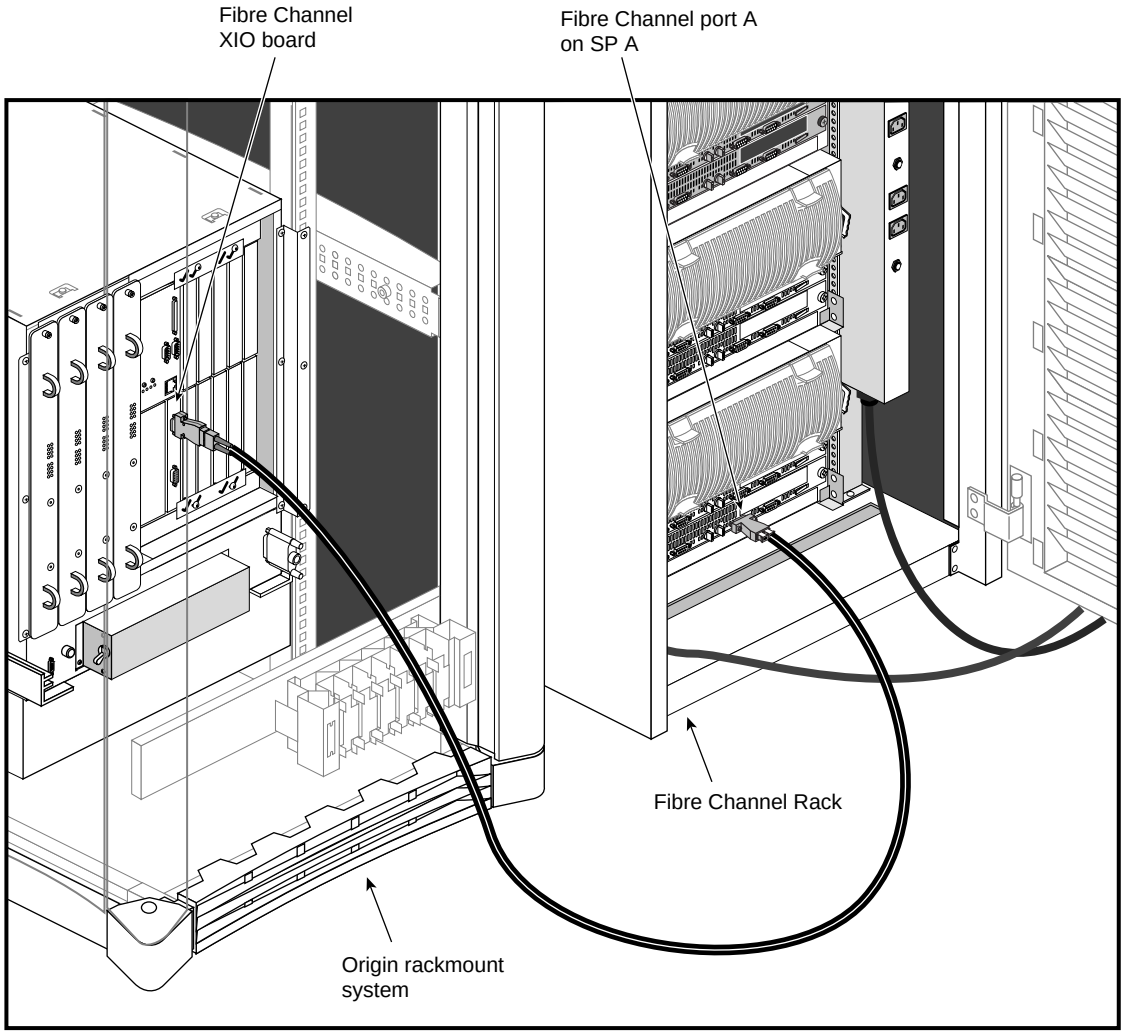


Figure 2-6 FC XIO Board Cabling Example

2.4 Chassis Grounding

Grounding issues are very important in Origin and Onyx2 systems. Each chassis must be well grounded through its power connector. All chassis connected together with XIO copper cables must share the same transformer, must be grounded through the same earthing rod, and must be on the same branch circuit.

If you have any doubts about the quality of the ground connection, it is important that you consult with a qualified electrician. Using optical cabling between the fibre enclosure(s) and the host XIO connection eliminates any problems related to common grounding.

Caution: Any difference in ground potential greater than 500 millivolts (0.5 volts) between two chassis connected with copper XIO cables can cause severe equipment damage and can create hazardous conditions.

The branch circuit wiring should include an insulated grounding conductor that is identical in size, insulation material, and thickness to the earthed and unearthed branch-circuit supply conductors.

The grounding conductor should be green, with or without one or more yellow stripes. This grounding or earthing conductor should be connected to earth at the service equipment or, if supplied by a separately derived system, at the supply transformer or motor-generator set. The power receptacles in the vicinity of the systems should all be of an earthing type, and the grounding or earthing conductors serving these receptacles should be connected to earth at the service equipment.

2.5 Restarting the Fibre Channel Host System

Restart the host only after the fibre channel enclosure(s) is installed, configured, and properly connected. When the board is installed and connected, follow these instructions to start operation:

1. Set the system circuit breaker power switch in the On position.
2. Restart the system by turning the key in the module's System Controller to On.
3. Log on after the system boots.
4. Depending on the IRIX release on the host system, you may have to install a patch or even possibly upgrade the operating system. Consult the release notes.
5. If you have not installed and configured the software, do so now by following the instructions in the release notes. The new fibre channel mass storage system does not function until the software is properly configured.

   Note: After you finish configuring the software, reboot the system (or run the *autoconfig* command) to build a new operating system (kernel) that includes the new drivers. Then reboot the host again to start running this new operating system.

2.6 Checking the Installation

To verify that the board is recognized by the operating system during the bootup, enter

```
% hinv
```

Example output follows:

```
# hinv
FPU: MIPS R10010 Floating Point Chip Revision: 0.0
CPU: MIPS R10000 Processor Chip Revision: 2.6
2 180 MHZ IP27 Processors
Main memory size: 128 Mbytes
Instruction cache size: 32 Kbytes
Data cache size: 32 Kbytes
Secondary unified instruction/data cache size: 1 Mbyte
Integral SCSI controller 0: Version QL1040B
  Disk drive: unit 1 on SCSI controller 0
  Disk drive: unit 2 on SCSI controller 0
Integral SCSI controller 1: Version QL1040B
Integral SCSI controller 2: Version Emerald Fibrechannel
  Disk drive: unit 40 on SCSI controller 2
  Disk drive: unit 41 on SCSI controller 2
  Disk drive: unit 42 on SCSI controller 2
  Disk drive: unit 43 on SCSI controller 2
  Disk drive: unit 44 on SCSI controller 2
  Disk drive: unit 45 on SCSI controller 2
  Disk drive: unit 46 on SCSI controller 2
  Disk drive: unit 47 on SCSI controller 2
  Disk drive: unit 48 on SCSI controller 2
  Disk drive: unit 49 on SCSI controller 2
  Disk drive: unit 50 on SCSI controller 2
  Disk drive: unit 51 on SCSI controller 2
  Disk drive: unit 52 on SCSI controller 2
  Disk drive: unit 53 on SCSI controller 2
  Disk drive: unit 54 on SCSI controller 2
  Disk drive: unit 55 on SCSI controller 2
  Disk drive: unit 56 on SCSI controller 2
  Disk drive: unit 57 on SCSI controller 2
  Disk drive: unit 58 on SCSI controller 2
  Disk drive: unit 59 on SCSI controller 2
  Disk drive: unit 110 on SCSI controller 2
  Disk drive: unit 111 on SCSI controller 2
  Disk drive: unit 112 on SCSI controller 2
  Disk drive: unit 113 on SCSI controller 2
  Disk drive: unit 114 on SCSI controller 2
  Disk drive: unit 115 on SCSI controller 2
  Disk drive: unit 116 on SCSI controller 2
  Disk drive: unit 117 on SCSI controller 2
  Disk drive: unit 118 on SCSI controller 2
  Disk drive: unit 119 on SCSI controller 2
```

```
Integral SCSI controller 3: Version Emerald Fibrechannel
  Disk drive: unit 0, lun 7 on SCSI controller 3
  Disk drive: unit 1 on SCSI controller 3
  Disk drive: unit 2 on SCSI controller 3
  Disk drive: unit 3 on SCSI controller 3
  Disk drive: unit 4 on SCSI controller 3
  Disk drive: unit 5 on SCSI controller 3
IOC3 serial port: tty1
IOC3 serial port: tty2
Integral Fast Ethernet: ef0, version 1
IOC3 external interrupts: 1
```

The first two SCSI controllers in the *hinv* listing are the native controllers that come with every Origin2000 or Onyx2 system. The next two are fibre controllers. The first controls two enclosures with a total of twenty non-RAID fibre drives. The second controls a five-disk RAID LUN that also has a hot spare available.

To confirm or identify the host XIO slot the XIO fibre controller is installed in, enter

```
# find /hw/module -name fibre_channel
```

This command provides information similar to the following:

```
/hw/module/1/slot/io6/fibre_channel
```

Output should correctly identify the chassis and XIO slot into which you installed the board. Use the **-l** option for more detail about the option; for example:

```
# ls -l /hw/module/1/slot/io6/fibre_channel
```

The following is a possible output, showing an FC XIO option board entry.

```
lrw-------    1 root     sys          26 May  7 20:40 .master ->
/hw/module/1/slot/n1/node
drwxr-xr-x    2 root     sys          0 May  7 20:40 pci
```

Use the hardware graph listing to determine whether the system sees the fibre drives after the board is cabled. For more information, see the *Origin2000 and Onyx2 Deskside and Rackmount Installation Instructions*.

Chapter 3

Setting Up a Fibre Channel Rack

This chapter explains how to set up a Fibre Channel Rack and install DPE and DAE systems in it. This chapter is organized as follows:

- Section 3.1, “Unpacking and Setting Up a Fibre Channel Rack”
- Section 3.2, “Installing an Enclosure in the Fibre Channel Rack”
- Section 3.3, “Setting the Enclosure Address”
- Section 3.4, “Connecting the Enclosure Power Cord(s)”
- Section 3.5, “Cabling Enclosures in the Fibre Channel Rack”
- Section 3.6, “Powering On the Fibre Channel Rack”

Note: Before installing or significantly upgrading a fibre channel storage system, make sure that the installation site meets the air-conditioning, floor-loading, AC power, and operating requirements listed in Appendix A, “Technical Specifications.”

3.1 Unpacking and Setting Up a Fibre Channel Rack

The procedures in this section require

- at least one other trained and qualified installer
- eye protection
- 9/16ths-inch (14.275 mm) nut driver with 3-inch (7.62 cm) extension if available; the ratcheting type is recommended
- #2 Phillips screwdriver
- adjustable wrench

Note that the shipping container is 6 feet 10 inches (2.08 meters) tall and 46.5 inches (1.18 meters) wide. These measurements do not include height and width added when using a pallet jack. Also note that some pallet jacks have fork spacing that is too narrow for the pallet configuration used with the Fibre Channel Rack. See Figure 3-1.

Figure 3-1 Fibre Channel Rack Shipping Carton and Pallet

Warning: **The fully loaded Fibre Channel Rack weighs approximately 1100 lbs (500 kg). Its weight is distributed within a relatively small footprint of 6 ft^2 (0.56 m^2), with a potential maximum floor loading of 183 lbs/ft^2 (893 kg/m^2). Some sites have floor loadings as low as 50 lbs/ft^2 (244 kg/m^2). Check that the flooring, especially raised flooring, can properly support the distribution of the rack's weight. Give particular care to installations with more than one Fibre Channel Rack placed close together.**

At least two persons are required to unpack and move a Fibre Channel Rack. The Fibre Channel Rack is prone to tipping on even a slight grade. Do not undertake this procedure unless another trained and qualified installer is available to help.

To unpack and set up a Fibre Channel Rack, follow these steps:

1. Make sure that all flooring, especially raised flooring, can properly support the distribution of the rack's weight. Be especially careful for installations with more than one Fibre Channel Rack placed close together.
2. When possible, leave the rack bolted to the pallet and use a pallet jack to move it as near the installation location as possible.

   Note: The rack can be very difficult to move on rugs; it is much easier to move it while it is still bolted to the pallet. A fully loaded Fibre Channel Rack weighs approximately 1100 pounds (500 kg). The rack moves fairly easily on a hard floor surface.

3. Wearing eye protection, clip and remove the four vertical bands and remove the cardboard top cover. See Figure 3-2.

Warning: **The bands are under tension and can snap back when cut.**

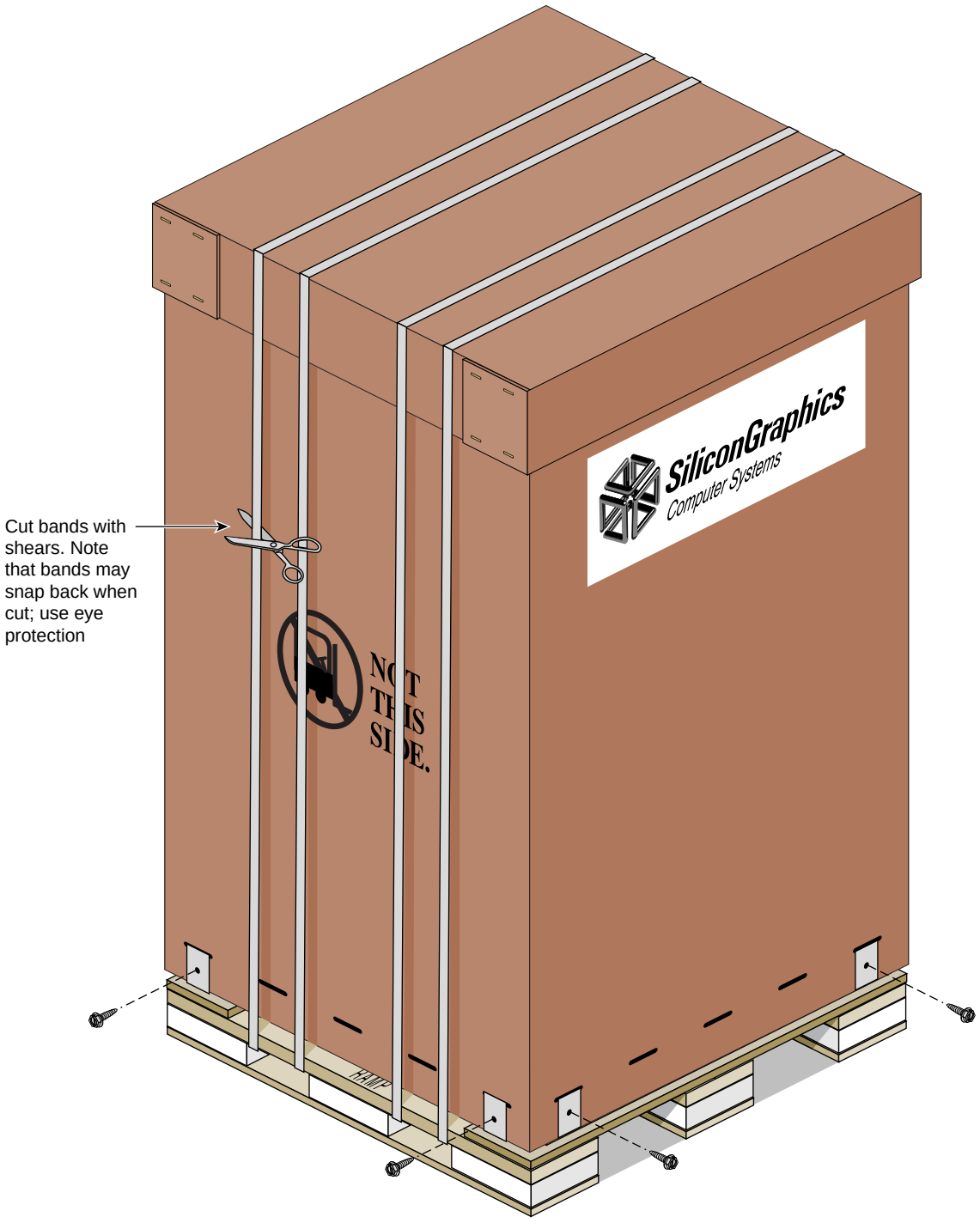


Figure 3-2 Fibre Channel Rack Pallet and Shipping Crate

4. Use a #2 Phillips screwdriver to detach the eight screws that hold the cardboard siding to the base of the pallet. See Figure 3-2.
5. Pull off the cardboard top; see Figure 3-3.

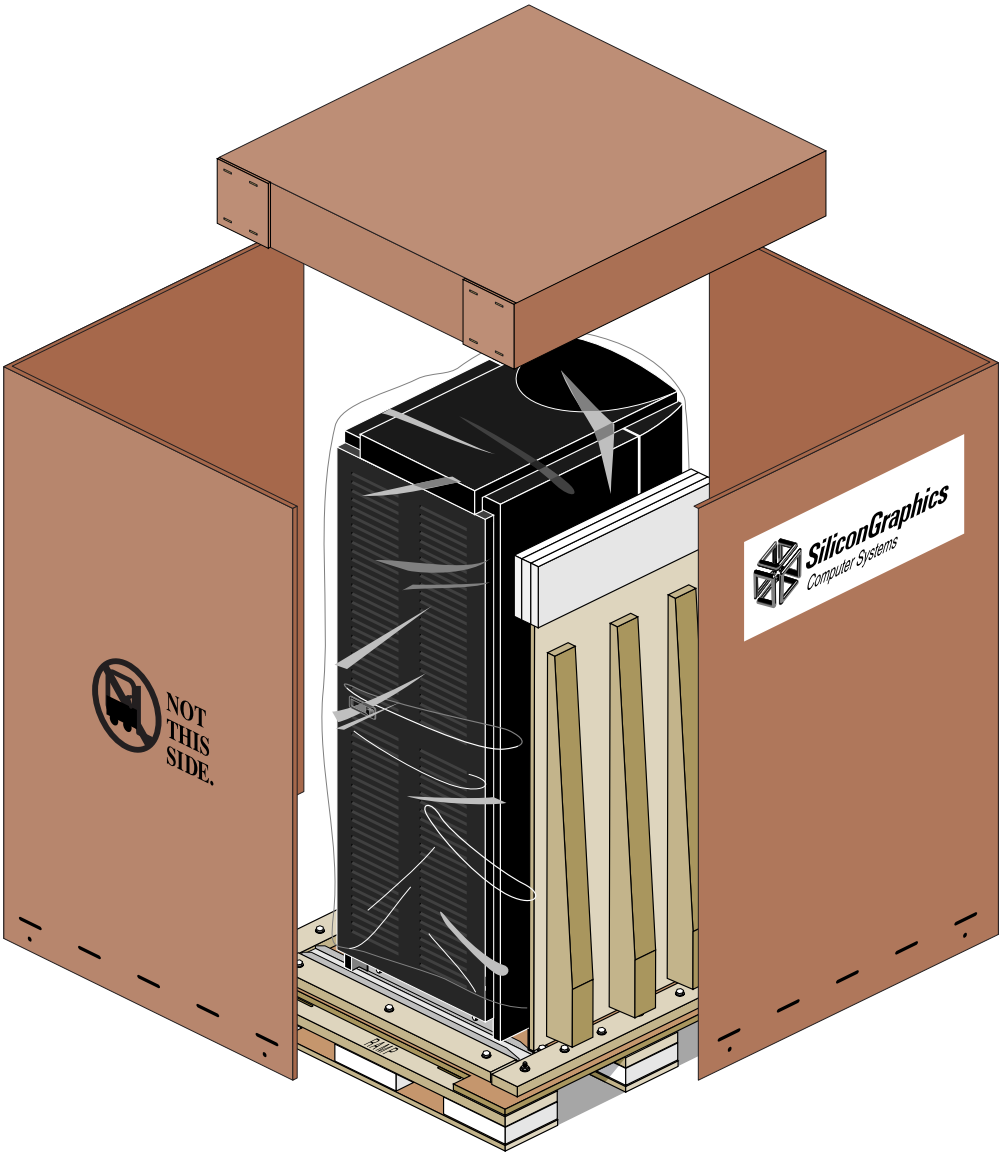


Figure 3-3 Opening the Crate

6. Remove the plastic wrap and verify that all parts are present and in good condition. If they are not, notify the shipper of the damaged or missing parts.

7. With the 9/16ths-inch nut driver, detach the pallet ramp (shown in Figure 3-4) by removing two bolts. You use this ramp to move the rack off the pallet.

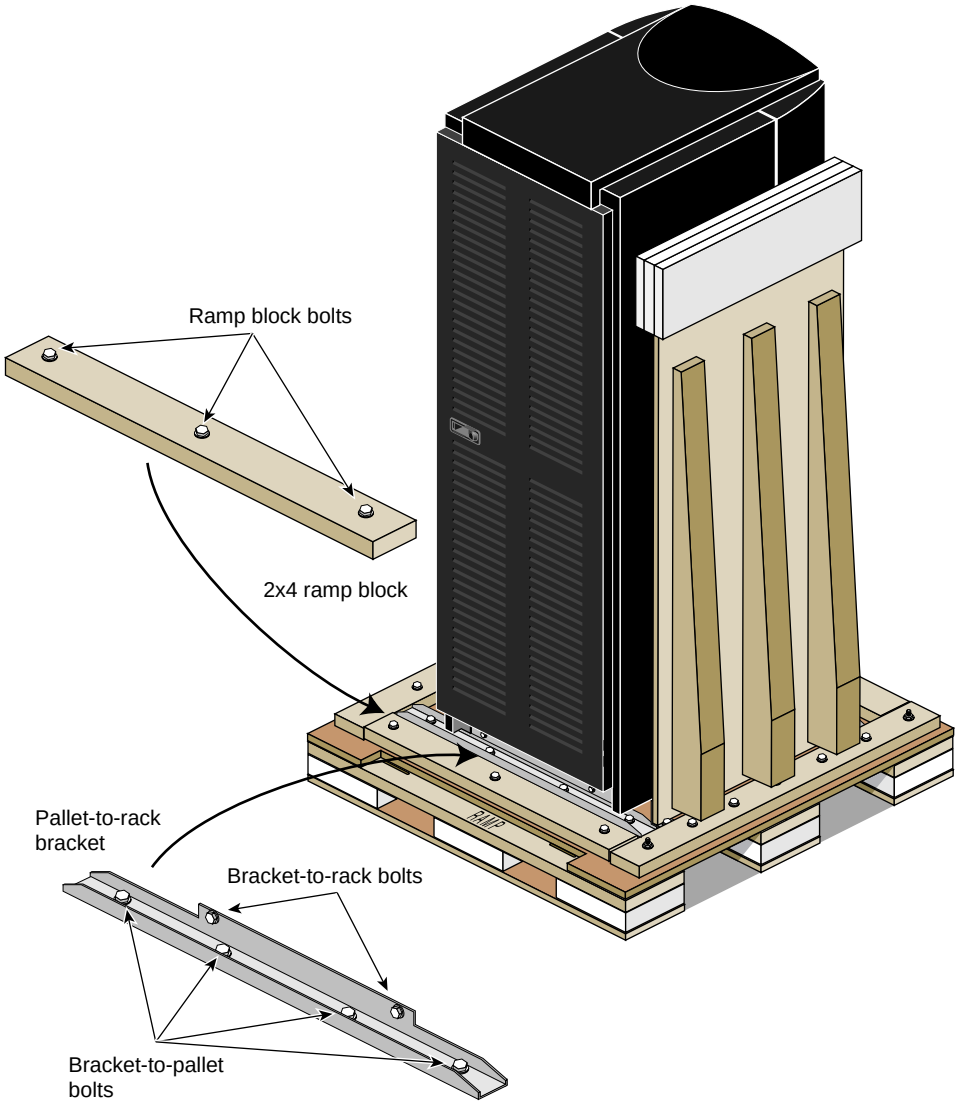


Figure 3-4 Fibre Channel Rack and Pallet Ramp

- Remove the three bolts that hold the 2x4 ramp block.
- Remove the four bolts that hold the pallet-to-rack bracket.
- Remove the two bolts that hold the bracket to the rack chassis at the front of the system.

8. Install the pallet ramp; see Figure 3-5. The ramp with pallet folded down takes up about 7.5 feet (2.29 m) by 4 feet (1.22 m); you also need another 3.5 feet (1.1 m) clear at the end of the ramp to maneuver the rack.

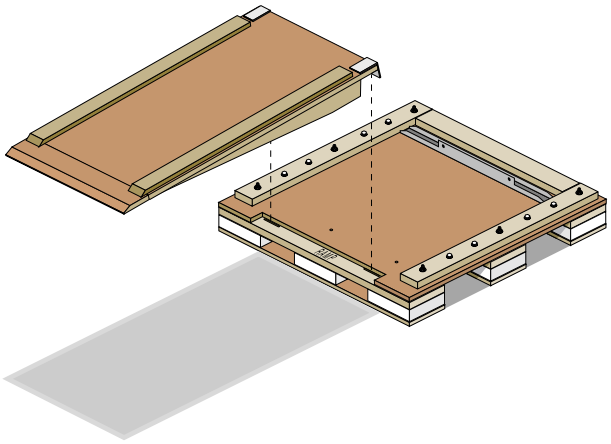


Figure 3-5 Ramp Installation on the Pallet

9. Open or remove the rear door of the rack. There are two door-handle designs:
   - Grasp the handle and tug the door straight outward.

   or

   - Push in the button at the right of the handle, and pull the handle; see Figure 3-6.

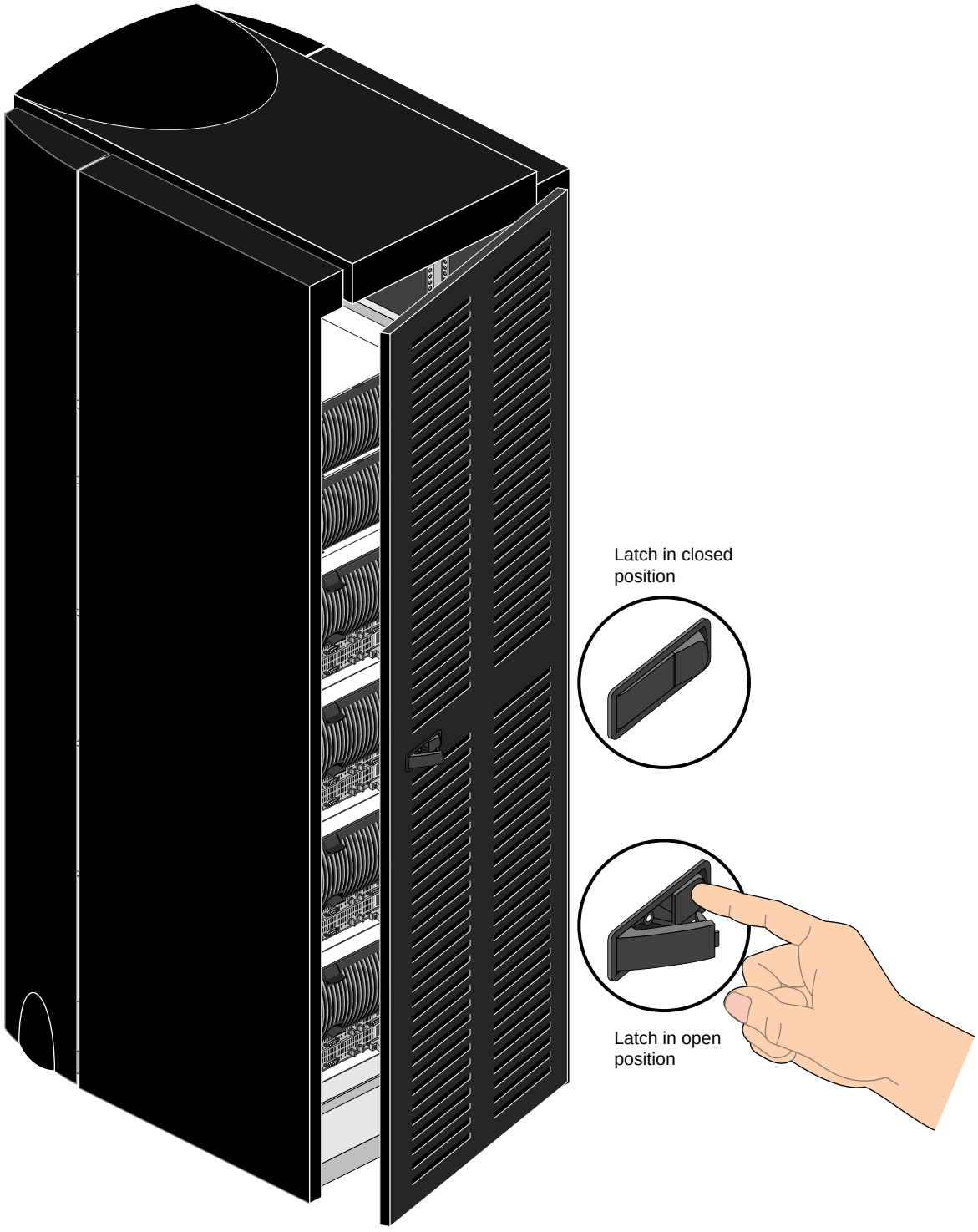


Figure 3-6 Opening the Fibre Channel Rack Rear Door

Note: If you remove the rear door entirely for any procedure, rehanging the rear door might require the help of a second person because of the difficulty of lining up the door's three pinlocks.

10. Position the ramp and lock it securely in place using the two slots at the side of the pallet; see Figure 3-5.
11. Using the 9/16ths-inch nut driver, undo the two 9/16ths-inch bolts that connect the back of the rack to the pallet-to-chassis retaining bracket. You should not need to remove the bolts that hold the bracket to the pallet.
12. Remove the four 9/16ths-inch bolts that attach the front bracket to the pallet.
13. Use an adjustable wrench to loosen each of the four screw-down feet directly adjacent to each caster. These feet must be raised in order for the rack to roll. Note that the front casters rotate completely (the rear casters are fixed).

    Note: Handle the rack carefully; the side panels scratch or mar easily.

    Caution: Never try to move the rack off the pallet sideways; doing so increases the potential for it tipping over. Always move it straight down the ramp.

14. With help from your partner, carefully move the rack off the pallet using the ramp and roll it to its intended place at the site.

    If the sides of the rack will be inaccessible in the intended location (such as for a bank of Fibre Channel Racks), remove any shipping braces before you place the rack, because this procedure requires removing the rack's side panels. See Section 3.2.2, "Removing a Horizontal Shipping Brace."

Caution: Proper service access requires that the installation location of the Fibre Channel Rack should have 36 inches (91.5 cm) of direct front access and 30 inches (76.2 cm) of rear space.

3.2 Installing an Enclosure in the Fibre Channel Rack

Install the DPE or DAE as described in these subsections:

- Section 3.2.1, "Preparing the Rack for Enclosure Installation"
- Section 3.2.2, "Removing a Horizontal Shipping Brace"
- Section 3.2.3, "Installing the Rack's Mounting Rails"
- Section 3.2.4, "Installing a 1/2-U Filler Panel"
- Section 3.2.5, "Installing the Enclosure"

For instructions on mounting hardware and procedures used to install or remove enclosures in an Onyx2 or Origin2000 rack; see Chapter 8, "Installing a Non-RAID FibreVault in the Origin Rack."

Warning: **Two persons are required to install disk enclosures in a Fibre Channel Rack. Do not undertake this procedure unless another trained and qualified installer is available.**

The procedures in this section require these tools:

- #2 Phillips screwdriver
- 5/16ths-inch (7.9 mm) box wrench or small adjustable wrench
- if possible, a piece of stiff cardboard, or plastic or foam, as a measuring template

3.2.1 Preparing the Rack for Enclosure Installation

Follow these steps to prepare a newly or previously installed Fibre Channel Rack for a FibreVault or Fibre Channel RAID enclosure:

1. Unpack the enclosure unit and verify that all parts are present. If they are not, notify the shipper of the missing parts. Note that enclosures ship with 0, 5, 9, or 10 disks installed. Examine the disk bays carefully because the air-flow filler panels look similar to disk modules.

   You can open the front door of each enclosure you are installing by unlocking the main latch and pushing the release. (If you accidently pull the door down with so much force that it becomes unhinged, snap it back on the hinges.)

   Note: To reduce the weight of the enclosure for insertion into the rack, remove disk modules, which weigh about 2 lbs. (0.9 kg) apiece. In a Fibre Channel RAID enclosure, drives 0, 1, and 2 contain licensed internal code; label these as you remove them, because they *must* be reinstalled in their original positions. See Section 6.1, "Adding or Replacing a Disk Module" in Chapter 6 for instructions.

   Temporarily removing the rear fan module also provides an extra hand hold location for lifting the enclosure; see page 3-23 for instructions.

2. If the rack is powered on, power it off before installing or removing enclosures:
   - If applicable, work with the system administrator at the site to shut down the system.
   - Stop all drives in the Fibre Channel Rack from the host system.
   - Open the door and set the rack's main circuit breaker switches (located at the top of each PDU) to the off position.

3. Starting at the bottom of the rack, press the release buttons on either side of the filler panel at the first open location and pull off the panel as shown in Figure 3-7.

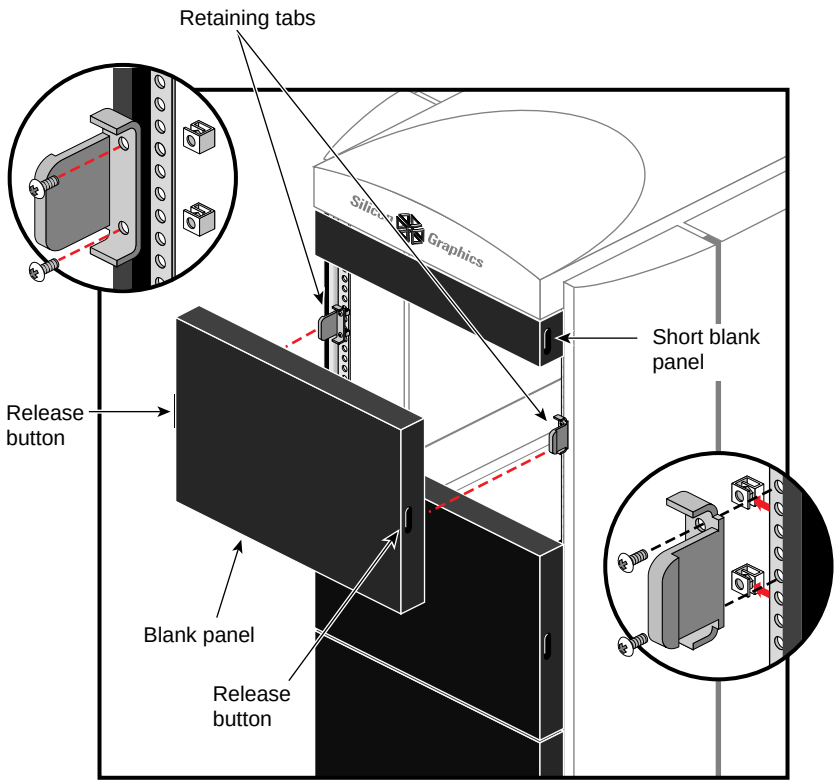


Figure 3-7 Fibre Channel Rack Filler Panel Retaining Tabs

Note: Always fill the rack with FibreVault or Fibre Channel RAID enclosures starting at the bottom, not at the top. If you are installing a 6.5 U Fibre Channel RAID enclosure, you must remove at least two filler panels.

4. Using a #2 Phillips head screwdriver, remove the plastic and metal retaining tab assembly from the vertical rail on each side of the rack; see Figure 3-7.

5. Determine the mounting location for a new fibre channel enclosure: using the templates in Appendix C, “Measuring Templates for NEMA Units,” cut a piece of stiff cardboard, sheet plastic, or foam to determine the exact position the additional enclosure will occupy:

   - DAE: 3.5 U (6.125 inches, or 15.56 cm)
   - DPE, including standby power supply (SPS): 7.5U (13.125 inches, or 33.37 cm)
   - DPE, no SPS: 6.5 U (11.375 inches, or 28.89 cm)

   Note: For a DPE with no SPS included, leave a 1 U (1.75 inches, or 4.45 cm) space directly underneath the unit to allow room for an optional SPS. The SPS has its own tray and does not need rails.

When you install the maximum number of enclosures in a rack, be sure the lowest mounting rail is in the lowest position. The bottom of the enclosure aligns with the center of the lowest rail hole when the rail is installed correctly.

3.2.2 Removing a Horizontal Shipping Brace

If you are installing an enclosure in an already installed Fibre Channel Rack, skip this section and go on to Section 3.2.3, “Installing the Rack’s Mounting Rails.”

If you are installing a new Fibre Channel Rack, you must remove one or more horizontal shipping braces. These braces are attached to the front vertical attachment rails to keep the vertical rails from flexing outward during shipment and handling.

In older Fibre Channel Racks, you must remove the side panels as well as the rear door to access the screws that hold the braces. In newer racks, removing the rear door suffices.

Follow these steps:

1. Remove the rack’s rear door: open it and lift it off the pins.
2. If necessary, remove the rack’s side panels:
   - Grasp the bottom of the side panel and pull firmly outward. The ball locks on the panel should both release.
   - Lift the panel up and away from the chassis.

   Note: The panel scratches or mars easily, so set it aside carefully.

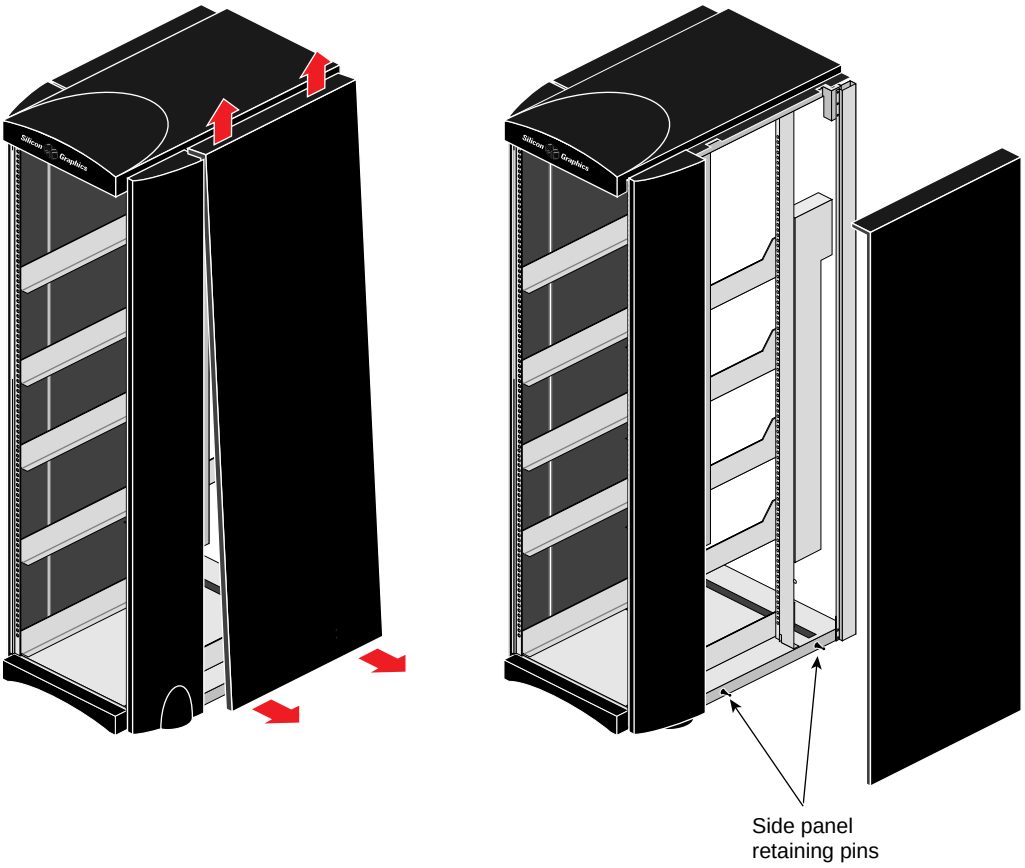


Figure 3-8 Removing the Fibre Channel Rack’s Side Panel

3. With a #2 Phillips screwdriver, undo the four nuts and remove the horizontal shipping brace; see Figure 3-9.

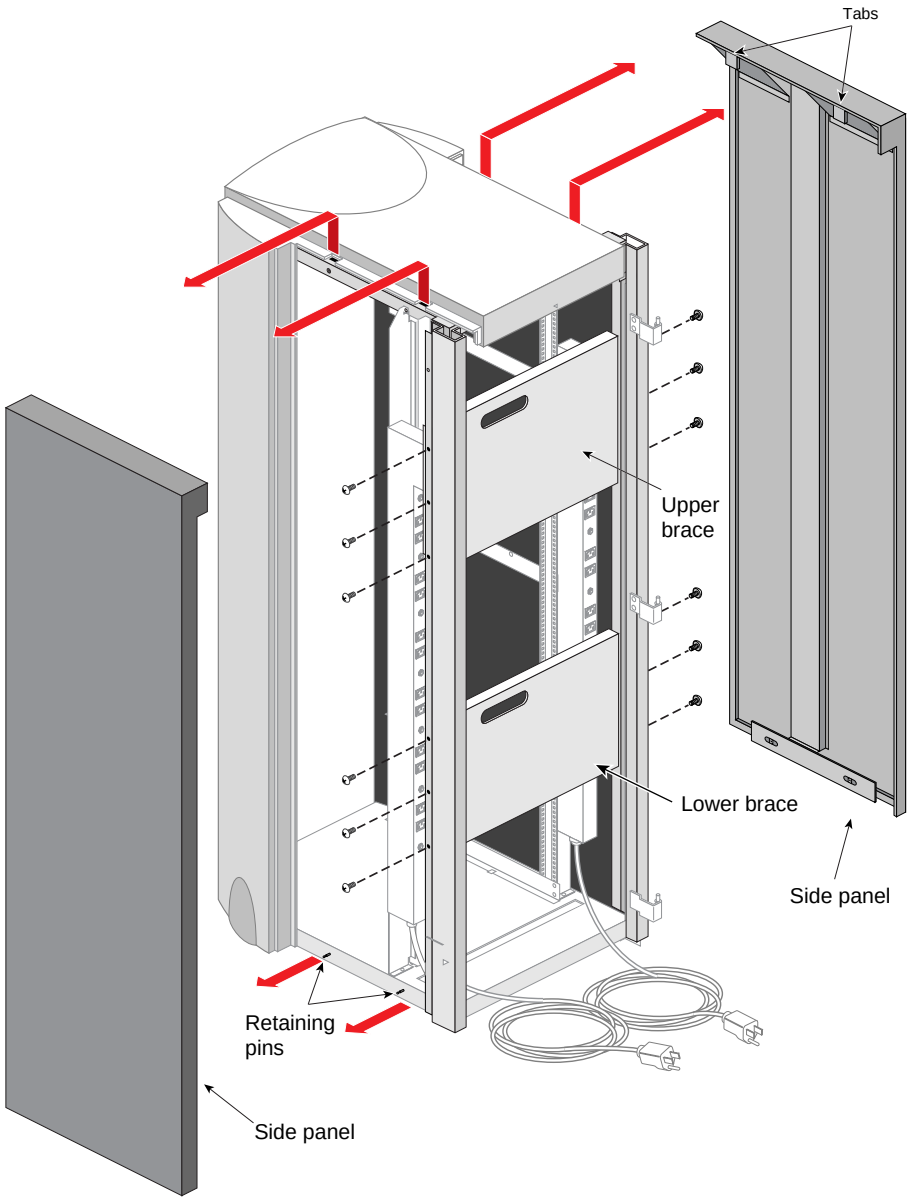


Figure 3-9 Removing the Horizontal Shipping Brace

4. Replace the side panels if you removed them. If you are not installing units in the rack, rehang and close the door.

3.2.3 Installing the Rack's Mounting Rails

This section is organized as follows:

- Section 3.2.3.1, "Mounting Hole Measurements"
- Section 3.2.3.2, "Installing the Rails"

3.2.3.1 Mounting Hole Measurements

The mounting holes in the Fibre Channel Rack are predrilled at distances of 0.5 inch (1.27 cm) and 0.625 inch (1.59 cm). As you count upward, the center of the lowest hole is 0.5 inch (1.27 cm) from the center of the next hole up. The next hole's center is 0.625 inch (1.59 cm) from the last hole's center, as is the third hole. The sequence of holes is then repeated, as shown in Figure 3-10.

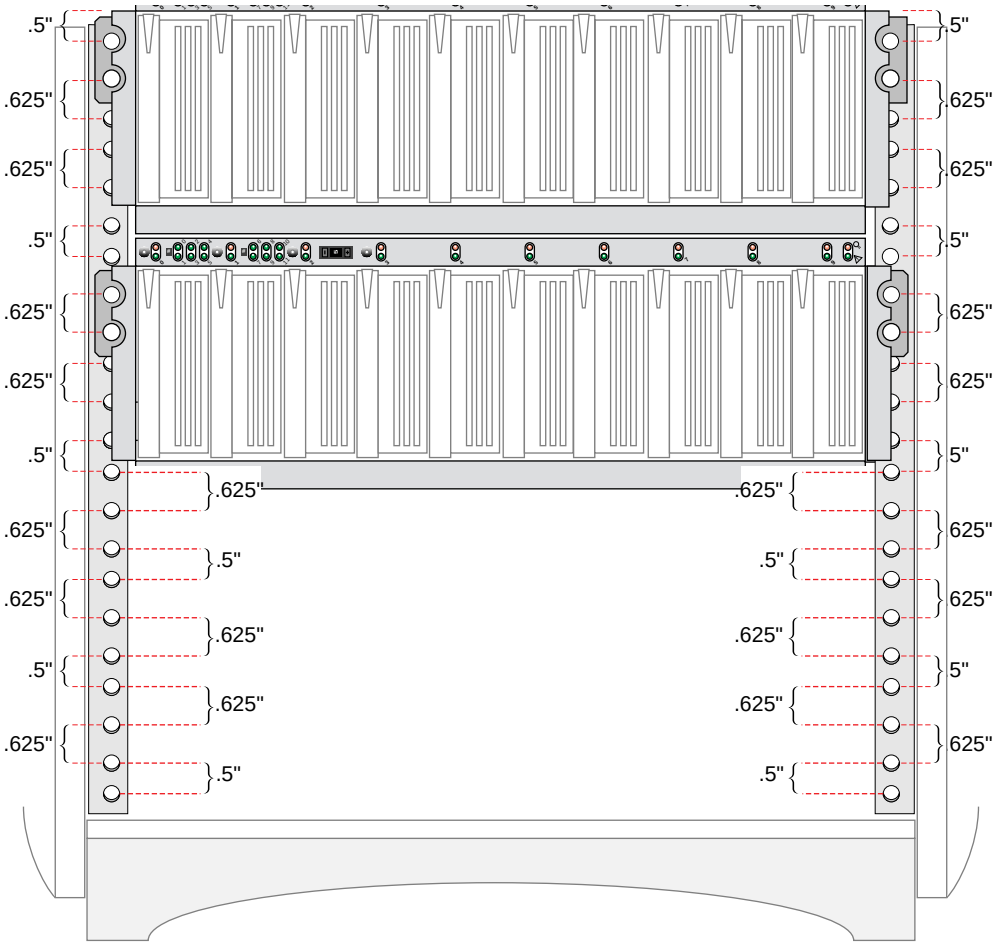


Figure 3-10 Mounting Hole Measurements

Table 3-1 provides height and hole alignment information for the Fibre Channel RAID, standby power supply (SPS), and FibreVault products.

Table 3-1 Fibre Enclosure Height Requirements (NEMA Units)

Device (Enclosure Type)	Height	Channel Holes (Starting U-Aligned)
Fibre Channel RAID enclosure (DPE) with SPS / tray without SPS / tray	7.5 U (13.125 in. / 33.37 cm) 6.5 U (11.375 in. / 28.89 cm)	22 19
Standby power supply (SPS)	1 U (1.75 in. / 4.45 cm)	03
FibreVault or Fibre Channel RAID expansion enclosure (DAE)	3.5 U (6.125 in. / 15.56 cm)	10

3.2.3.2 Installing the Rails

Calculate carefully where the mounting rails go so that the Fibre Channel Rack holds the maximum number of fibre enclosures. See the information in Section 3.2.3.1 for measuring details.

DAEs and DPEs use different types of mounting rails; this section describes how to install each type. After you select the proper mounting location (keeping in mind the measurements in Section 3.2.3.1), identify the proper rail hardware and prepare it for installation:

- Each FibreVault or Fibre Channel RAID expansion enclosure (DAE) mounting rail uses two screws at the front and two screws plus two clip nuts at the rear. The rails have a distinctive “shark fin” shape at the rear mounting end.
- The Fibre Channel RAID enclosure (DPE) uses a uniform (straight) rail design. The front of the mounting rail uses the same two screws as the FibreVault rails. The rear of the rails mount to the vertical channels with two nut and washer assemblies that go on threaded studs. The nuts are removed or tightened with a 5 / 16ths-inch (0.31 inch, or 7.9 mm) wrench or a small adjustable wrench. Be sure not to overtighten the nuts that attach the studs at the rear rails because they *will break off*.

Install the mounting rails using the following steps:

1. For easier access, remove the cabinet rear side panels if they are in place (this is not necessary to complete the procedure).
2. Mark the lowest available U-aligned screw position on the cabinet front channels.

   If you are installing an enclosure in the first (bottom) location, the bottom of the rail should be just above the center of the lowest hole.
3. Position the front of the first mounting rail so that the screw holes are aligned.
4. With a #2 Phillips screwdriver, secure the two front mounting rail screws; see Figure 3-11.

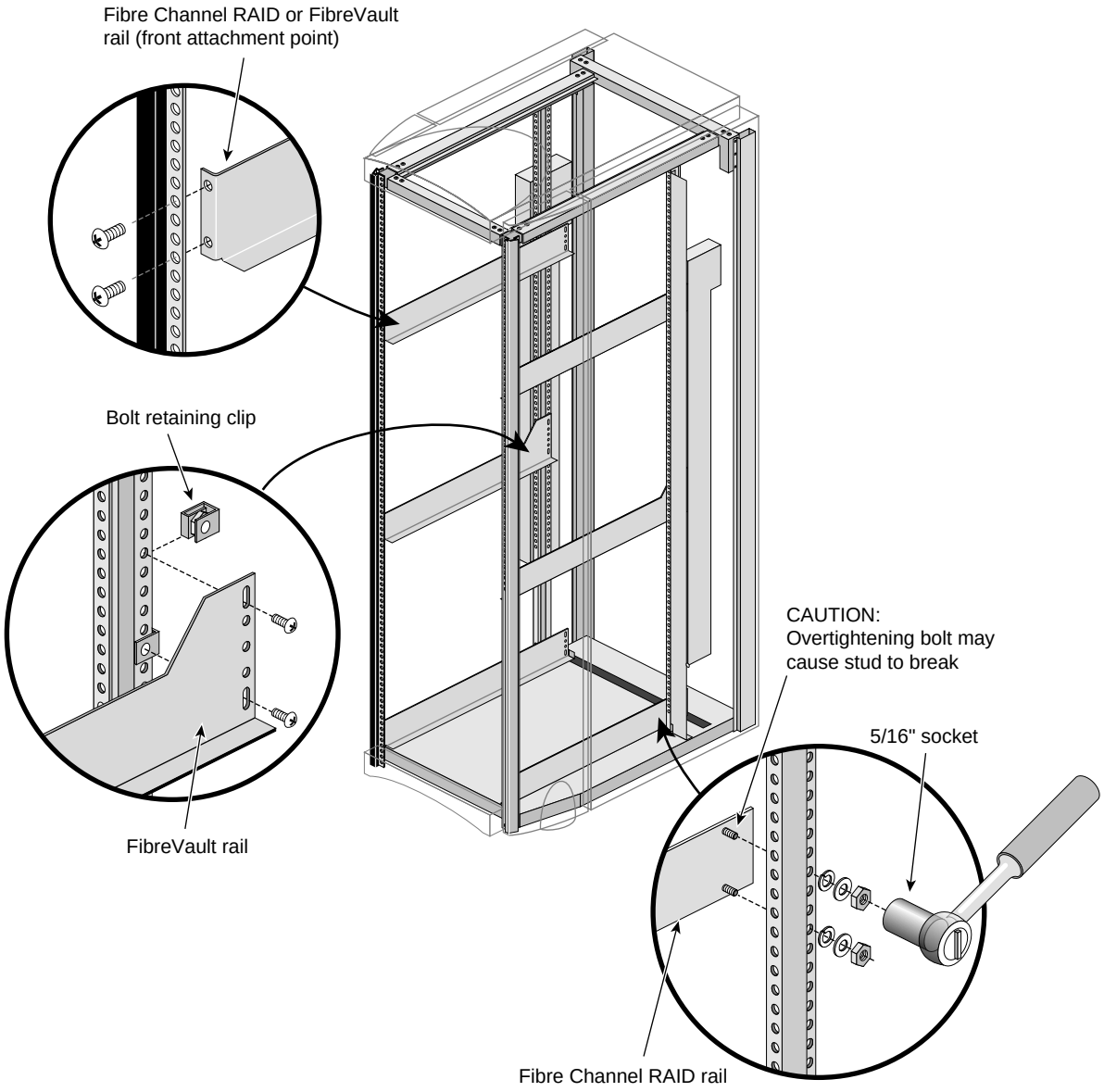


Figure 3-11 Mounting the Rails in the Fibre Channel Rack

5. Confirm that the two mounting holes for the rear of the slide rail are properly aligned.
6. Secure the rear of the mounting rail using one of these procedures:
    - For FibreVault or Fibre Channel RAID expansion enclosures (DAEs), slip a clip nut over each of the aligned rear holes. Using a #2 Phillips screwdriver, attach the rail with the screws provided.
    - For Fibre Channel RAID enclosures, slip the two attached screws at the rear of the rail through the proper holes, then place a washer, lock washer, and nut over each. Tighten each assembly carefully using a 5/16ths-inch (7.9 mm) box wrench or small adjustable wrench. Do not overtighten.
7. Repeat the process with the next rail.

3.2.4 Installing a 1/2-U Filler Panel

Some rack configurations have a 1/2-U gap between the top of an enclosure and the rack's other blank filler panels. In this case, use a 1/2-U filler panel that attaches to the top of an enclosure to close the gap. Use a #2 Phillips screwdriver on the screws; see Figure 3-12.

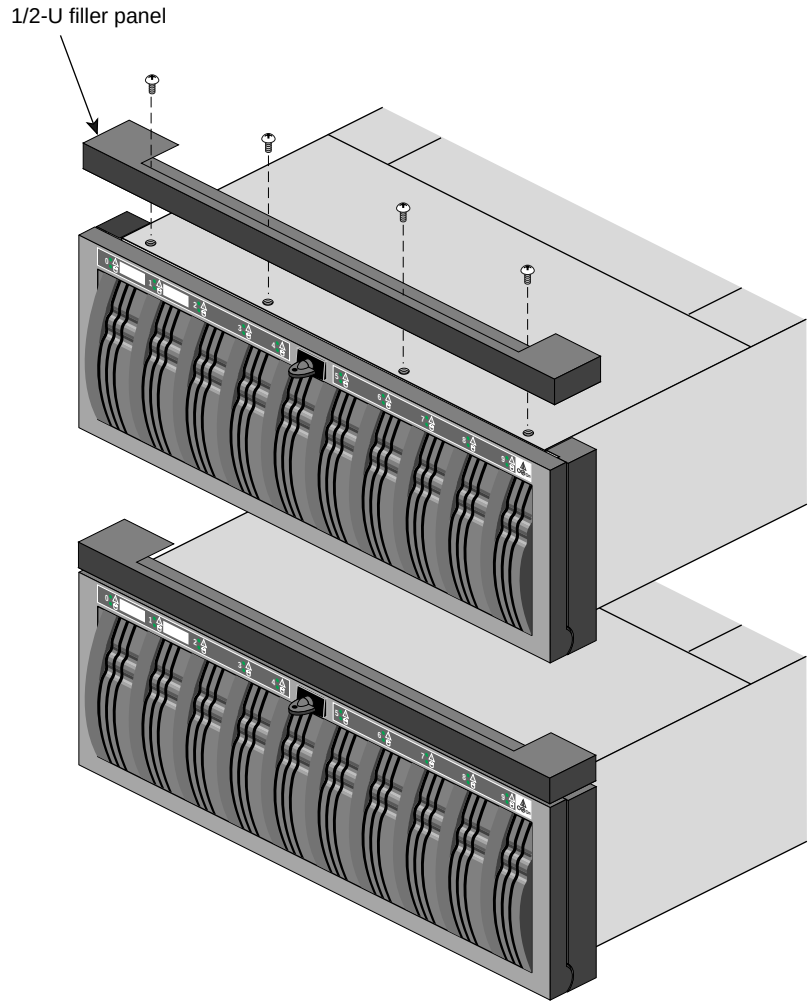


Figure 3-12 1/2-U Front Filler Panel for the Rack

3.2.5 Installing the Enclosure

Use the following information to install the enclosure(s) in the rack.

Warning: **The enclosures are heavy. The Fibre Channel RAID enclosure can weigh up to 110 lb. (49.6 kg) fully loaded. Never remove, replace, or install an enclosure alone.**

1. To make the enclosure much easier to grasp and maneuver, remove the rear fan module from the enclosure. On Fibre Channel RAID, remove the front panel and fan module also. See page 3-23.
2. Working with another installer, lift the enclosure and engage the bottom rear of the enclosure with the rails. Be careful not to damage the LCC handles or scrape the new enclosure against the rack or other enclosures.

   Note: When installing an enclosure in the middle of several others (as when replacing an existing unit), tilt the front of the enclosure downward about 45 degrees before engaging the bottom sheet metal with the mounting rails.
3. Slide the enclosure into the rack as shown in Figure 3-13.

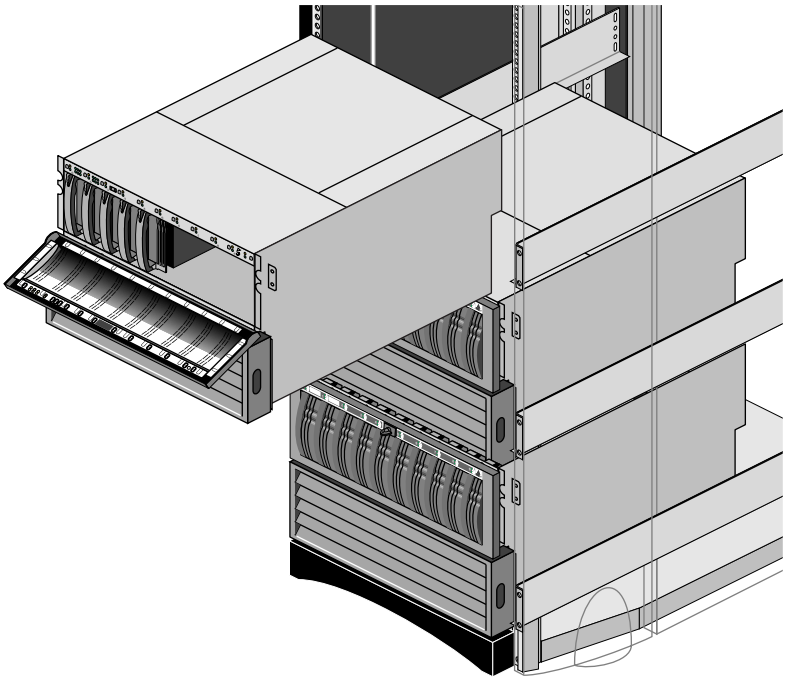


Figure 3-13 Inserting the Enclosure Into the Fibre Channel Rack

4. With a #2 Phillips screwdriver, secure the enclosure in the rack using one retaining screw per rail.
    - The Fibre Channel RAID enclosure (Figure 3-14) secures in the rack at the rear of each rail.

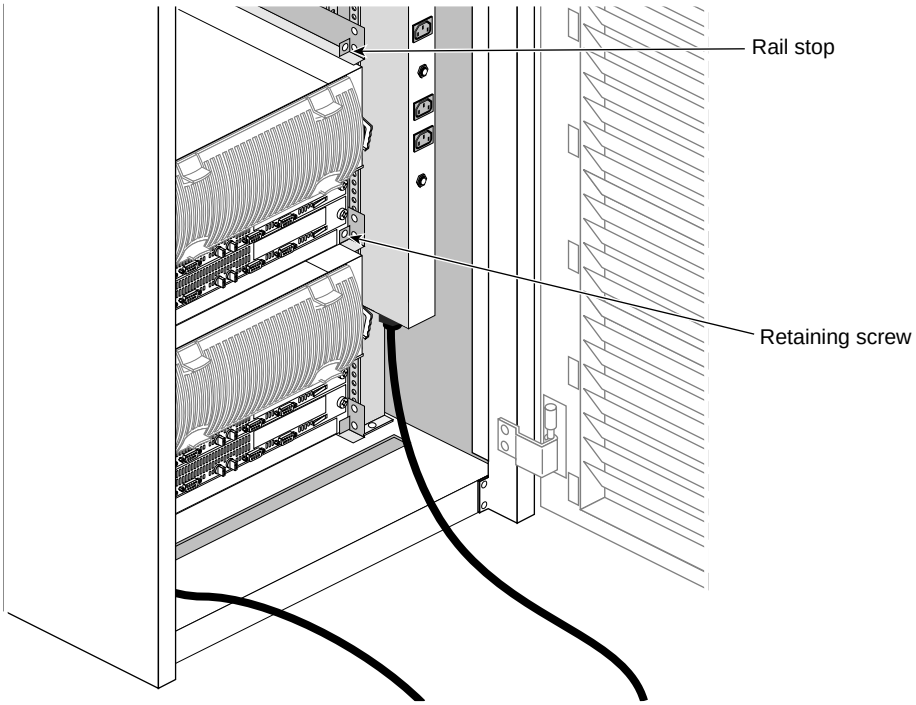


Figure 3-14 Fibre Channel RAID Enclosure Installation Example

    - The front of the FibreVault has two openings for screws on each side. Only one aligns properly with a screw hole. Insert a clip nut in the proper position on each of the rack's vertical mounting bars and secure the enclosure.
5. Install any disk modules that were removed earlier. For the Fibre Channel RAID enclosure, be sure to reinstall the first three disk modules in the correct order.
6. Replace any fan modules removed. You may want to leave the rear fan module(s) out until you install the enclosure power cords (described later in Section 3.4, "Connecting the Enclosure Power Cord(s)").

3.3 Setting the Enclosure Address

When you have installed all enclosures, set the enclosure addresses. This section is organized as follows:

- Section 3.3.1, "Enclosure and Disk Address Guidelines"
- Section 3.3.2, "Setting the Enclosure Address on the FibreVault"
- Section 3.3.3, "Setting the Enclosure Address on a Fibre Channel RAID Enclosure"

3.3.1 Enclosure and Disk Address Guidelines

Guidelines for enclosure and drive module combinations on an FC-AL are as follows:

- Configure all RAID loops in a linear chain: the address of the first DPE in the loop is 0, the first DAE cabled to it is 1, the next DAE is 2, and so on in sequence.

  Each enclosure on an FC loop (all DAEs daisy-chained to a DPE connected to an FC port) must have a unique address in the sequence in which they are cabled, with no gaps between addresses.

  Separate loops (connected to different FC ports) can reuse these addresses as long as each enclosure in a loop has a unique address, in sequence, with no gaps.

  For JBOD FibreVault loops, each enclosure must have a unique address, but the address numbers need not be in sequence or without gaps.

- All Fibre Channel RAID disk enclosures and their expansion enclosures attached to an FC-AL must have at least five disk modules installed.
- If you must configure a non-RAID FibreVault with only one drive, it must be either the last enclosure on the loop or the only enclosure on the loop.
- The non-RAID FibreVault enclosure must always have a disk module installed in either slot 0 or 1. Access to enclosure-specific environmental information depends on at least one of these slots being populated with a disk.
- Never connect a FibreVault or Fibre Channel RAID enclosure to an FC port if it has no drives installed.

For high availability, you must have optional IRIS FailSafe software and certain redundant hardware components, which can provide protection from a failure occurring at a disk, path, power supply, fan, or host. IRIS FailSafe configuration is explained in that product's documentation.

For full details on configuring disks and RAID groups, see the *Origin FibreVault and Fibre Channel RAID Administrator's Guide* and the *Origin FibreVault and Fibre Channel RAID Owner's Guide*.

3.3.2 Setting the Enclosure Address on the FibreVault

The drives read their FC-AL physical address only at power-on or when the drive is reset. As a result, you must set the enclosure address when you install the FibreVault and power is off. Never change the address while power is on.

Note: Each enclosure on an FC-AL loop must have a different ID number, as explained in Section 3.3.1, "Enclosure and Disk Address Guidelines."

Set the enclosure address for each unit by using a pencil or ballpoint pen to move the down or up switch. Figure 3-15 shows the address switch.

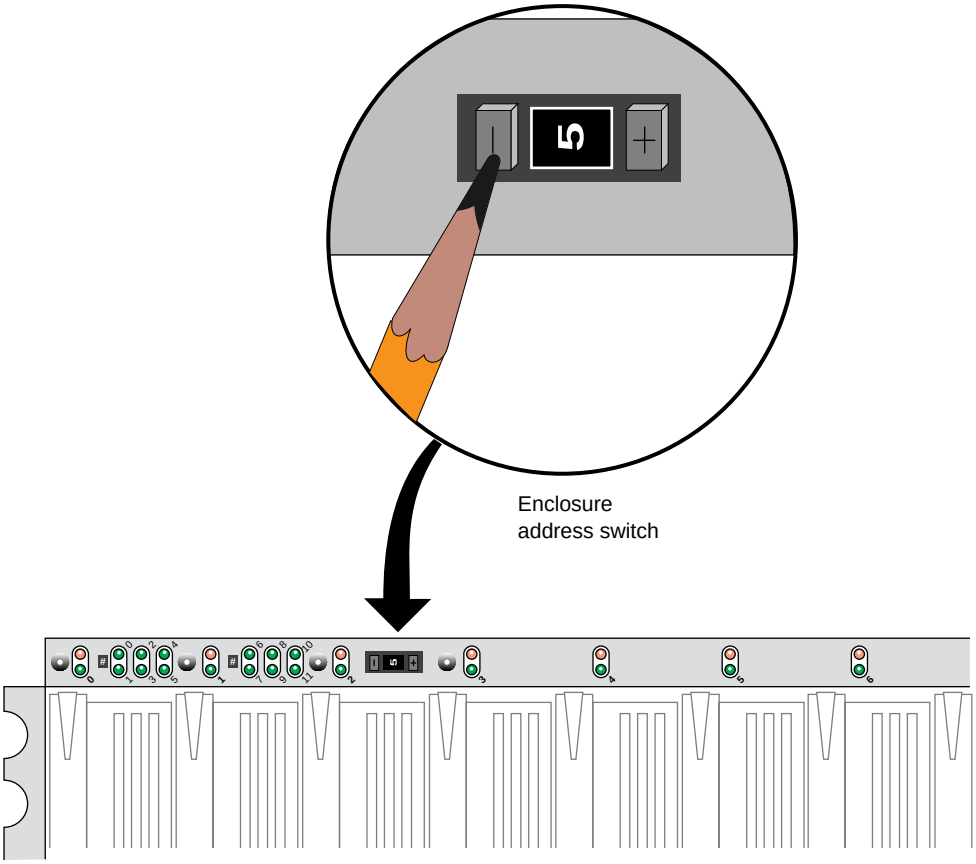


Figure 3-15 Setting the FibreVault Enclosure ID

When you are finished setting the address, push up the FibreVault's front door until it latches into place.

The disk slots in a FibreVault enclosure are numbered 0-9 (from left to right). Disk modules are numbered based on the ID of the enclosure. Each disk module on an FC-AL must have a unique FC-AL physical address. This address is derived from the enclosure address ({EA) as follows:

- FC-AL physical address = (10 multiplied by EA) + SA
- SA is the slot assignment number of the slot (0–9) containing the disk module

Table 3-2 shows the maximum disk numbering.

Table 3-2 Enclosure and Disk Slot Numbering

Enclosure ID	Disk Slot Number
0	0-9
1	10-19
2	20-29
3	30-39
...	...
9	90-99
10	100-109

3.3.3 Setting the Enclosure Address on a Fibre Channel RAID Enclosure

Each system processor (SP) must have a unique fibre channel front-end address. The Fibre Channel RAID enclosure address is determined and set on the SP board, accessible at the rear of the enclosure. Valid address ranges are 0 through 109 (decimal). This equals 0 through 6D hexadecimal (0 on both switches through 6 on the left switch and D on the right switch); see Figure 3-16.

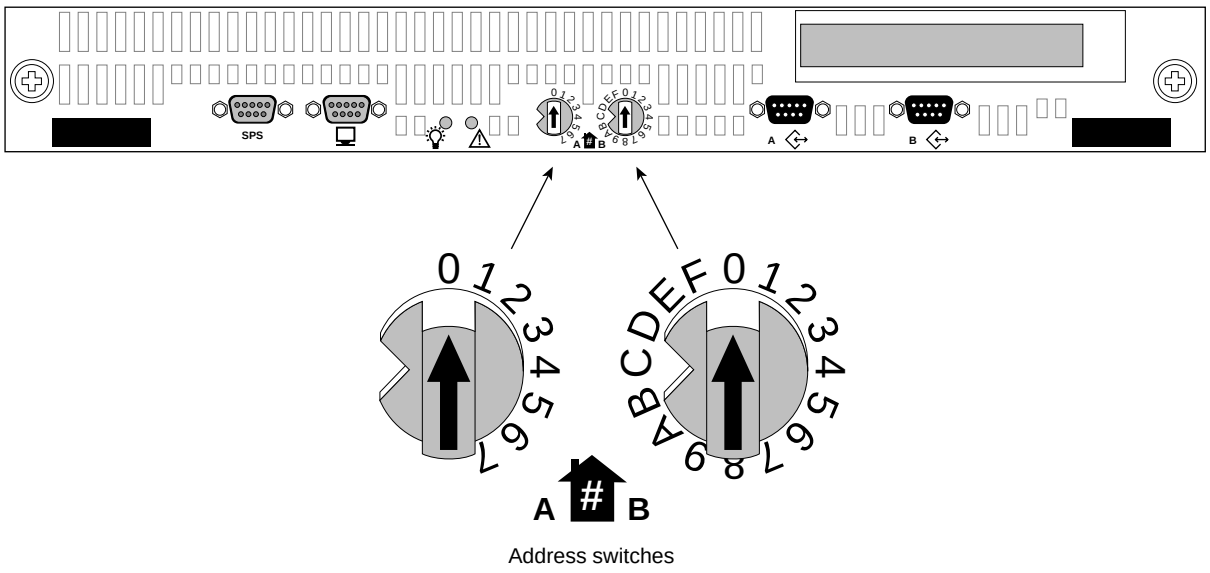


Figure 3-16 Fibre Channel RAID Enclosure Channel Address Switches

Disk modules are numbered based on the ID of the Fibre Channel RAID enclosure. Table 3-2 shows the maximum disk numbering. Read the scsiha(1M) reference (man) page for additional information on this topic.

3.4 Connecting the Enclosure Power Cord(s)

As a general rule, connect the power cord(s) after the enclosure is installed in the Fibre Channel Rack.

To attach the enclosure power cord, follow these steps:

1. At the back of the enclosure, remove the fan assembly; see the example in Figure 3-17. Squeeze the fan assembly latches toward each other to release the unit. Go on to step 2 if the fan module is already out.

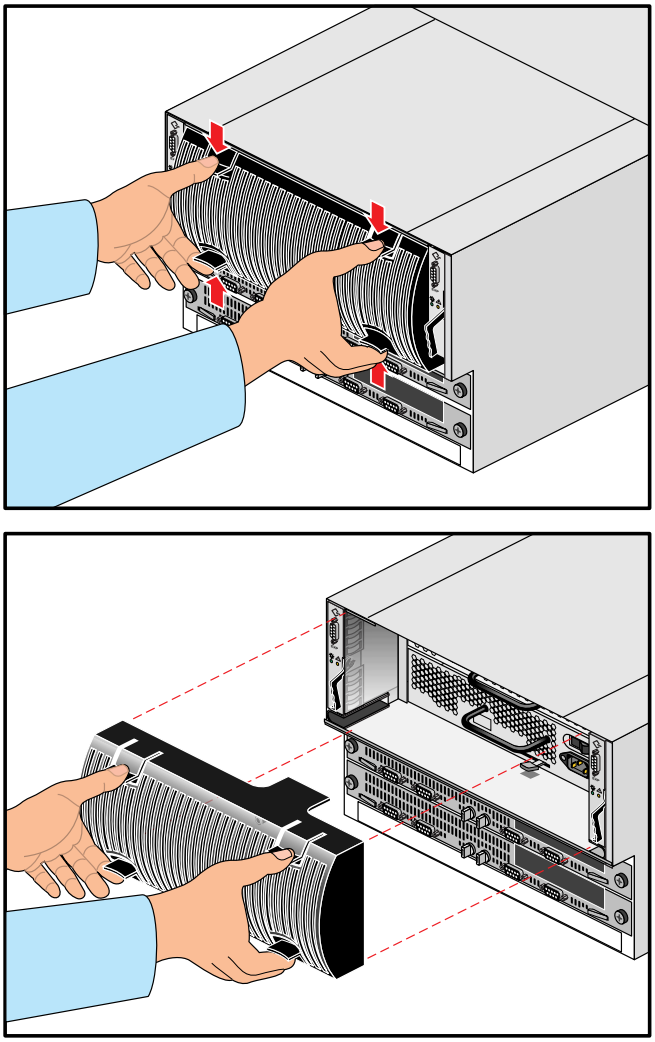


Figure 3-17 Removing the Fan Assembly

If the assembly does not pull out easily, grasp the fan assembly's handles (squeeze latches) on one side and pull them inward towards the middle of the fan assembly until you feel them loosen.

While keeping a thumb on each of the already loose latches, grasp the set of squeeze latches on the opposite side of the assembly with your fingers and pull them in toward the middle of the assembly and outward.

2. At the back of the rack, plug the power supply AC line cord supplied with the enclosure into the power supply outlet and route the cord along the power supply to the side of the enclosure chassis, avoiding the space for the fan assembly. See Figure 3-18 and Figure 3-19.

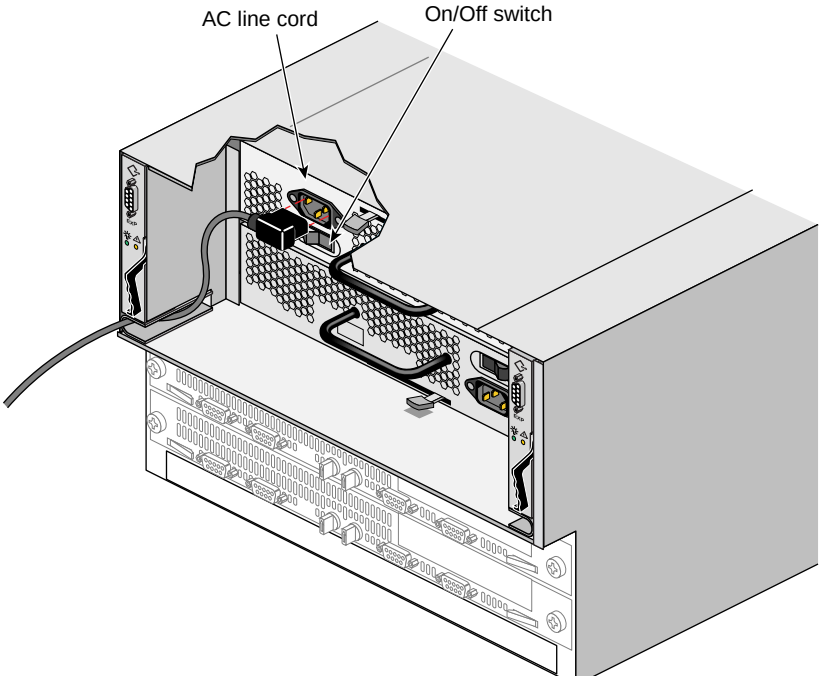


Figure 3-18 Attaching the AC Line Cord: Top Power Supply

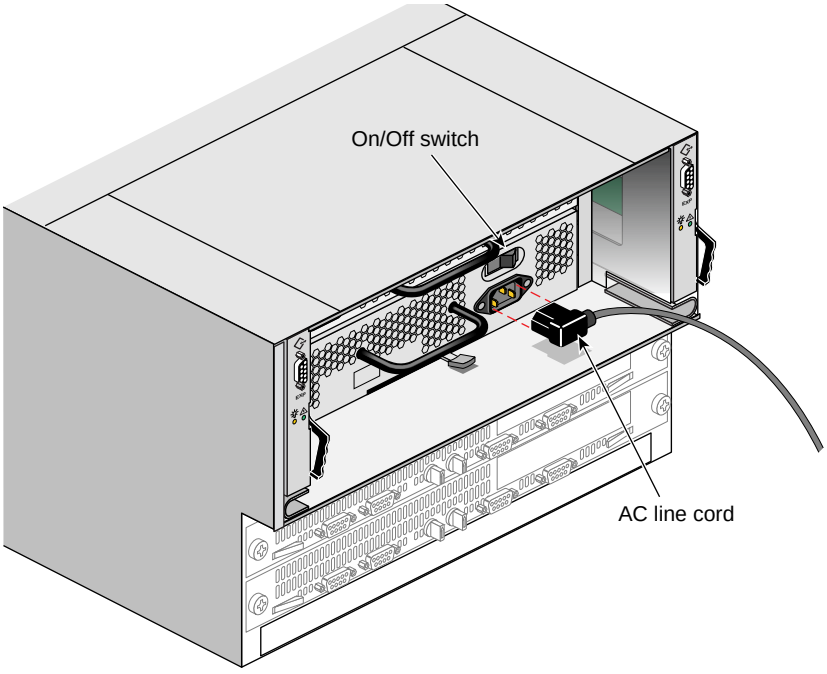


Figure 3-19 Attaching the AC Line Cord: Bottom Power Supply

3. Bend the cord into a U shape and slide it into the channel so that the end of the cable comes out of the channel at the back of the chassis.
4. Plug the end of the cord into one of the rack's outlets, as shown in Figure 3-20.

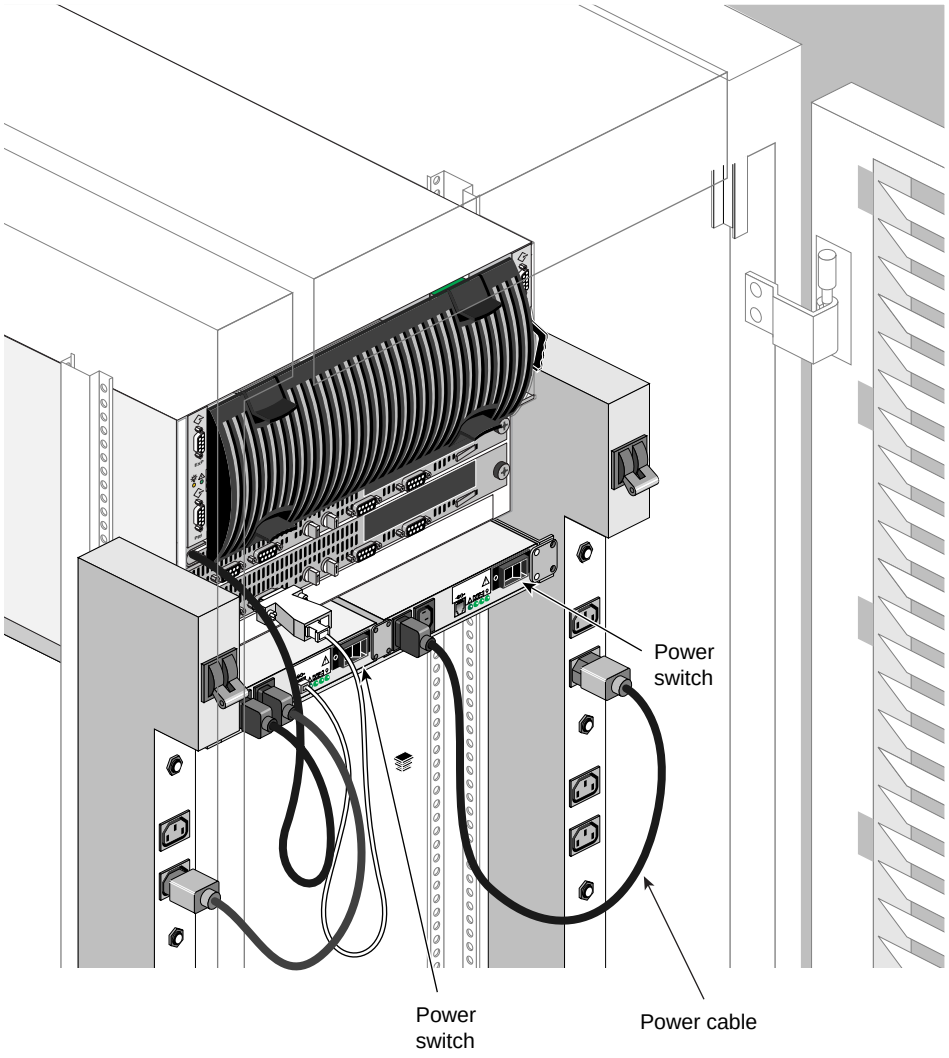


Figure 3-20 Routing the Power Cable to the PDU

Note: Figure 3-20 shows an optional standby power supply (SPS) installed and cabled. For high-availability power management, put all A hardware components on one path (SPS, PDU, power strip) and all B components on the other.

If the customer has ordered one or two SPSs and their mounting tray, see Section 7.1, "Installing or Removing a Standby Power Supply (SPS) in a Fibre Channel Rack" in Chapter 7 for installation and cabling instructions.

5. Set the power switch on each power supply to the on position. The enclosures do not power on until the rack itself is powered on.
6. Reinstall the fan assembly.

Although the fan assembly attaches to the enclosure with either side up, for consistency among multiple FibreVault or Fibre Channel RAID enclosures, install it with the amber status light in the upper right corner.

Squeezing the fan assembly latches toward each other, align and push the assembly forward into the chassis. The fan assembly snaps onto the power supply.

7. Repeat the process for all new enclosures you have installed.

3.5 Cabling Enclosures in the Fibre Channel Rack

Before you cable enclosures, read Section 3.3.1, “Enclosure and Disk Address Guidelines.”

When you connect multiple enclosures on one FC-AL signal, retiming is required to maintain signal integrity. The drive modules in each enclosure must provide this timing.

Signal retiming is a functional feature of the fibre channel standard that guarantees signal integrity for the arbitrated loop topology. Each active device within a loop receives a bused signal from the device ahead of it on the FC-AL loop. The signal is retimed and retransmitted so that each device on the loop receives signals within the defined fibre channel minimum signal margins.

Note these cabling restrictions:

- A single FC port on the host supports enclosures in a single Fibre Channel Rack. Do not extend the loop to another rack (even when fewer than 110 drives are installed in a Fibre Channel Rack).
- Always connect the first FC port on the host to port A on SP A on a Fibre Channel RAID enclosure.
- Never disconnect a cable from an operating enclosure.
- Never connect a cable from LCC A to LCC B.
- If a DPE has two LCCs (A and B), each DAE cabled to it must also have two LCCs. If a DAE has no LCC B, binding LUNs on SP B is restricted in some circumstances: If SP A uses disk modules 00 through 09 (that is, all the disk modules in the DPE) in LUNs, you cannot bind any LUNs on SP B, because the connection to the disk modules in the DAE is missing. There is no path through LCC B (absent) and no path through the disk modules on the DPE (all are bound on SP A).

To cable the enclosures, follow these steps:

1. Connect one end of the enclosure’s 0.3-meter cable to the expansion (**EXP)** port of the enclosure’s LCC, as shown in Figure 3-21. If cabling is on one side of the rack only, use the LCC on that side.

   Note: To connect enclosures, use only the 0.3-meter (11.8-inch) copper cables supplied for this purpose. Daisy-chaining to enclosures in other racks is not supported.

2. Connect the other end of the enclosure cable to the primary (**PRI)** port of the next enclosure.

3. If cabling is on both sides of the rack (dual link control cards), connect the optional second enclosure cable to the other LCC as in steps 1 and 2.

   Note: Make sure you have no cross-cabling between LCC As and LCC Bs.

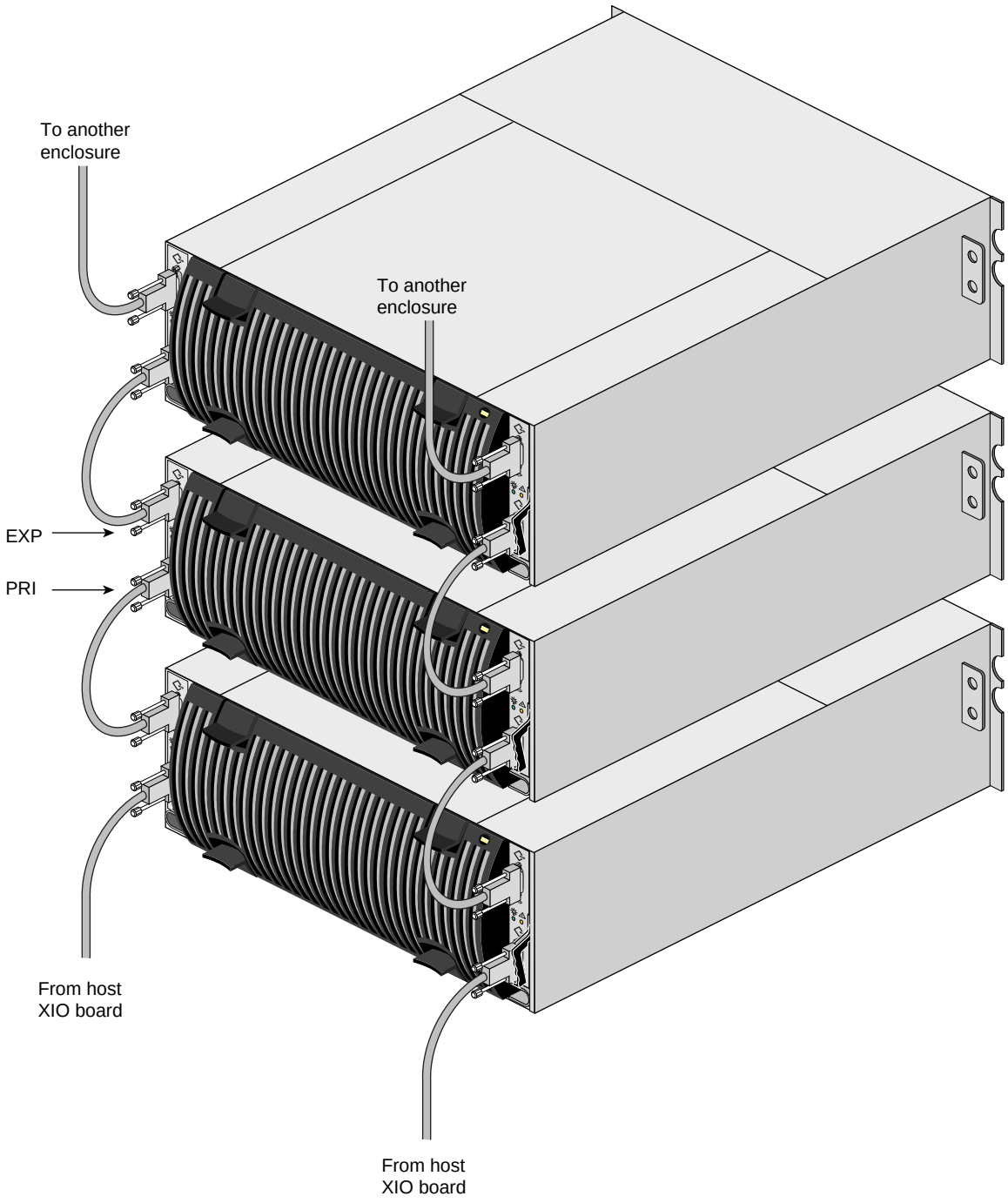


Figure 3-21 Cabling Separate LCC Loops

When you finish cabling enclosures, cable the DPE to the host system. Working with the customer, connect port A on SP A to a port on a fibre channel board in the host. If applicable, connect port B on SP A and the ports on SP B to other FC ports in the host. Figure 3-22 points out the connectors. (For IRIS FailSafe cabling, see the *IRIS FailSafe Installation and Maintenance Instructions* (108-0144-005 or later).)

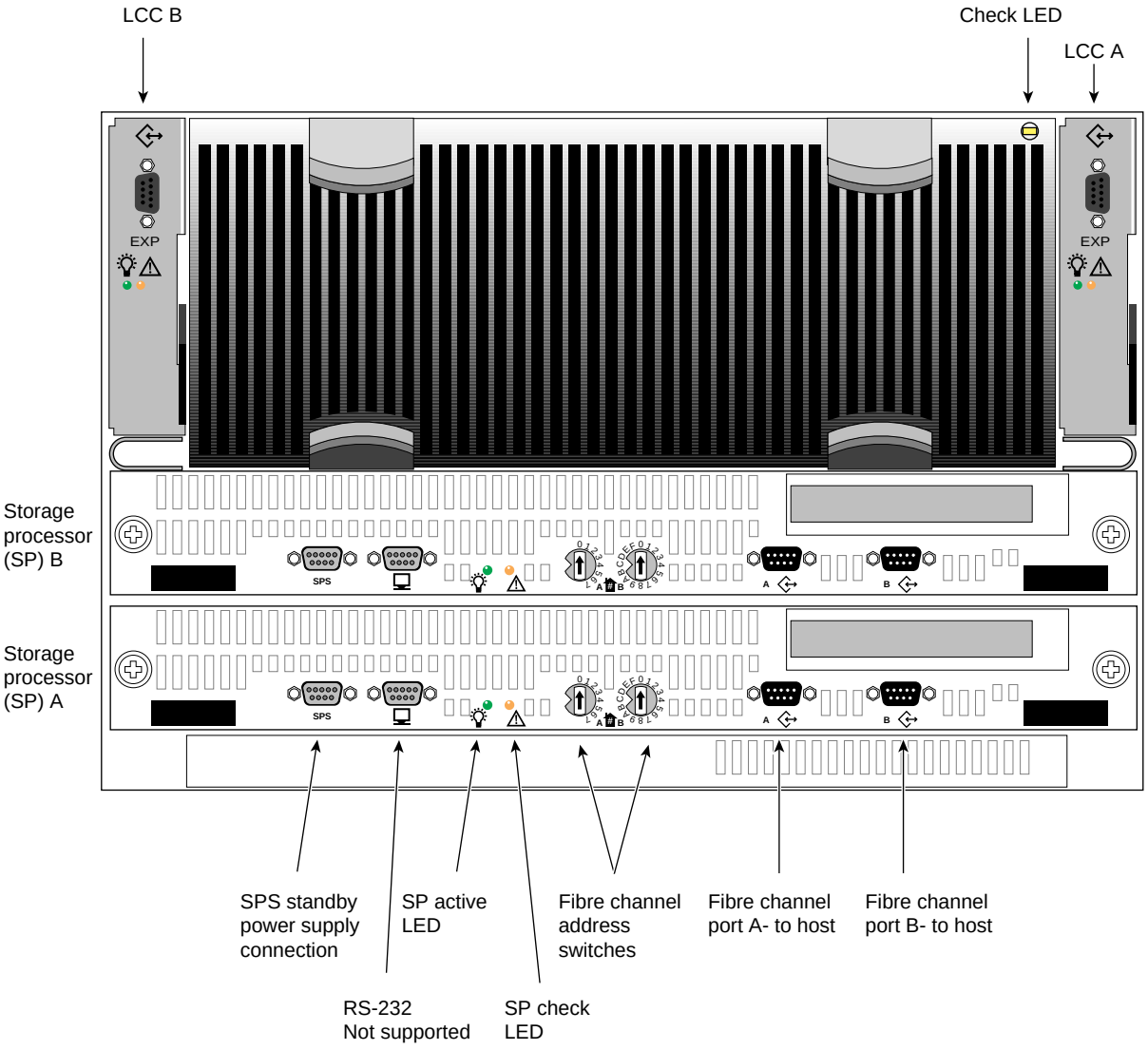


Figure 3-22 SP Connectors

3.6 Powering On the Fibre Channel Rack

The only power switches on an enclosure are those on the power supplies, which are normally covered by the drive fan pack. As a result, the enclosure is always active as long as power is available.

When AC power is initially applied to an enclosure (the Fibre Channel Rack power switch is in the On position), the disk drives power on and spin up in a specified sequence. The slot spin-up delays are multiples of 12 seconds. The same delays occur when a drive is inserted while the enclosure is powered on.

The drives read their FC-AL physical address only at power-up or when the drive is reset. As a result, you must set the enclosure address when you install the enclosure and power is off, and not change the address while power is on.

To power on the Fibre Channel Rack, follow these steps:

1. Make sure that the power switch on each enclosure's supply is set to on.
2. Make sure all the slots in each enclosure contain either disk modules or fillers.
3. Confirm that the power cord for each supply in each enclosure is plugged in to an AC power outlet on the power distribution unit (PDU). See Figure 3-20.
4. In the rack, set the PDU's circuit breaker switches to the on position. The enclosures in the cabinet power on. If you have cabled to both PDUs, power on the other one.
5. Power on the host system.
6. Check the installation and install software as explained in Check the installation and install software as explained in Chapter 5, "Checking the Installation and Installing and Configuring the Software."

Chapter 4

Setting Up a FibreVault or Fibre Channel RAID Deskside System

This chapter discusses

- Section 4.1, “Unpacking the Deskside FibreVault System”
- Section 4.2, “Cabling the FibreVault”
- Section 4.3, “Unpacking the Deskside Fibre Channel RAID System (Widebody)”
- Section 4.4, “Connecting the Widebody Power Cables”
- Section 4.5, “Cabling the Widebody DPE to the DAE and the Host”

Warning: **The FibreVault tower weighs 36 kg (about 80 lbs) empty and 60 kg (132 lbs) fully configured. Never attempt to pick up the deskside FibreVault without arranging for the help of a second person before you start.The Fibre Channel RAID tower weighs 76.5 kg (168.6 lbs) with most components removed, and 140 kg (309 lbs) fully configured.**

Note: Before installing or significantly upgrading a fibre channel storage system, make sure that the installation site meets the air-conditioning, floor-loading, AC power requirements, and operating limits listed in Appendix A, “Technical Specifications.”

4.1 Unpacking the Deskside FibreVault System

The FibreVault deskside tower comes in a pallet-mounted carton. Move the entire package to the assembly area if possible.

Warning: **The FibreVault tower weighs about 80 lbs (36 kg) empty and up to 132 lbs (60 kg) fully loaded. Never attempt to pick up the deskside FibreVault without the help of a second person.**

The procedures in this section require

- #2 Phillips screwdriver
- if you must lift the FibreVault, the help of another trained and qualified installer

Figure 4-1 shows the deskside FibreVault with its locking wheels and anti-tip legs. Lock the front wheels by pushing the locking lever on each front wheel down. You lift he wheel up when you need to roll the system to a new location.

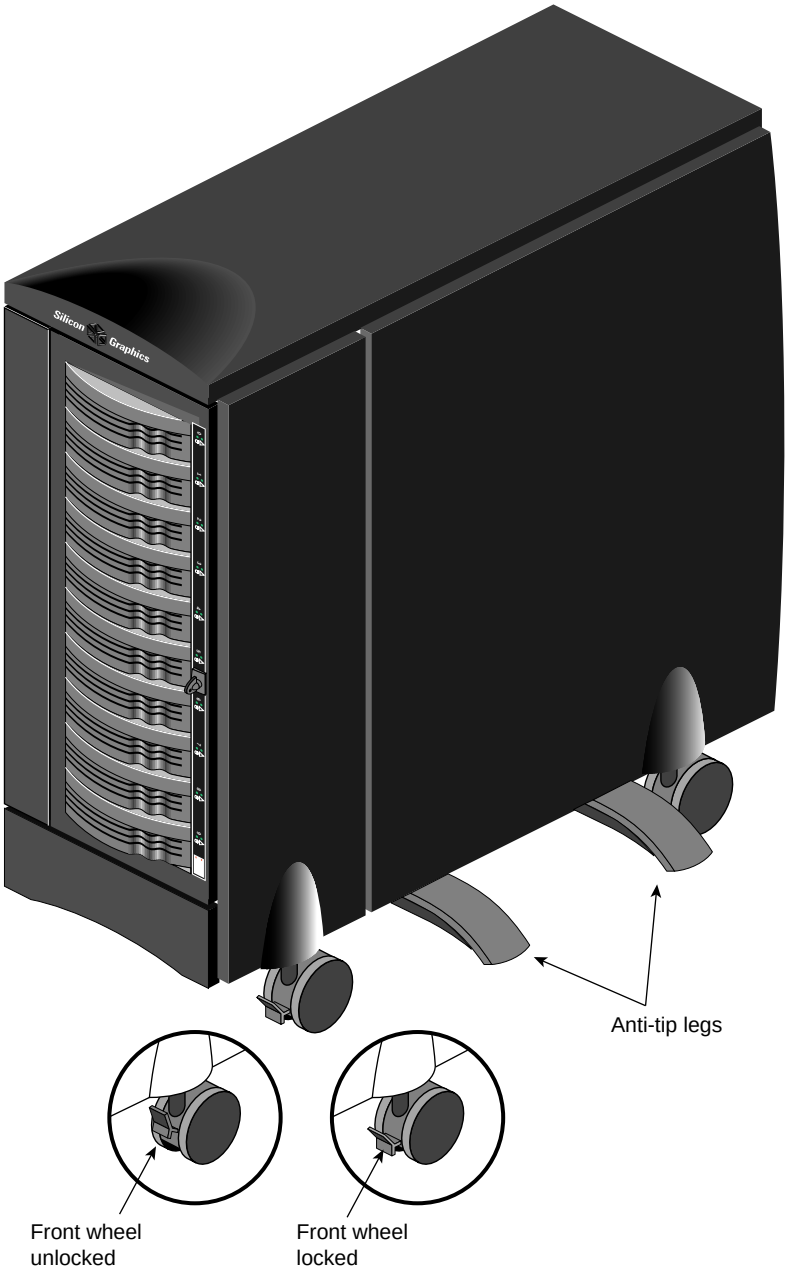


Figure 4-1 FibreVault Deskside: Wheels and Legs

Caution: The deskside FibreVault's anti-tip legs should always stay attached to the enclosure. The legs stabilize the tower unit and prevent it from tipping over.

Use the following guidelines to unpack the unit.

1. Pull the top cover off the pallet and remove the plastic wrap. Check the unit for damage and report any problems to the shipper.

- With a #2 Phillips screwdriver, unbolt the bracket retainers that hold the unit to the pallet.

2. Unlock the wheels; see Figure 4-1.
3. Roll the deskside tower off the pallet to the designated installation site.

   When you take the unit off the pallet, lift the edge of the tower up a bit to clear the anti-tip legs.

4. When the tower is positioned, lock the wheels.
5. Working with the customer, set the enclosure address following instructions in Section 3.3, “Setting the Enclosure Address” in Chapter 3.
6. Cable the FibreVault following instructions in Section 4.2, “Cabling the FibreVault.”

4.2 Cabling the FibreVault

To connect the FibreVault power cord and other cables, attach the power cords to sockets in the PDUs, as shown in Figure 4-2.

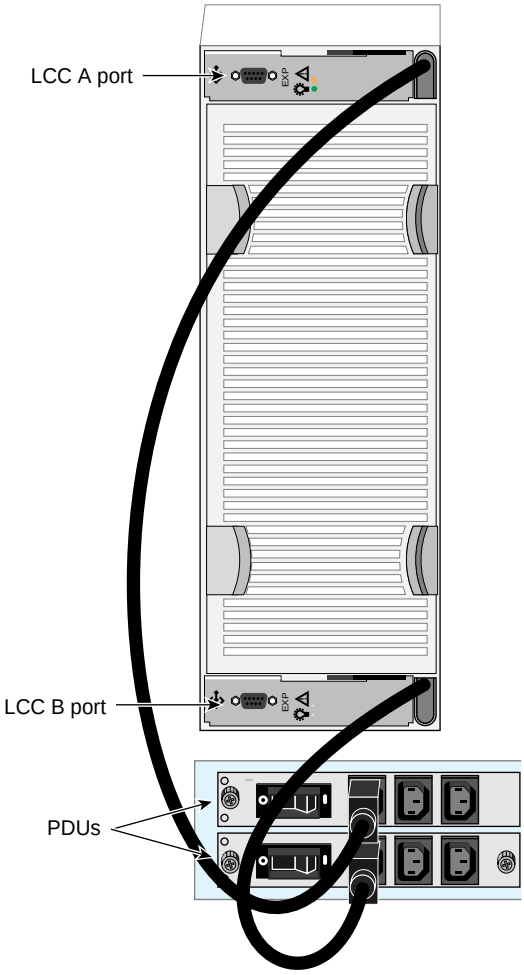


Figure 4-2 Connecting the FibreVault Power Cords to the PDUs

Connect the power cord from power supply A, at the top, to PDU A (the top PDU); connect the power cord from power supply B, to PDU B (the bottom one).

Cable the FibreVault to the host system: working with the customer, connect the port on LCC A to a port on a fibre channel board in the host. If applicable, connect the port on LCC B to another FC port in the host. (The host need not be powered off.)

Power on the FibreVault. Check the installation and install software as explained in Chapter 5, “Checking the Installation and Installing and Configuring the Software.”

4.3 Unpacking the Deskside Fibre Channel RAID System (Widebody)

The fibre RAID deskside (widebody) comes in a pallet-mounted carton. Move the entire package to the assembly area with a pallet jack if possible.

Warning: **The Fibre Channel RAID tower weighs 76.5 kg (168.6 lbs with most components removed) and 140 kg (309 lbs) fully configured. Never attempt to pick up the Fibre Channel RAID deskside without the help of a second person.**

This procedure requires

- if you must lift the tower, the help of another trained and qualified installer
- 9/16-in. (14.275 mm) nut driver
- #2 Phillips screwdriver

Use the following guidelines to unpack the unit.

1. Pull the top cover off the pallet and remove the plastic wrap. Note the retaining brackets on the front and back of the unit. Check the unit for damage and report any problems to the shipper.
2. Lower the pallet's ramp into the unloading position, as shown in Figure 4-3.

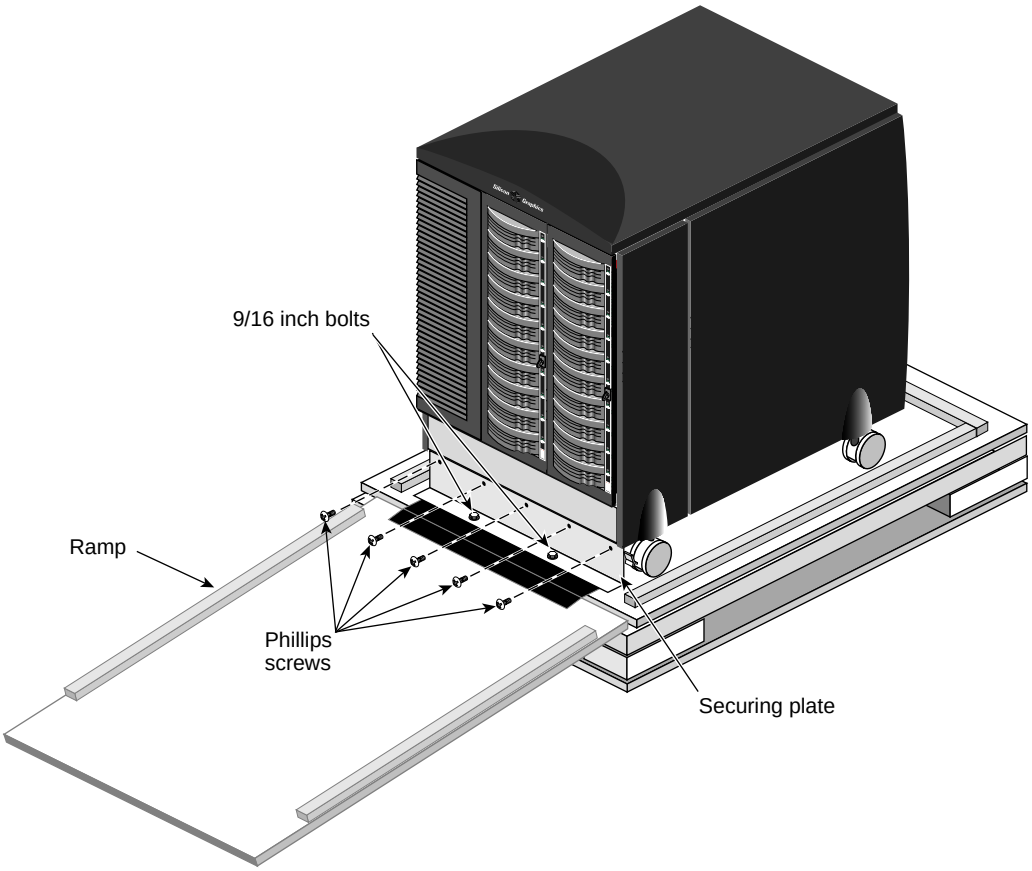


Figure 4-3 Unbolting the Fibre Channel RAID Deskside

3. Pull off the front plastic bezel from the lower front of the unit.
4. Use the 9/16-in. (14.275 mm) nut driver to remove the bolts connecting the front bracket to the pallet. Use an adjustable wrench if necessary. See Figure 4-3.
5. Use the Phillips screwdriver to remove the five screws holding the deskside tower to the bracket at the front; repeat the process at the rear.

   Note: You should not need to remove the bolts holding the retaining bracket to the pallet at the rear of the unit.

6. Make sure the locking mechanisms on the front wheels are released (similar to those in Figure 4-1).
7. With another person, carefully roll the deskside tower off the pallet to the designated installation site (see Figure 4-4).

Warning: **The widebody weighs 168.6 lbs (76.5 kg) empty and up to 309 lbs (140 kg) fully loaded. Never attempt to pick up the deskside Fibre Channel RAID system without the help of a second person.**

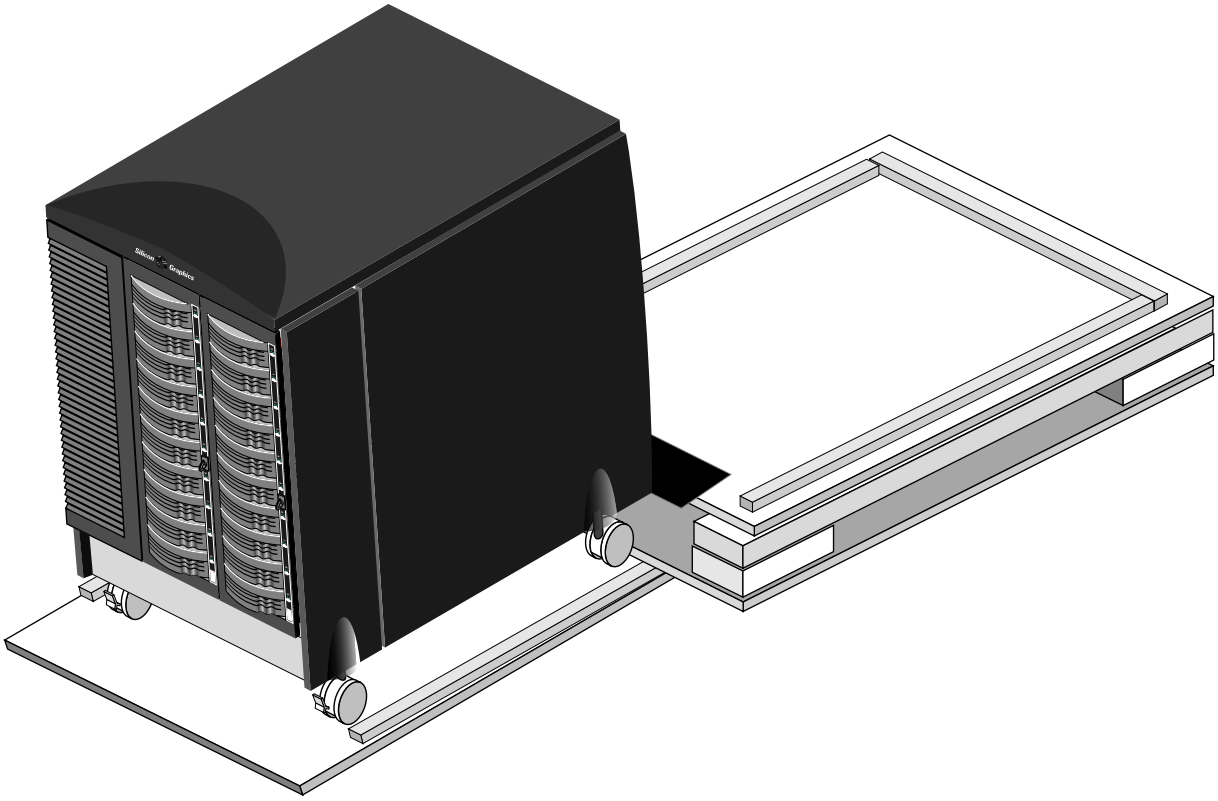


Figure 4-4 Unloading the Fibre Channel RAID Deskside

8. When the tower is positioned, lock the wheels. The widebody's wheels lock the same way as the FibreVault's; see Figure 4-5.

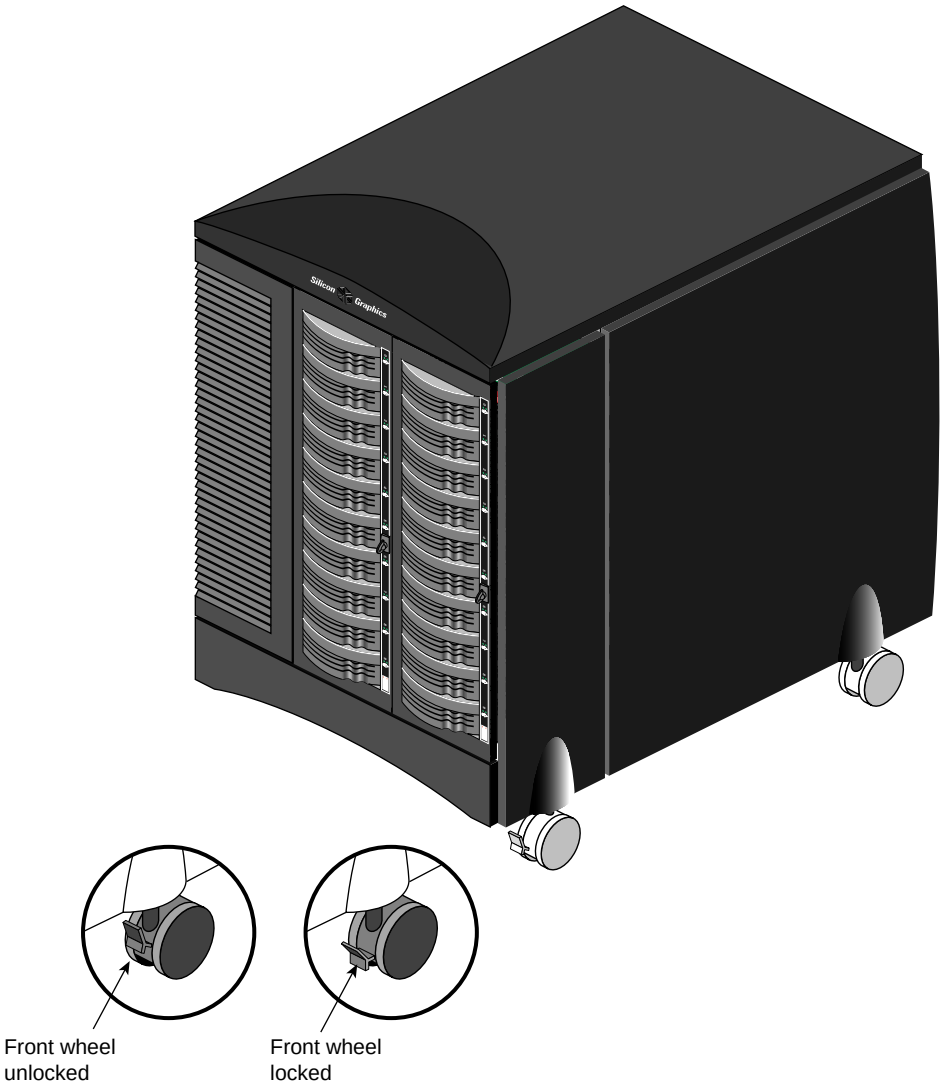


Figure 4-5 FIbre Channel RAID Deskside: Wheel Locking

9. Replace the front bezel.
10. Working with the customer, set enclosure addresses according to instructions in Section 3.3, “Setting the Enclosure Address” in Chapter 3.
11. Cable the widebody following instructions in the rest of this chapter.

4.4 Connecting the Widebody Power Cables

For redundancy, the widebody can have one or two optional standby power supplies. The widebody's DAE and DPE can each have a second optional power supply (VSC). All widebodies ship with two PDUs. Figure 4-6 diagrams power cord cabling for various optional hardware.

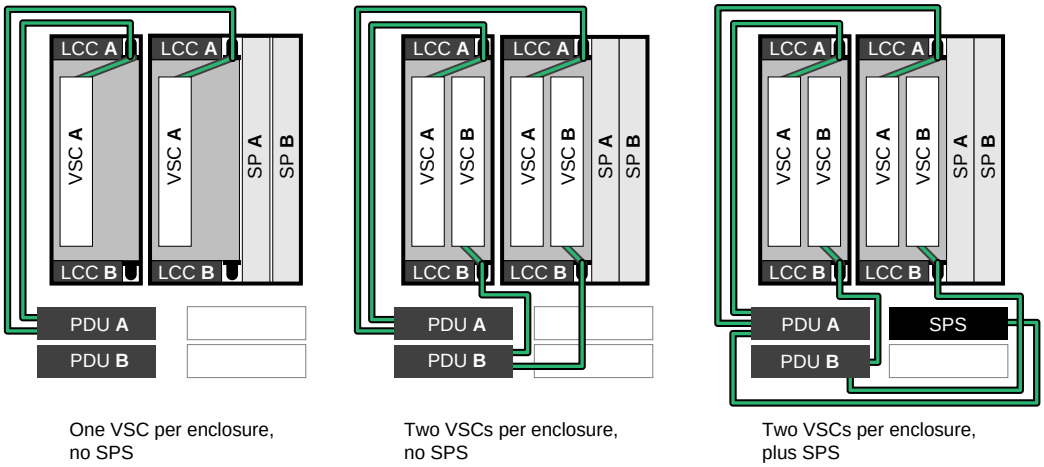


Figure 4-6 Widebody Power Cabling

Note: If the widebody was ordered from the factory, the power cords are preconfigured. If you must attach the power cords to the VSCs, you must pull out the fan assembly and route the cables; see Section 3.4, "Connecting the Enclosure Power Cord(s)" in Chapter 3.

This section is organized as follows:

- Section 4.4.1, "Widebody Power Cabling With No SPS"
- Section 4.4.2, "Widebody Power Cabling With SPS"

4.4.1 Widebody Power Cabling With No SPS

To connect power cables in a widebody with no standby power supplies, follow these steps:

1. Attach the DAE power cord from VSC A (which exits near the top LCC) to PDU A (the upper one).
2. Attach the DPE power cord from VSC A to PDU A. See Figure 4-7.

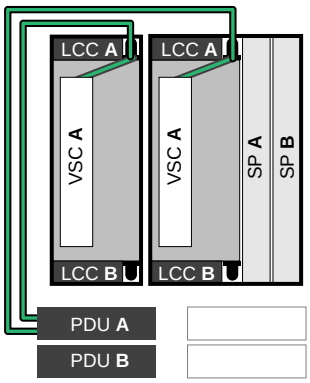


Figure 4-7 Widebody Power Cabling: Power Supply A to PDU A

Note: For high-availability power management, put all A hardware components on one path (PDU, power strip) and all B components on the other. For other configurations, this is not strictly necessary.

3. If the widebody has optional second power supplies, attach the DAE power cord from VSC B (which exits near the bottom LCC) to PDU B (the lower one). Attach the DPE power cord from VSC B to PDU B; see Figure 4-8.

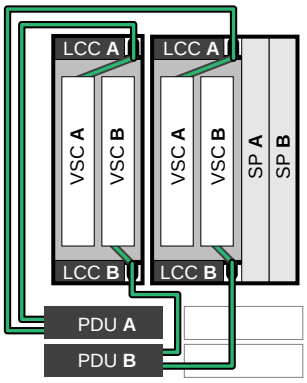


Figure 4-8 Widebody Power Cabling: Power Supply B to PDU B

4.4.2 Widebody Power Cabling With SPS

To connect power cables in a widebody with one or two optional standby power supplies, follow these steps:

1. Attach power cords as explained in “Widebody Power Cabling With No SPS.”
2. Attach the short power cord from the PDU A to the SPS. This cord ships with the SPS.

   Figure 4-9 diagrams this cabling.

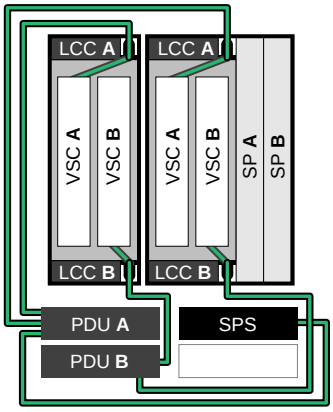


Figure 4-9 Widebody Power Cabling: Optional SPS

Figure 4-10 shows this cabling.

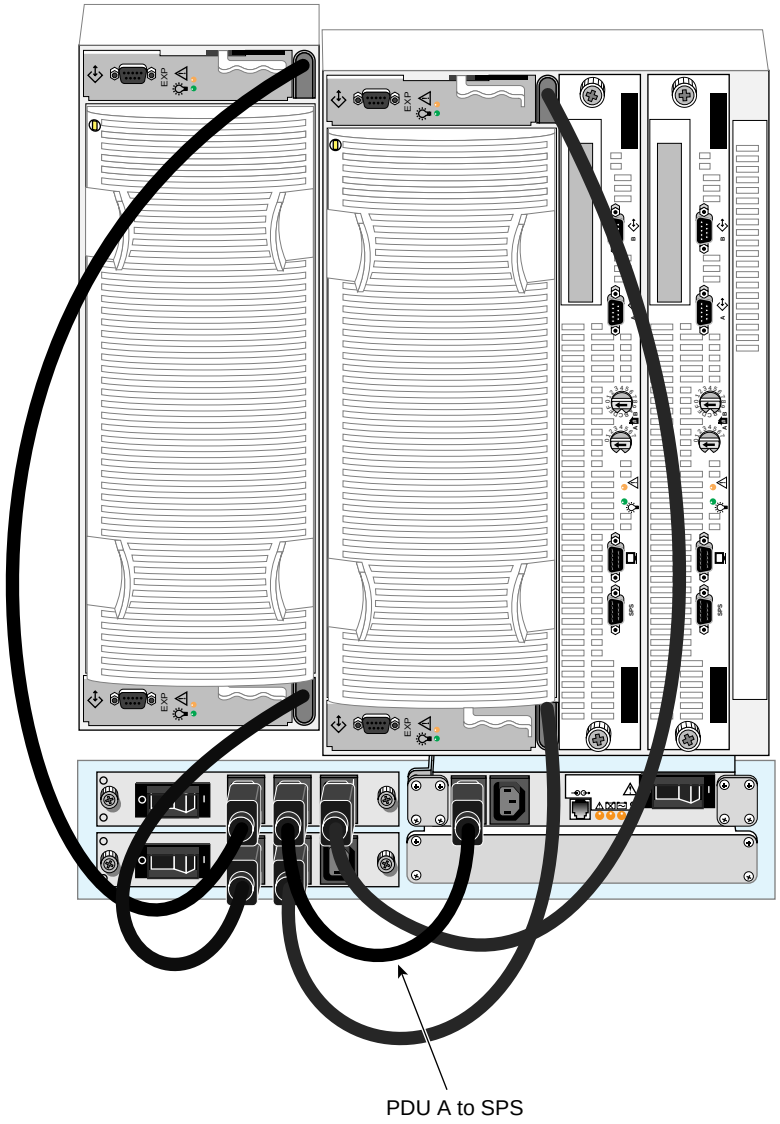


Figure 4-10 Widebody Power Cabling With Optional SPS

3. If the widebody has a second optional SPS, cable it to PDU B.

4. Connect the interface cable:
   - Connect the RJ-11 (jack) end of the interface cable to the SPS connection (below the LEDs), as shown in Figure 4-11.
   - Connect the 9-pin female end of the interface cable to the connection on the rear of SP A that is labeled **SPS**, as shown in Figure 4-11.

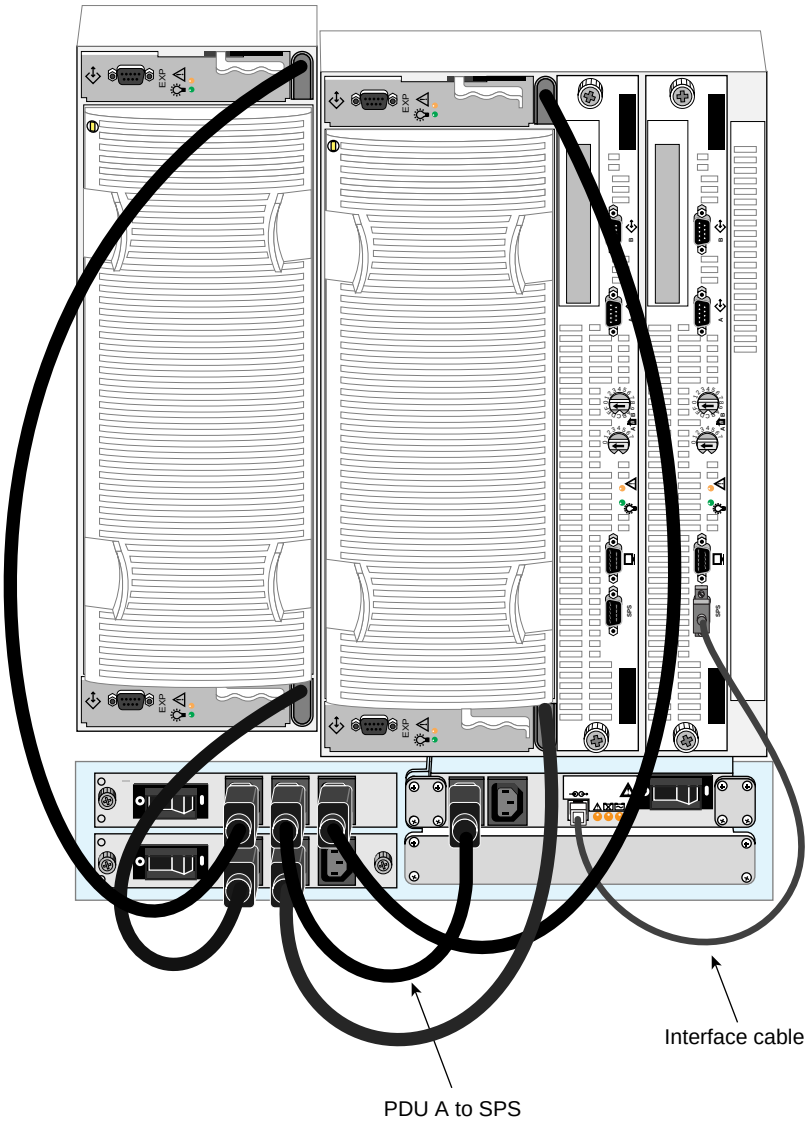


Figure 4-11 Widebody Power Cabling With Optional SPS: Connecting the Interface Cable

5. If the widebody has a second optional SPS, connect its interface cable to SP B the same way.

4.5 Cabling the Widebody DPE to the DAE and the Host

You must cable the widebody's DPE to its DAE, and cable the DPE to the host. Follow these steps:

1. Connect one end of a 0.3-meter cable included with the enclosure to the port on the DPE's LCC A, as shown in Figure 4-12.

   Note: To connect enclosures, use only the 0.3-meter (11.8-inch) copper cables supplied for this purpose. Daisy-chaining to enclosures in other racks is not supported.

2. Connect the other end of the cable to the LCC A port of the DAE.
3. Repeat the process for LCC B on the DPE and DAE.

   Note: Make sure you have no cross-cabling between LCC As and LCC Bs.

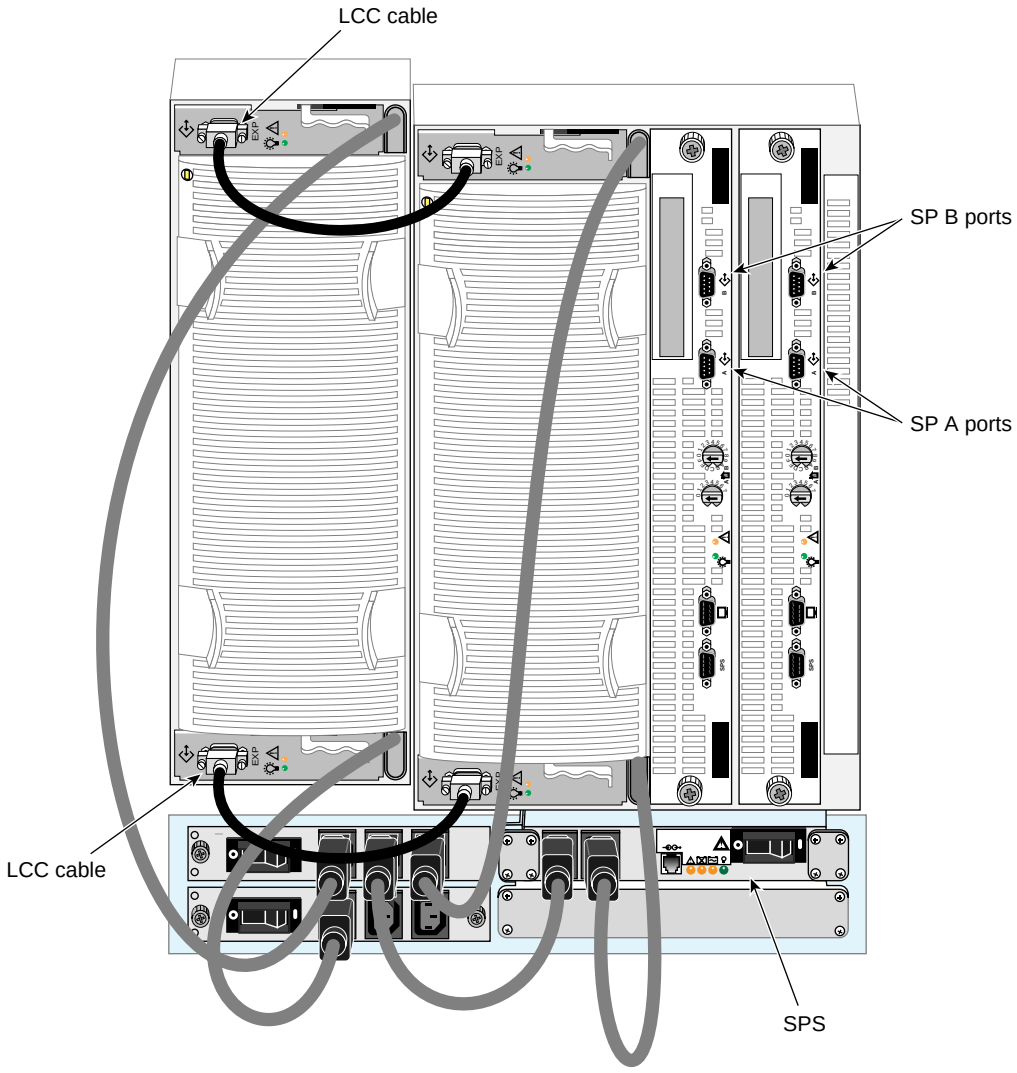


Figure 4-12 Cabling Widebody LCCs

4. Cable the DPE to the host system: working with the customer, connect port A on SP A to a port on a fibre channel board in the host. If applicable, connect port B on SP A and the ports on SP B to other FC ports in the host. These ports are called out in Figure 4-12. (For IRIS FailSafe cabling, see the *IRIS FailSafe Installation and Maintenance Instructions* (108-0144-005 or later.)
5. Power on the widebody.
6. Check the installation and install software as explained in Chapter 5, “Checking the Installation and Installing and Configuring the Software.”

Chapter 5

Checking the Installation and Installing and Configuring the Software

This chapter consists of these sections:

5.1 Checking a JBOD Installation

You can check non-RAID installations by running *hinv* after the disk drives spin up.

You can check RAID installations after installing the software included in the option; see Section 5.5, “Configuring LUNs.”

5.2 Installing the Software

Follow these steps to install the software on the host:

1. Make sure the host is running IRIX version 6.4 or later, and applicable patches. If it is not, upgrade the software using patches included in the current Required Patches List, including those on the patches CD-ROM included with the product.

   Note: If the RAID storage system is not connected to the server during the software install process, the device nodes are not created.

2. Load the software from the CD-ROM. The images are created in *inst* format; thus, they require using *inst*. Installation software and instructions are included with the standard Silicon Graphics software products.

   Note: Be sure to install the release notes.

3. After quitting *inst*, reboot the system to start the software.

5.3 Creating a Configuration File

The RAID agent uses a configuration file, which you create by copying */etc/config/ssmagent.config.proto* to */etc/config/ssmagent.config* and editing it. Working with the customer, edit this file on the server (enter user names and so on). This file is self-documenting and contains samples. For instructions, consult the man page (reference page) ssmagent(7).

The JBOD agent does not require a similar configuration file.

5.4 Starting the Agents

Daemons known as agents handle storage system administration. RAID and JBOD storage use different agents, *ssmagent* and *fcagent*, respectively. Installing the software automatically installs these agents. Each agent communicates to the storage system through */dev/scsi* device nodes and interprets commands from the command-line interface for the SCSI device, namely, the storage system. When the storage system is installed, the startup script starts the agent.

These sections explain how to confirm agent presence and launching the agent:

- Section 5.4.1, “Starting the RAID Agent”
- Section 5.4.2, “Starting the JBOD Agent”

5.4.1 Starting the RAID Agent

The RAID Fibre Channel command-line and graphical interfaces work directly with the RAID fibre channel agent *ssmagent*. The *ssmagent* must be running before commands are accepted and executed by the fibre channel host system. Follow these steps to start the agent:

1. Make sure that the host system on which the agent is to run has the correct date and time.
2. To confirm that the Fibre Channel RAID *ssmagent* is installed on the host system, enter the following at the command line:

   ```
   chkconfig -f ssm on
   ```

3. If the software is not available on the host, install it using the information in the release notes and the CD included with the Fibre Channel RAID option.

4. If *ssmagent* is present, you (or the customer) must
   - configure the path to *ssm* executables in *.cshrc* (if the customer desires)
   - start the Fibre Channel RAID agent
   - if desired, start the RAID GUI to begin configuring LUNs

   See Chapter 1 of the *Origin FibreVault and Fibre Channel RAID Administrator's Guide* for instructions on these processes.

5.4.2 Starting the JBOD Agent

The non-RAID Fibre Channel command-line interface *fccli* works directly with the non-RAID fibre channel agent *fcagent*. The *fcagent* must be running before *fccli* commands are accepted and executed by the fibre channel host system. To start the *fcagent*, follow these steps:

1. Enter

   `chkconfig fcagent on`

   to turn on the *fcagent* flag.

2. Launch the agent by entering

   `/etc/init.d/fcagent start`

Stop the agent by entering

`/etc/init.d/fcagent stop`

5.5 Configuring LUNs

Working with the customer, configure LUNs as explained in the *Origin FibreVault and Fibre Channel RAID Administrator's Guide*.

Make the LUNs available to the operating system:

- Reboot the host.

or

- Enter

  `scsiha -lp` *controllernumber*`;` **`ioconfig -f /hw`**

  For example:

  ```
  scsiha -lp 3; ioconfig -f /hw
  ```

5.6 Checking a RAID Installation

For RAID installations, you can run *hinv* to check the devices (controller number, unit number, LUN number). The following is example output:

```
FPU: MIPS R10010 Floating Point Chip Revision: 0.0
CPU: MIPS R10000 Processor Chip Revision: 2.6
2 180 MHZ IP27 Processors
Main memory size: 128 Mbytes
Instruction cache size: 32 Kbytes
Data cache size: 32 Kbytes
Secondary unified instruction/data cache size: 1 Mbyte
Integral SCSI controller 2: Version Fibre Channel AIC-1160, revision 1
  RAID controller: unit 2 on SCSI controller 2
  RAID lun: unit 2, lun 0 on SCSI controller 2
  RAID lun: unit 2, lun 2 on SCSI controller 2
  RAID lun: unit 2, lun 3 on SCSI controller 2
Integral SCSI controller 3: Version Fibre Channel AIC-1160, revision 1
  RAID controller: unit 8 on SCSI controller 3
  RAID lun: unit 8, lun 0 on SCSI controller 3
  RAID lun: unit 8, lun 2 on SCSI controller 3
  RAID lun: unit 8, lun 7 on SCSI controller 3
  RAID lun: unit 8, lun 8 on SCSI controller 3
  RAID lun: unit 8, lun 9 on SCSI controller 3
  RAID controller: unit 9 on SCSI controller 3
  RAID lun: unit 9, lun 4 on SCSI controller 3
Integral SCSI controller 4: Version Fibre Channel AIC-1160, revision 1
  RAID controller: unit 0 on SCSI controller 4
  RAID lun: unit 0, lun 1 on SCSI controller 4
Integral SCSI controller 5: Version Fibre Channel AIC-1160, revision 1
  RAID controller: unit 7 on SCSI controller 5
  RAID controller: unit 10 on SCSI controller 5
Integral SCSI controller 0: Version QL1040B (rev. 2)
  Disk drive: unit 1 on SCSI controller 0
  Disk drive: unit 2 on SCSI controller 0
  CDROM: unit 6 on SCSI controller 0
Integral SCSI controller 1: Version QL1040B (rev. 2)
IOC3 serial port: tty1
IOC3 serial port: tty2
IOC3 serial port: tty3
IOC3 serial port: tty4
IOC3 parallel port: plp1
Graphics board: Reality
Integral Fast Ethernet: ef0, version 1
Iris Audio Processor: version RAD revision 7.0, number 1
IOC3 external interrupts: 1
```

5.7 Enabling Command-Tagged Queuing

Command-tagged queueing (CTQ) allows multiple outstanding commands to a single SCSI target (that is, a LUN in a storage system) resulting in increased I/O performance.

The SP supports SCSI-2 queuing of requests for its LUNs. The requests are first-come, first-served in that all requests could be sent to one LUN from one initiator and cause a Queue Full status (unexpected SCSI status byte 0x28) to be returned for all other I_T_L SCSI selections. This condition would continue until one of the outstanding requests completes and thus frees queue space. The SP can handle up to 250 CTQs.

If Queue Full status is returned for a given I/O request, that request is retried. If the requests cannot be sent to the SP after four retries, the request is aborted, which, in the case of a write request, can have unfortunate consequences.

When CTQ is enabled (with *fx*) for a given LUN, the default CTQ depth for the LUN is 2; this value is stored in the LUN's volume header. You must use *fx* to change this value. Table 5-1 defines the maximum CTQ depth values per LUN for single-hosted SPs and dual-hosted SPs.

Table 5-1 Maximum CTQ Depths per LUN

Number of LUNs	Maximum CTQ Depth per LUN: Single-Hosted SPs	Maximum CTQ Depth per LUN: Dual-Hosted SPs
1	250	126
2	125	62
3	62	31
4	31	15

For optimum system performance, enable command-tagged queuing. Table 5-2 shows performance benefits of CTQ.

Table 5-2 CTQ Performance Benefits for 2K Random Read, 16 Threads

CTQ	avque	r+w/s	blks/s	w/s	wblks/s	avwait (μs)	avserv (ms)
Disabled	16.0	69	137	0	0	217.6	14.5
Enabled	16.0	304	607	0	0	48.8	3.3

The *fx* program syntax is as follows.

`fx -x "`*controllertype*`(`*controller_number*`,`*drive_number*`,`*lun_number*`)"`

To enable CTQ, follow these steps:

1. Enter the *fx* command with appropriate parameters; for example:

   ```
   fx -x "dksc(6,2,2)"
   ```

Output such as the following appears:

```
fx version 6.4, Aug 3, 1998
...opening dksc(6,2,2)
...controller test...OK
Scsi drive type == SGI RAID 5 0757
fx: Warning: bad sgilabel on disk

creating new sgilabel


----- please choose one (? for help, .. to quit this menu)-----
[exi]t             [d]ebug/           [l]abel/           [a]uto
[b]adblock/        [exe]rcise/        [r]epartition/     [f]ormat
```

2. Update parameters; at the `fx>` prompt, type the following:

   `fx> /label/set/param`

   Output such as the following appears:

```
fx/label/set/parameters: Error correction = (enabled)
fx/label/set/parameters: Data transfer on error = (enabled)
fx/label/set/parameters: Report recovered errors = (enabled)
fx/label/set/parameters: Delay for error recovery = (enabled)
fx/label/set/parameters: Err retry count = (0)
fx/label/set/parameters: Transfer of bad data blocks = (enabled)
fx/label/set/parameters: Auto bad block reallocation (write) =
(enabled)
fx/label/set/parameters: Auto bad block reallocation (read) =
(enabled)
fx/label/set/parameters: Read ahead caching = (disabled)
```

3. At the `Enable CTQ` prompt, type **`enable`**:

```
fx/label/set/parameters: Enable CTQ = (disabled) enable
```

4. At the `CTQ depth` prompt, type **`10`**:

```
fx/label/set/parameters: CTQ depth = (2) 10
```

   Output such as the following appears.

```
fx/label/set/parameters: Read buffer ratio = (0/256)
fx/label/set/parameters: Write buffer ratio = (0/256)
 * * * * * W A R N I N G * * * * *
```

5. At the following prompt in the last line above, type **`yes`**.

```
about to modify drive parameters on disk dksc(6,2,2)! ok? yes
```

   The following output appears:

```
----- please choose one (? for help, .. to quit this menu)-----
[exi]t             [d]ebug/           [l]abel/           [a]uto
[b]adblock/        [exe]rcise/        [r]epartition/     [f]ormat
```

6. Type **`exit`** to exit *fx*. The following message appears:

```
label info has changed for disk dksc(6,2,2). write out changes? (yes)
```

7. Type **`y`** to write the changes to disk.

Chapter 6

Installing and Replacing Components in Rackmount and Deskside DAEs and DPEs

The FibreVault and Fibre Channel RAID enclosures are designed to remain powered on and hot-repairable; that is, you can replace some redundant components without powering off the storage system or the host(s) to which they are attached. Each FibreVault and Fibre Channel RAID enclosure compartment should contain either a component (drive, power supply, and so on), or a filler panel to ensure EMI compliance and proper air flow over the components.

While the FibreVault or Fibre Channel RAID enclosure is powered on, you can (under carefully controlled procedures) remove a disk module, redundant power supply, link control card (LCC), or filler, but you should replace it as soon as possible with a replacement component or a filler. You can also remove the fan assembly while the enclosure is powered on, but you must replace it within two minutes to keep the disk drive modules powered on.

Caution: Failure to replace the fan within the two-minute period causes an uncontrolled shutdown of the disk array and can result in data loss.

Table 1-1 at the beginning of Chapter 1 gives marketing codes and part numbers for fibre channel FRUs.

This chapter is organized as follows:

- Section 6.1, “Adding or Replacing a Disk Module”
- Section 6.2, “Replacing or Adding a Link Control Card (LCC)”
- Section 6.3, “Replacing a Fan Assembly”
- Section 6.4, “Replacing or Adding a Power Supply”
- Section 6.5, “Installing or Replacing a Standby Power Supply in the Deskside Fibre Channel RAID System (Widebody)”
- Section 6.6, “Replacing the FibreVault Power Distribution Unit (PDU)”
- Section 6.7, “Replacing the Deskside Fibre Channel RAID PDU”
- Section 6.8, “Replacing or Adding an SP”
- Section 6.9, “Adding, Replacing, or Moving Memory (DIMMs)”

For information on replacing Fibre Channel Rack components, see Chapter 6, “Installing and Replacing Components in Rackmount and Deskside DAEs and DPEs.”

6.1 Adding or Replacing a Disk Module

The disk module's amber fault LED illuminates, or both LEDs are off when the host is bypassing it. (In the GUI, a failed, inaccessible, or removed disk module is shown in amber.) This section explains how to replace a failed disk module:

- Section 6.1.1, "Fibre Channel Disk Module Types"
- Section 6.1.2, "Fibre Channel Disk Module Placement"
- Section 6.1.3, "Checking the Failed Disk Module"
- Section 6.1.4, "LUN Integrity and Disk Module Failure"
- Section 6.1.5, "Replacing or Adding a Fibre Channel Disk Module"
- Section 6.1.6, "Replacing Database Disk Modules"

6.1.1 Fibre Channel Disk Module Types

Replace a failed disk module only with another Silicon Graphics FC-AL disk module. Always confirm the type of fibre drive (RAID or non-RAID) before you install it. Each drive module has an identifying sticker with its part number:

- 9470192 for (8.8 GB) RAID drives (520-byte sectors)
- 9470140 for (9.1 GB) non-RAID drives (512-byte sectors)

Note the following:

- The FC RAID and FC non-RAID disks are not interchangeable with each other and cannot be converted to the other type in the field.
- All disks in an FC enclosure must be either RAID or non-RAID. Disks in a DPE must be RAID.
- The FC RAID disks are not interchangeable with SCSI RAID disks.
- The FC non-RAID disks are not interchangeable with regular SCSI disks.

Caution: The disk modules have no ESD shielding; do not stack them on top of each other prior to installation. Use standard ESD precautions and always leave disks in an antistatic container until ready for installation.

Do not replace more than one disk module at a time unless the enclosure is powered off.

Special rules apply when you replace a disk module in either of these two groups:

- The first three disk modules in the first enclosure (DPE) in a chain, or in the only enclosure in the array, contain licensed internal code (LIC). These disk modules, with disk IDs 00, 01, and 02, are known as *database disk modules*.

  If all three are removed at the same time when the array is powered on, contact with the array is lost. If you replace them with the array powered off, label these as you remove them, because they must be reinstalled in their original positions. Section 6.1.6, "Replacing Database Disk Modules" gives the procedure for replacing these disk modules.

- If the array uses write caching, the disk modules that the array uses for its cache vault are 00 through 08.

  If a cache vault disk module fails, the array dumps its write cache image to the remaining modules in the vault. Then it writes all dirty (modified) pages to disk and disables write caching. Write caching remains disabled until a replacement disk module is inserted and the array rebuilds the LUN with the replacement module in it. The Write Cache State field in the Cache section of the SP Information window (see the section on SP cache information in Chapter 4 of the *Origin FibreVault and Fibre Channel RAID Administrator's Guide*) tells whether array write caching is enabled or disabled.

6.1.2 Fibre Channel Disk Module Placement

If you are adding or replacing new disk modules, note the following:

- Fill slots starting with the lowest address (0) and add disks until you reach the highest applicable address (left to right).
- In a DPE (main Fibre Channel RAID enclosure), drives 0, 1, and 2 contain licensed internal code. See Section 6.1.1, "Fibre Channel Disk Module Types" for information.
- If you replace all the disk drive modules in a RAID LUN, you must update the code; see Chapter 8, "Installing a Non-RAID FibreVault in the Origin Rack." This procedure requires rebooting, which terminates all outstanding I/O to the array. If you plan to reboot, you must unmount any filesystems or partitions on the array and quiesce the bus. Plan to work with the customer for this procedure.
- All Fibre Channel RAID disk enclosures and their expansion enclosures attached to an FC port should have at least five disk modules installed.
- If you must configure a non-RAID FibreVault with only one drive, it must be either the last enclosure on the loop or the only enclosure on the loop.
- The non-RAID FibreVault enclosure must always have a disk module installed in either slot 0 or 1. Access to enclosure-specific environmental information depends on at least one of these slots being populated with a disk.
- A FibreVault or Fibre Channel RAID enclosure cannot remain connected to an FC-AL if it has no drives installed.

6.1.3 Checking the Failed Disk Module

Removing the wrong disk module can introduce an additional fault that shuts down the LUN containing the failed module. Before removing a disk module, check the module's amber check or fault light. If it is illuminated, or if both LEDs are off, the host is bypassing it, indicating a failure.

To check further on the disk module:

- For a JBOD disk module, use *fccli GETSTATUS*; for example:

  ```
  fccli GETSTATUS -c 01 -e 01
  ```

  This example gets information on channel 1 in enclosure 1. For full details on this command, see the chapter on the non-RAID command-line interface (CLI) in the *Origin FibreVault and Fibre Channel RAID Administrator's Guide*.

- For a RAID disk module, use *ssmcli* **-d** *device getdisk* **-state**; for example:

  ```
  ssmcli -d sc2d0l0 getdisk 0_1 -state
  ```

  This example gets the current state of disk module 1 in enclosure 0 (the DPE). For full details of this command, see the chapter on the RAID CLI in the *Origin FibreVault and Fibre Channel RAID Administrator's Guide*.

- Alternatively, for a RAID disk module, use the GUI to get more information:

  1. Double-click on the disk icon to read fault information (see "Disk Module Error Information" in Chapter 4 of the *Origin FibreVault and Fibre Channel RAID Administrator's Guide*).
  2. Read the event log for the SP that owns the LUN containing the faulty disk module for a message about the disk module. See the information on displaying an event log in Chapter 4 of the *Origin FibreVault and Fibre Channel RAID Administrator's Guide*.
  3. Check for any other messages that indicate a related failure, such as a failure of a SCSI bus or a general shutdown of an enclosure. Such a message could mean the disk module itself has not failed.

     A message about the disk module contains its module ID. If the disk module button does not show the module ID, in the Array Configuration window, choose Show Disk IDs from the View menu to see the location of the disk module. Figure 6-1 shows an example.

Figure 6-1 Array Configuration Window: Disk Module IDs

6.1.4 LUN Integrity and Disk Module Failure

If a failed disk module is part of a RAID 5, 3, 1, or 1/0 LUN, you (or the customer) can replace the disk module without powering off the array or interrupting user applications. If the array contains a hot spare on standby, the SP automatically rebuilds the failed module on the hot spare. When you replace a disk module in a RAID 5, 3, 1, or 1/0 LUN, the SP equalizes the new module, and then begins to reconstruct the data. While rebuilding occurs, users have uninterrupted access to information on the LUN. (For more information on how these LUNs are rebuilt, see the chapter on identifying and correcting failures in the *Origin FibreVault and Fibre Channel RAID Administrator's Guide*.)

RAID disk modules do not have to be taken offline to be replaced unless two or more in a LUN fail so that the LUN's data redundancy is compromised:

- RAID 0: a single disk module fails
- RAID 1/0: both modules in a pair
- RAID 1: both modules in a pair
- RAID 3: two modules in a LUN (RAID 3 does not use a second hot spare)
- RAID 5: two modules in a LUN

In these cases, the LUN becomes unowned (not accessible by either SP). After you replace these disk modules (one at a time), you unbind and then rebind the affected LUN(s). If the data on the failed disks was backed up, restore it to the new disks. Use *ssmcli unbind* and

bind, or the graphical user interface, as explained in the *Origin FibreVault and Fibre Channel RAID Administrator's Guide.*

A hot spare is a special LUN that acts as global disk spare that can be accessed by any RAID 5, 3, 1, or 1/0 LUN. A hot spare is unowned until it becomes part of a LUN when one of the LUN's disk modules fails. Note that a RAID 3 LUN can use only one hot spare in case of disk failure. If a second hot spare is available and a second disk module in the RAID 3 LUN fails, the LUN does not use the second hot spare.

If an individual disk LUN fails, you must unbind it, replace the disk, and rebind the LUN.

If you want to move disk modules from one array to another, back up the data, unbind the LUN(s), move each disk module one at a time to its new location, rebind, and restore the backed-up data.

6.1.5 Replacing or Adding a Fibre Channel Disk Module

Note the following:

- If the failed disk module is in slot 00, 01, or 02, follow instructions in Section 6.1.6, "Replacing Database Disk Modules" instead of those in this section.
- If the system remains powered on, do not remove and replace more than one disk module at a time.
- Make sure you follow guidelines in Section 6.1.2, "Fibre Channel Disk Module Placement."

To add or replace a disk module, follow these steps:

1. Have ready the proper replacement disk module:
   - 9470192 for RAID drives
   - 9470140 for non-RAID drives
2. If the failed disk module is a non-RAID disk module, take it offline:
   - If necessary, back up the information on the disk you are replacing.
   - To tell the host that you are removing a (non-RAID) disk module and taking it offline, use *fccli REMOVE* with the **-c** and **-t** arguments, which specify channel designator and target drive. This example takes drive 10 in channel 12 offline:

     ```
     fccli REMOVE -c 12 -t 10
     ```

     (The chapter on the fibre channel non-RAID (JBOD) CLI in the *Origin FibreVault and Fibre Channel RAID Administrator's Guide* has complete information on this interface.)

   If the failed disk module is a RAID disk module, you might need to unbind the LUN in certain circumstances; see Section 6.1.4, "LUN Integrity and Disk Module Failure." In these cases, back up data if necessary, and unbind the LUN.

   Caution: If you must replace all three database disk modules (00, 01, and 02), unbind the LUN(s) containing these modules; see Section 6.1.6, "Replacing Database Disk Modules."

3. Open the FibreVault or Fibre Channel RAID enclosure's front door by inserting the key in the door's latch and turning the key to the unlocked icon position. Remove the key. Push the door's latch, and pull the door down until it is fully open.

   If you pull down the door with enough force that it becomes unhinged, snap it back on the hinges.

4. Attach the clip of the ESD wristband to the FibreVault or Fibre Channel RAID enclosure chassis and put the wristband around your wrist with the metal button against your skin.

   Caution: The enclosure has no mechanism to prevent you from removing a disk module while the drive is spinning. Do not remove a module unless its green active light is off and its amber check light is on (or the entire enclosure is shut down).

5. Locate the disk or filler module to be removed from the target slot. This module's amber LED is lit (or both LEDs are off) to show that the host is bypassing it. The green activity LEDs of the other disk modules in the loop blink at a regular interval as part of the background loop verification process.

   Note: Do not remove a disk module or filler unless you have its replacement ready to install. Do not remove more than one disk module at a time.

   If you are replacing disk modules 00, 01, and 02, leave module 00 in place; see Section 6.1.6, "Replacing Database Disk Modules."

6. Grasp the disk module's handle so that your thumb is on its latch. Push the latch and slowly pull the module from the slot, supporting it with your other hand. See Figure 6-2. The disk module's active and check LEDs turn off.

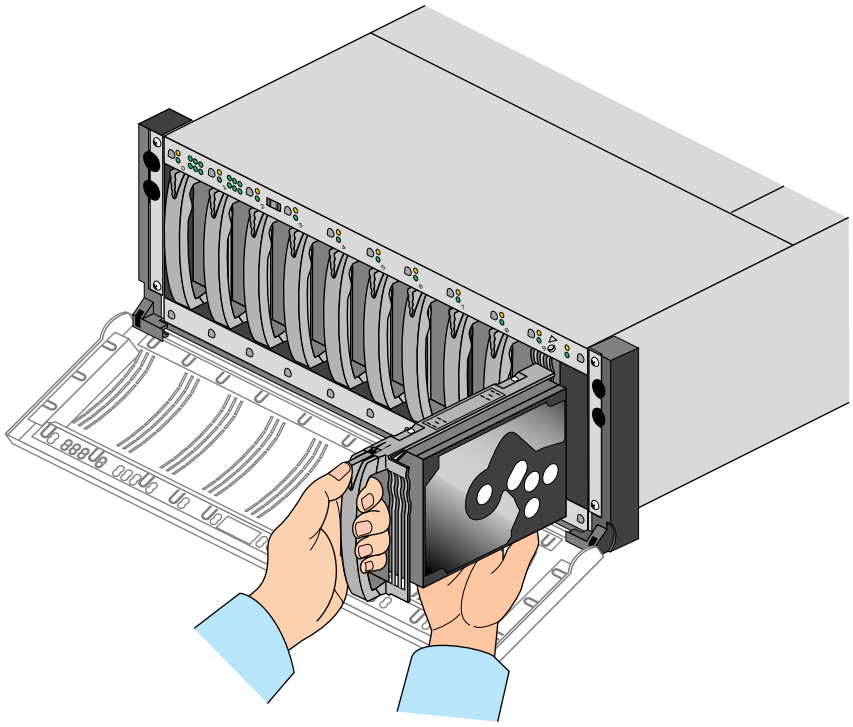


Figure 6-2 Removing (Inserting) a Disk Module

If power is on and if the disk you removed was bound in a RAID LUN, wait for the active LEDs of the other disk modules in the loop to resume blinking at a regular interval, which indicates that the driver has completed any necessary loop discovery.

7. Grasp the handle of the new disk module and align the module with the guides in the empty slot.
8. Slowly push the disk module into the slot until it clicks into place.

   If power is on and you have replaced a RAID disk module, the disk module's activity LED blinks; it may also flash rapidly. When the disk module is functioning normally as part of the LUN, its green LED blinks at the same interval as the rest of the disk modules on the loop. At this point, you can swap out another failed RAID disk module if necessary.

   Note: If the fault LED stays on after you insert the disk module, remove it and reinsert it. If it remains on, use another replacement disk module.

   If you are replacing a failed non-RAID disk module, its amber LED remains lit until you use the *fccli INSERT* command as explained in step 10 later in this process.
9. Remove and store the ESD wristband.
10. If you have replaced or added a non-RAID disk module, use *fccli INSERT* in the CLI to inform the host (that owns the loop) of its presence; see the *Origin FibreVault and Fibre Channel RAID Administrator's Guide*. The fault LED remains lit until the drive is online.

    If you are replacing failed RAID disk modules, follow instructions in "LUN Integrity and Disk Module Failure."

    If you are replacing disk modules 00, 01, and 02, see Section 6.1.6, "Replacing Database Disk Modules."
11. Push the enclosure's front door up until it latches into place.

    Note: The maximum number of times a disk module can be inserted and removed is 500. Exceeding this limit may damage the SCA connector on the disk module or the connector on the enclosure midplane.
12. If you have added disk modules, set enclosure addresses if necessary, as explained in Section 3.3, "Setting the Enclosure Address" in Chapter 3.

6.1.6 Replacing Database Disk Modules

The database disk modules are the first three disk modules (00, 01, and 02) in the first enclosure (DPE) in a chain, or in the only enclosure in the array; they contain licensed internal code (LIC). If all are removed at the same time, contact with the array is lost.

If you must replace all three database disk modules (00, 01, and 02), follow these steps:

1. Unbind the LUNs containing these modules.
2. One by one, replace all failed disk modules except for the one in slot 00; leave the disk module in slot 00 in place.

3. Bind the disk modules into the desired LUNs.

   Tip: Use a minibind in this case: *ssmcli bind* with the **-z** option. For information on the **-z** option, see the *Origin FibreVault and Fibre Channel RAID Administrator's Guide*.

   When you bind the LUNs, the SP copies the licensed internal code from the 00 disk module onto the other two database disk modules (01 and 02).

4. Unbind the LUN containing the 00 disk module.
5. Replace this disk module and rebind the LUN.

6.2 Replacing or Adding a Link Control Card (LCC)

This section explains removing and replacing an LCC or filler panel in a FibreVault or Fibre Channel RAID enclosure. The procedure is the same for DAEs and DPEs, whether rackmounted or tower.

Note: Do not remove an LCC or filler unless you have its replacement ready to install.

Follow these steps to remove an existing LCC or filler panel and install a new LCC:

1. Have ready the new or replacement LCC.

   Caution: When handling an LCC, be careful not to touch any of its electronic circuits or components. Remove the LCC from its packaging only when you are ready to install it.

2. If you are replacing an LCC, locate the FibreVault or Fibre Channel RAID enclosure containing the LCC with its check LED illuminated.
3. If the enclosure is mounted in a rack, open the rack rear door.
4. Attach the clip of an ESD wristband to the FibreVault or Fibre Channel RAID enclosure chassis and put the wristband around your wrist with the metal button against your skin.
5. Unplug the cable(s) (as applicable) connected to the faulty LCC.

6. Pull up on the latch of the LCC or filler panel; see Figure 6-3.

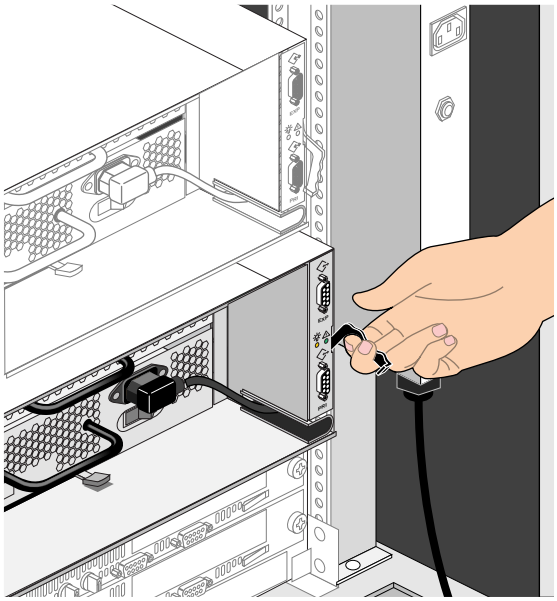


Figure 6-3 Unlatching an LCC

7. Grasp the LCC and slowly pull it out of the chassis, as shown in Figure 6-4. The LCC's active and check LEDs turn off if the enclosure is powered on.

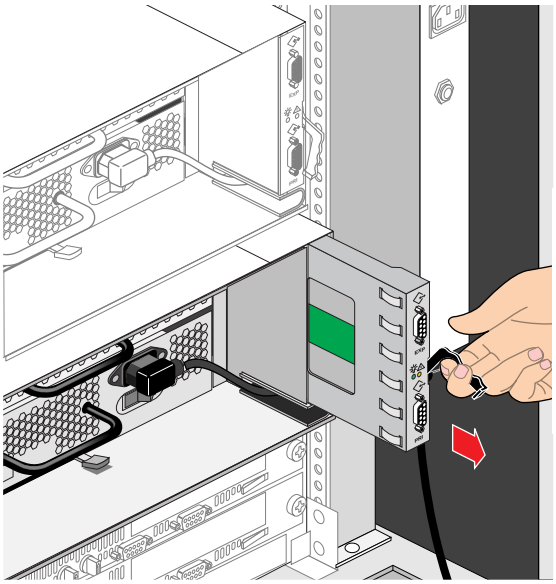


Figure 6-4 Removing an LCC

8. Wait ten seconds to allow the FLARE code time to recognize that the LCC is removed.
9. Align the new LCC with the guides in the empty bay and slide it into the slot.
10. Push down on the LCC's latch. The LCC's active LED illuminates if the enclosure is powered on.
11. Attach the LCC cables that you unplugged in step 5.
12. Remove and store the ESD wristband; close the rack rear door if applicable.

6.3 Replacing a Fan Assembly

If you are replacing the fan assembly in an operating storage system, you have a total of two minutes in which to complete the process.

Caution: Do not remove a fan assembly unless you have its replacement ready to install. Failure to replace the fan within the two-minute period causes an uncontrolled shutdown of the disk array and could result in data loss. If necessary, work with the system administrator at the site to power off the storage system.

Follow these steps:

1. Have the replacement fan assembly at hand, unwrapped and ready to insert.
2. Locate the enclosure with the faulty fan assembly; the fan assembly check LED is on.
3. Grasp the fan assembly's handles (squeeze latches) on one side and pull them inward towards the middle of the fan assembly until you feel them loosen.

4. While keeping a thumb on each of the loose latches, grasp the set of squeeze latches on the opposite side of the assembly with your fingers and pull them in toward the middle of the assembly and outward, as shown in Figure 6-5.

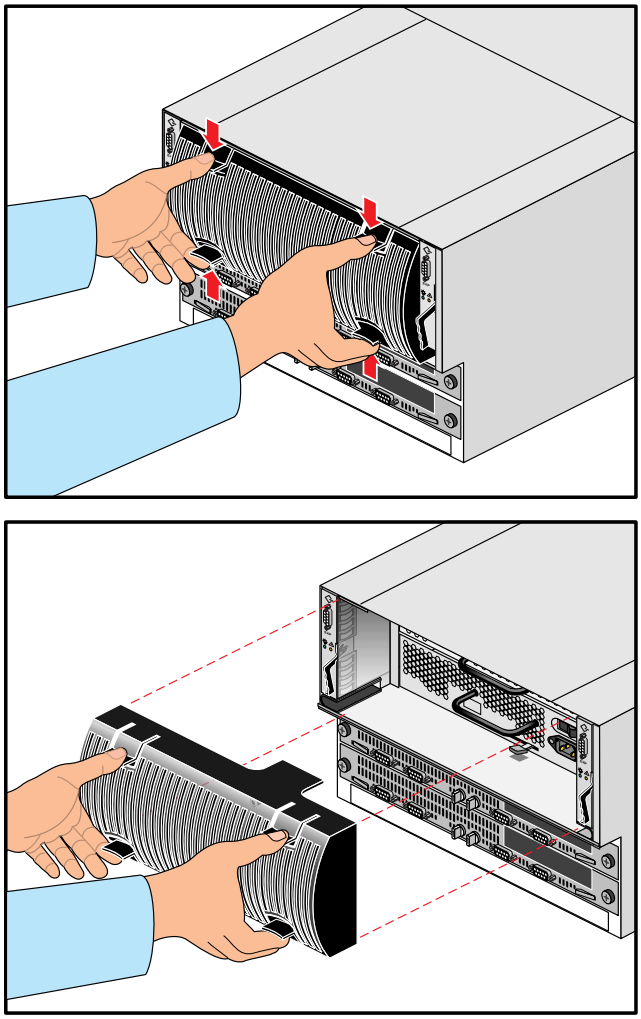


Figure 6-5 Removing the Fan Assembly

Caution: Do not leave the fan assembly out of the fibre enclosure for more than two minutes if the enclosure is running.

Once the fan assembly is disconnected from the power supply, its check LED turns off. The enclosure's front panel check LED and the cooling check LED on the power supply(ies) flash.

5. Orient the new fan assembly. Although the fan assembly attaches to the enclosure with either side up, for consistency among multiple FibreVault or Fibre Channel RAID enclosures, install it with the status light in the upper right corner as shown in Figure 6-6.

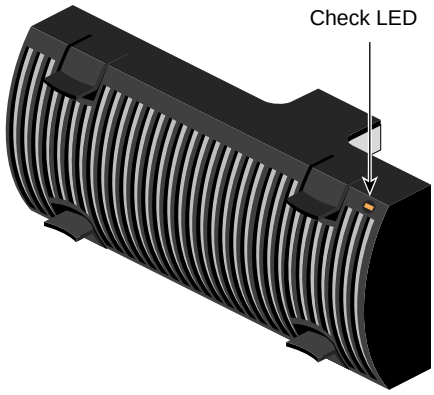


Figure 6-6 Fan Assembly Status LED Orientation

6. Squeezing the fan assembly latches toward each other, align and push the assembly forward into the chassis. The fan assembly snaps onto the power supply.

6.4 Replacing or Adding a Power Supply

The power supply modules are located behind the fan unit in the Origin FibreVault or Fibre Channel RAID enclosure, as shown in Figure 6-5. This procedure is fully applicable only when the vault has dual (redundant) power supplies. If there is only one supply installed, the FibreVault or Fibre Channel RAID enclosure shuts down if the supply fails.

This section is organized as follows:

- Section 6.4.1, “Preparing the New Power Supply”
- Section 6.4.2, “Removing and Replacing a FibreVault Power Supply or Filler”
- Section 6.4.3, “Removing and Replacing a Fibre Channel RAID Power Supply”

Caution: Do not remove a power supply or filler unless you have its replacement ready to install. Failure to replace the fan within the two-minute period causes an uncontrolled shutdown of the disk array and could result in data loss.

6.4.1 Preparing the New Power Supply

Follow these steps:

1. Have the new (replacement or additional) power supply at hand, unwrapped and ready to insert. Have a space available to put the fan unit and the power supply you are replacing.
2. Make sure the lever on the new power supply is in the unlocked position, as shown in Figure 6-7.

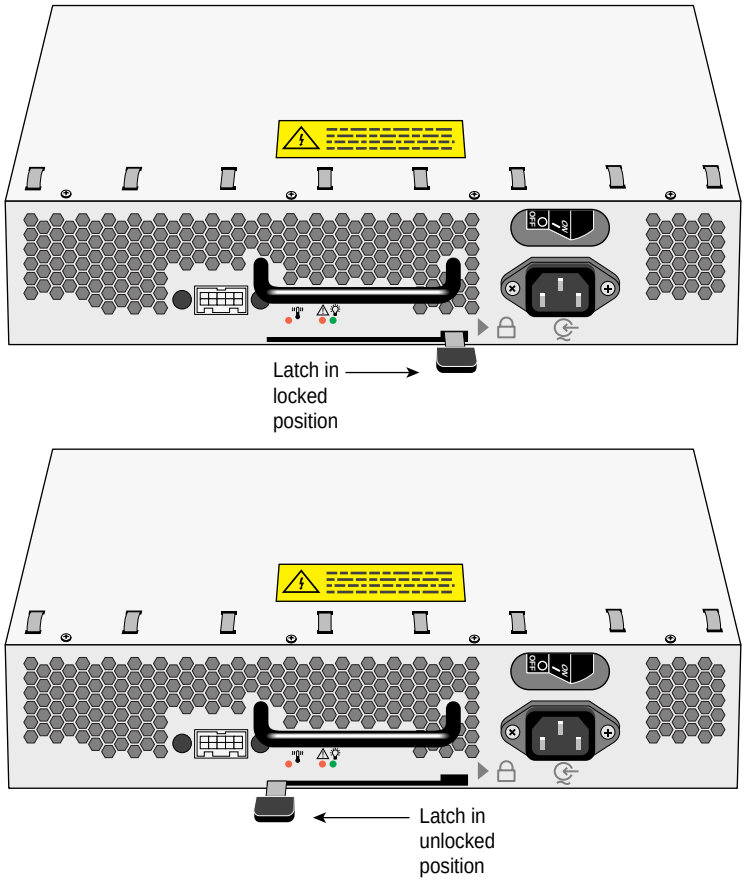


Figure 6-7 Unlatching a New Power Supply

6.4.2 Removing and Replacing a FibreVault Power Supply or Filler

To remove a power supply (VSC) from a FibreVault enclosure, follow these steps:

Caution: You have a total of two minutes in which to complete the process. Failure to replace the fan within the two-minute period causes an uncontrolled shutdown of the disk array and could result in data loss.

1. Identify the FibreVault enclosure containing the power supply with its check light on. The light is visible through the fan assembly.
2. Attach the clip of the ESD wristband to the FibreVault enclosure chassis and put the wristband around your wrist with the metal button against your skin.
3. Grasp the fan assembly by the handles on either side and pull it out to expose the power supply (bay), as shown in Figure 6-5. Do not leave the fan assembly out of the FibreVault or Fibre Channel RAID enclosure for more than two minutes or the enclosure goes through an automatic thermal shutdown.
4. Turn off the faulty power supply by pressing the on/off switch. The power supply's active and check LEDs turn off.

5. Unplug the AC line cord from the faulty power supply (Figure 6-8).

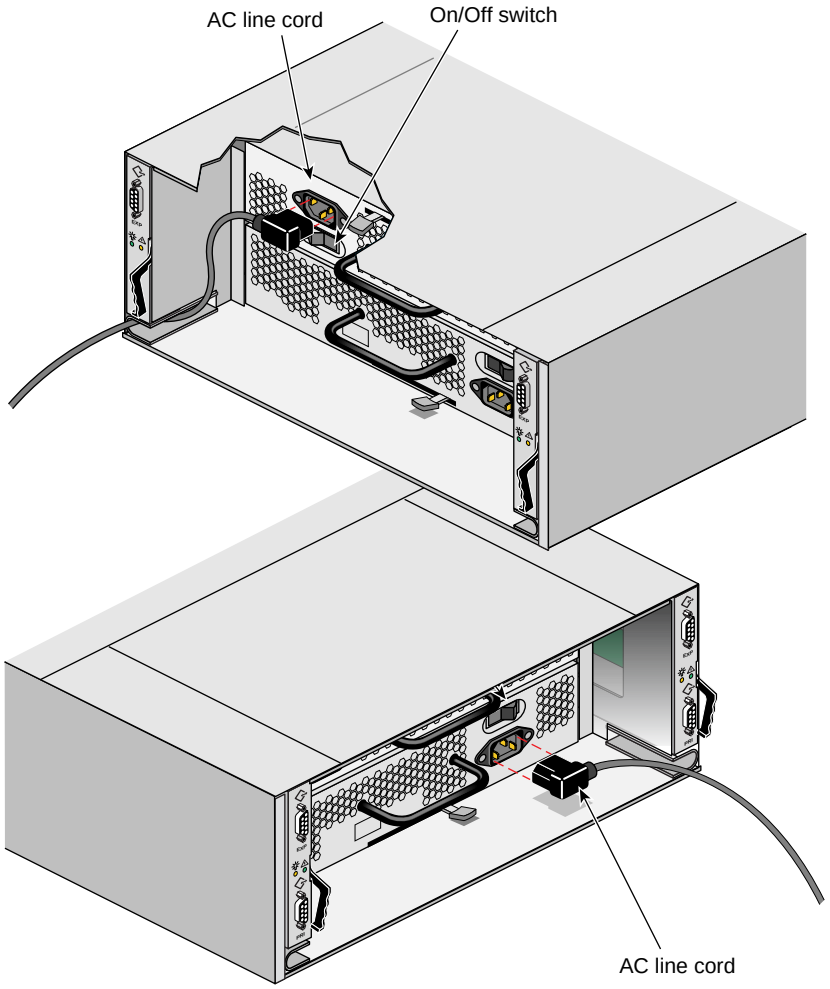


Figure 6-8 Power Supply Power Cord

6. Unlatch the faulty power supply:

   - For the top power supply, put your right palm against the right side of the power supply handle; with your thumb push the power supply's latch up and then right to the unlock position.
   - For the bottom power supply, put your left palm against the left side of the power supply handle; with your thumb push the power supply's latch down and then left to the unlock position.

   Figure 6-9 shows the bottom power supply unlatched.

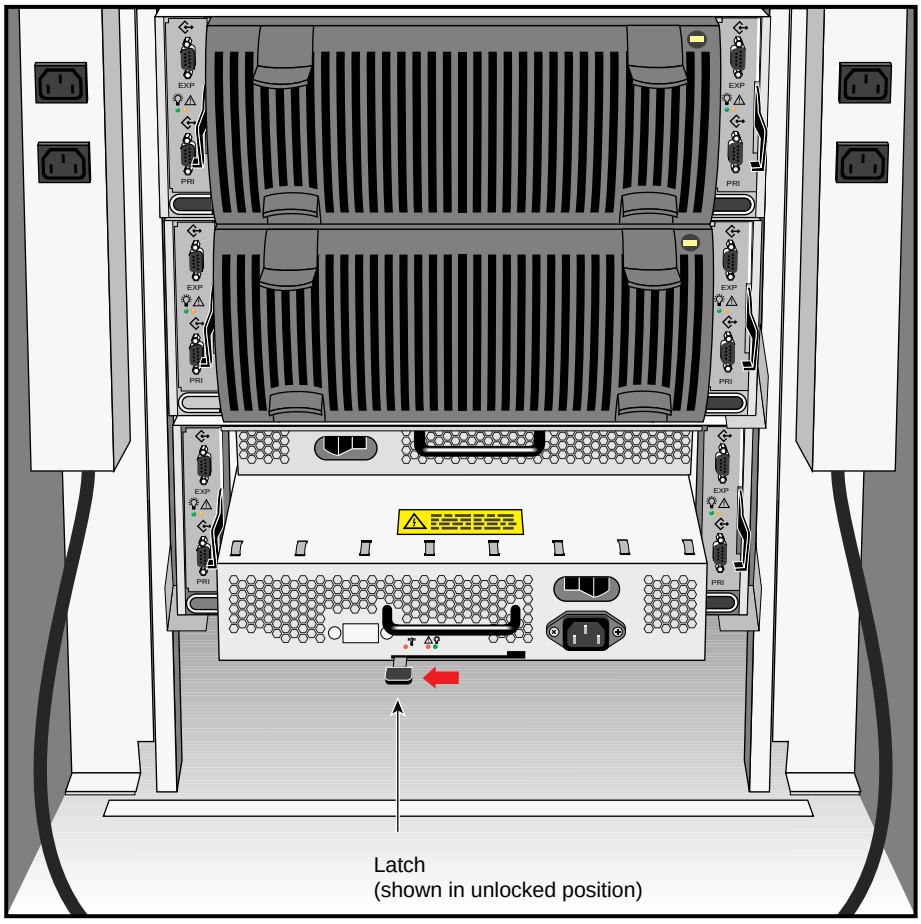


Figure 6-9 Unlatching a Power Supply

7. Pulling the handle, slide the filler or power supply out of the bay, supporting it with your other hand, as shown in Figure 6-10.

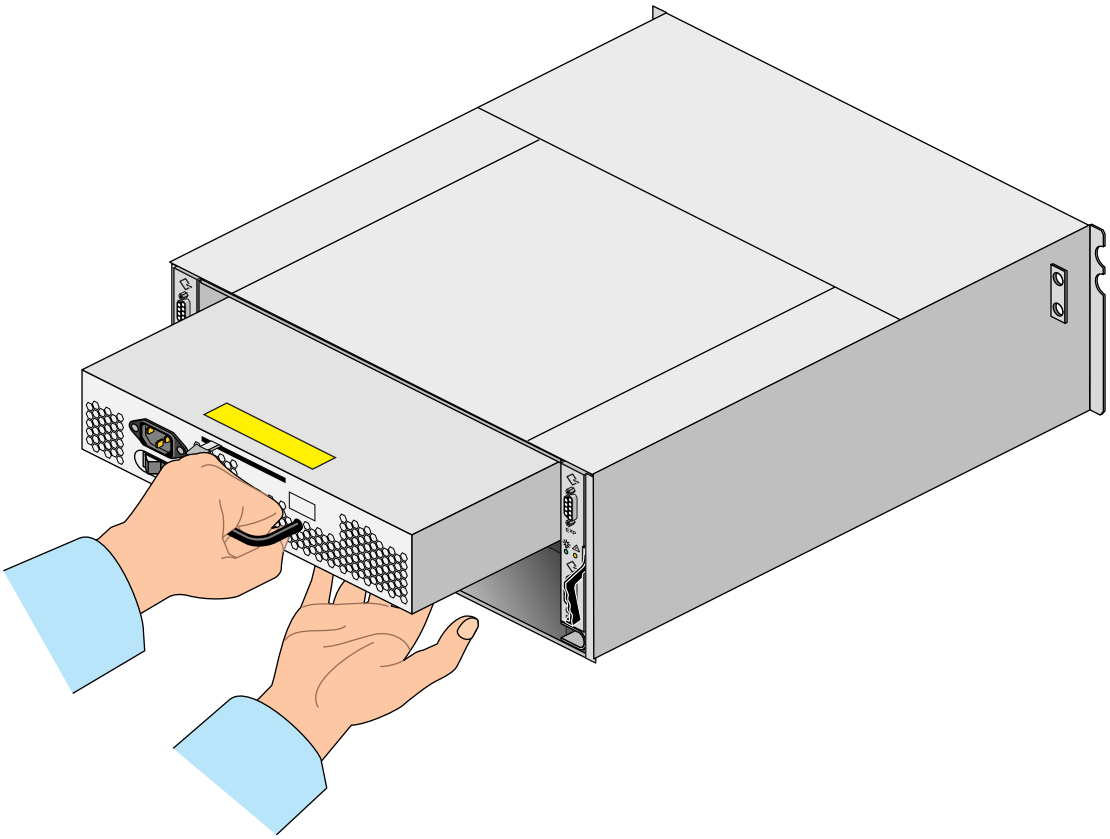


Figure 6-10 Removing a FibreVault Power Supply

8. Make sure the latch on the new power supply is in the unlocked position, as was shown in Figure 6-7.
9. Orient the new power supply as shown in Figure 6-10, slide it into the bay, and move the lever to the lock position.
10. Plug the AC line cord into the new power supply, as shown in Figure 6-8.
11. Turn on the power supply by pressing the on / off switch.

    The power supply's active LED turns on.
12. Reattach the fan assembly by squeezing the latches toward each other and pushing the assembly into the chassis.

    You can install the fan assembly in either orientation. However, for consistency among multiple FibreVault enclosures, install it with the status light in the upper right corner as shown in Figure 6-6.

Caution: Do not leave the fan assembly out of the fibre enclosure for more than two minutes if you want the enclosure to keep running. Failure to replace the fan within the two-minute period causes an uncontrolled shutdown of the disk array and could result in data loss.

6.4.3 Removing and Replacing a Fibre Channel RAID Power Supply

To remove, replace, or add a power supply (VSC) to the Fibre Channel RAID enclosure, you must first remove the disk fan module (see Section 6.3, “Replacing a Fan Assembly”). As noted in the fan replacement instructions, if you leave the fan assembly out of the fibre enclosure for more than two minutes, the disks shut down automatically. In the case of the Fibre Channel RAID enclosure, the system processor board(s) also shuts down.

Caution: Unless you are experienced at power supply removal or replacement, it is likely that the procedure will require more than two minutes to complete. If necessary, work with the system administrator at the site to power off the storage system.

Follow these steps to remove and replace an existing power supply:

1. If necessary, work with the system administrator at the site to inform users and shut down the storage system; power it off.
2. Have ready the replacement power supply.

   Caution: Handle the power supply with care and use all standard ESD precautions.
3. After removing the fan module, turn off the supply’s power by pressing the rocker switch to the 0 position.
4. Unplug and remove the supply’s AC line connector (Figure 6-11).

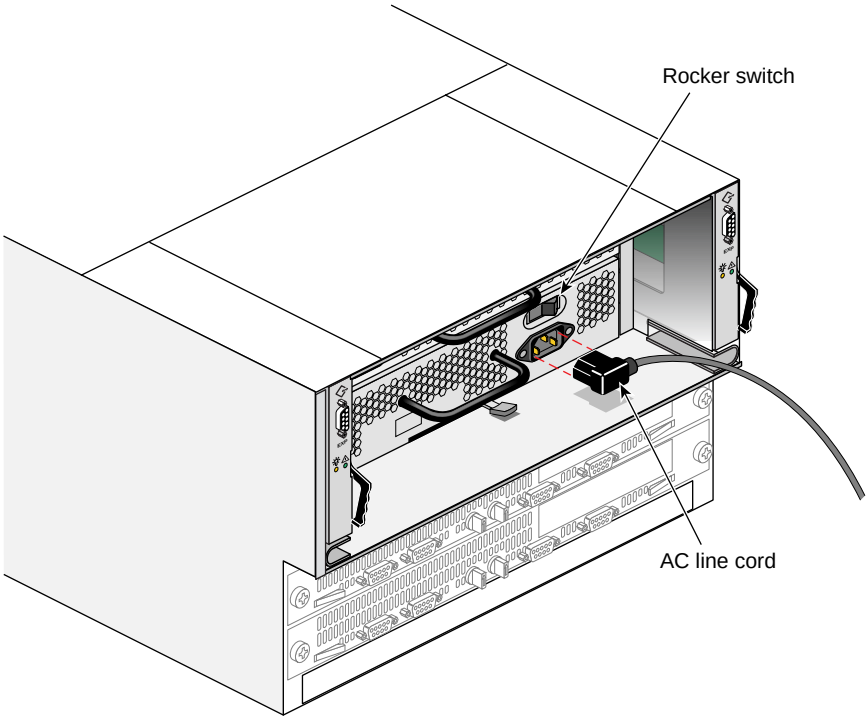


Figure 6-11 Turning Off Power and Unplugging Cord From Power Supply

5. Remove the power supply:
   - Unlatch the top power supply by moving the handle up and to the far right.
   - Unlatch the bottom power supply by moving the handle down and to the left; see Figure 6-12.

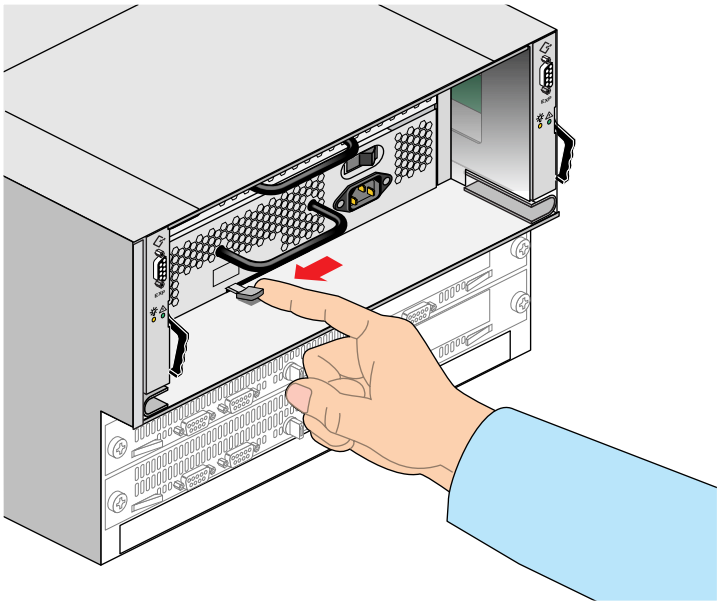


Figure 6-12 Unlatching a Power Supply

6. Pull the power supply straight out using the handle, as shown in Figure 6-13.

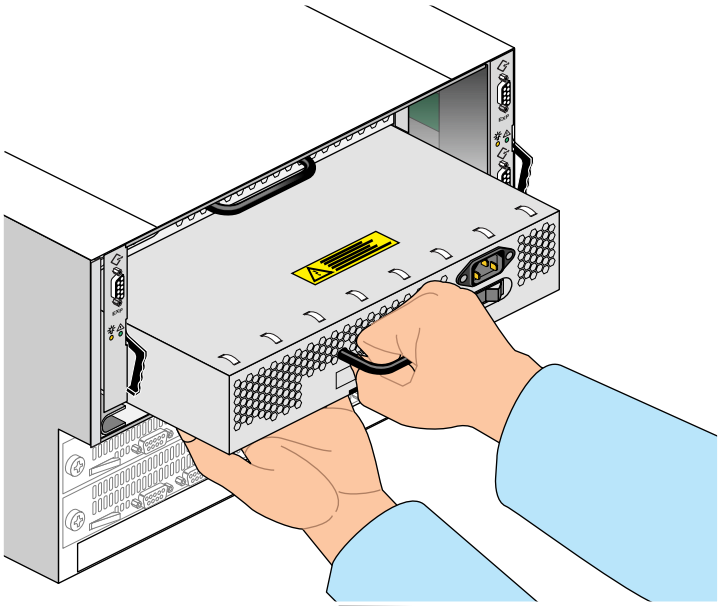


Figure 6-13 Removing a Fibre Channel RAID Power Supply

7. After confirming that the replacement supply's latch is in the open position, install the new supply by aligning it and sliding it straight in.

   Note: The orientation of the bottom supply is inverted from that of the top.

8. Push the supply into place until you see the latching lever move toward the latched position (see the example in Figure 6-14), and with your thumb or fingers, push the latch all the way into the locked position.

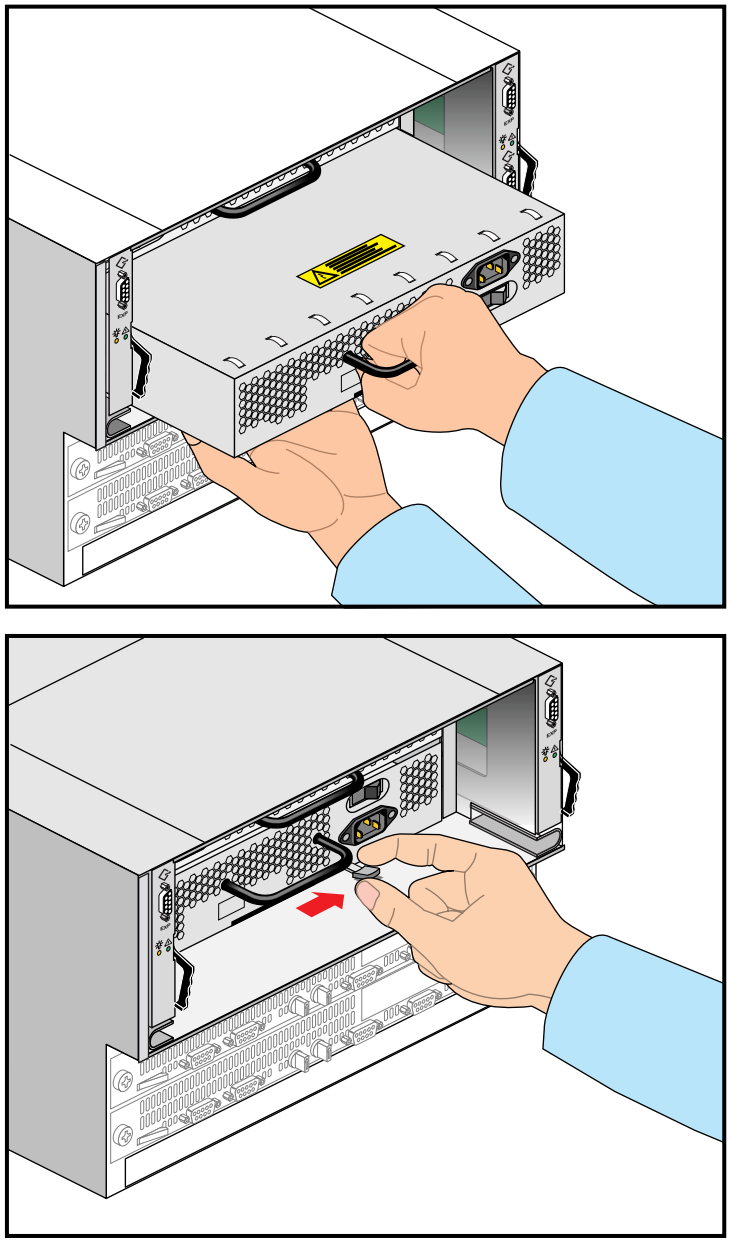


Figure 6-14 Installing the Bottom Fibre Channel RAID Power Supply

9. Plug the AC connector into the supply and route the cord along the power supply, then under the LCC position so that the cord exits the chassis without blocking the installation of the fan module.
10. Press the supply's rocker switch to the on position.
11. Reinstall the fan module.

6.5 Installing or Replacing a Standby Power Supply in the Deskside Fibre Channel RAID System (Widebody)

This section provides installation information for installing the optional standby power supply (SPS) in a deskside DPE. For information on installing an SPS in a DPE installed in a Fibre Channel Rack, see Chapter 6, "Installing and Replacing Components in Rackmount and Deskside DAEs and DPEs."

For write caching, an SPS is required. The information in this section is applicable when the SPS was not originally ordered with the widebody, or when you must replace an existing unit. Note that the SP board cannot use write caching unless a fully charged SPS is connected. If the SP does not detect a functional SPS, it automatically disables write caching, re-enabling it as soon as a functional SPS is detected. (If the system has a second valid SPS, write caching remains enabled.)

Write caching also requires two power supplies (VSCs). In a system with write caching, if one of the VSCs has failed along with the SPS, powering off the SPS also powers off the DPE, resulting in loss of access to data (but not data loss).

If you are installing one or more new SPSs, always install the first SPS in the top slot (next to the upper power distribution unit). This top SPS should connect to SP A and power supply A in the DPE unit. Install the second SPS in the lower slot.

This procedure requires a #2 Phillips screwdriver. Note that the SPS installation kit is generic and includes rack-oriented hardware that you do not use for the deskside installation.

Figure 6-15 shows features of the SPS panel.

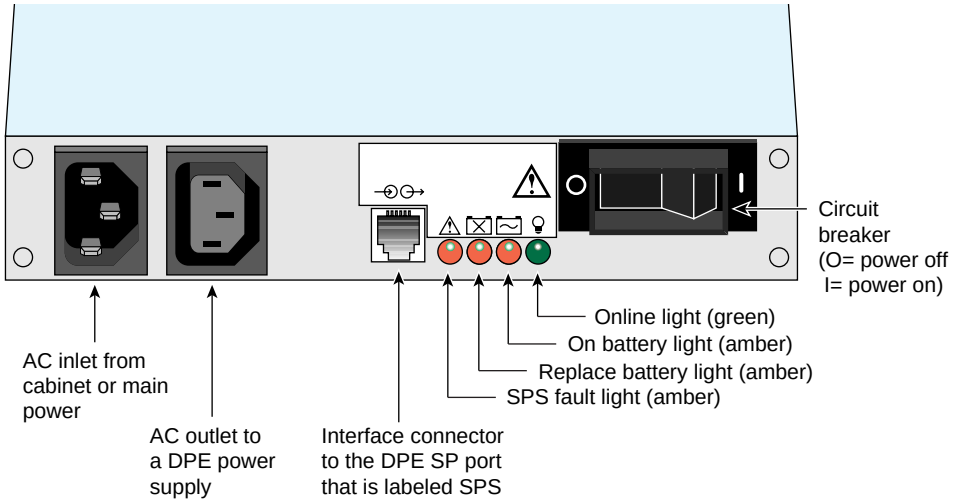


Figure 6-15 Fibre Channel RAID Standby Power Supply (SPS) Front Panel

Table 6-1 explains SPS LEDs.

Table 6-1 SPS LEDs

LED Type and Color	Function or Meaning
SPS internal fault (amber)	Lights when there is an internal SPS fault. Replace the SPS as soon as possible.
Replace battery (amber)	The SPS battery cannot support the expected load. The RAID SP flushes all cache data to disk and disables caching. Replace the SPS as soon as possible.
On battery (amber)	AC power has failed and the SPS is supplying AC power to the DPE. The DPE writes all cache data to disk and the SP event log records the incident. Restore AC power as soon as possible.
Power on (green)	When this LED is glowing steadily, the SPS is operating normally. Flashing means the SPS battery is being charged.

Note that the SP board cannot use write caching unless a fully charged SPS is connected. If the SP does not detect a functional SPS, it automatically disables write caching, re-enabling it as soon as a functional SPS is detected.

Install an SPS in the Fibre Channel RAID deskside system following these steps:

1. With a #2 Phillips screwdriver, remove the screws holding the top filler plate (located to the right of the top PDU) and remove the plate.
2. Unpack the SPS and mounting kit if you have not already done so.
3. Fasten a square attachment bracket to the left side of the SPS using two screws; repeat this procedure for the right side of the SPS.

4. Slide the SPS all the way into the empty slot; see Figure 6-16.

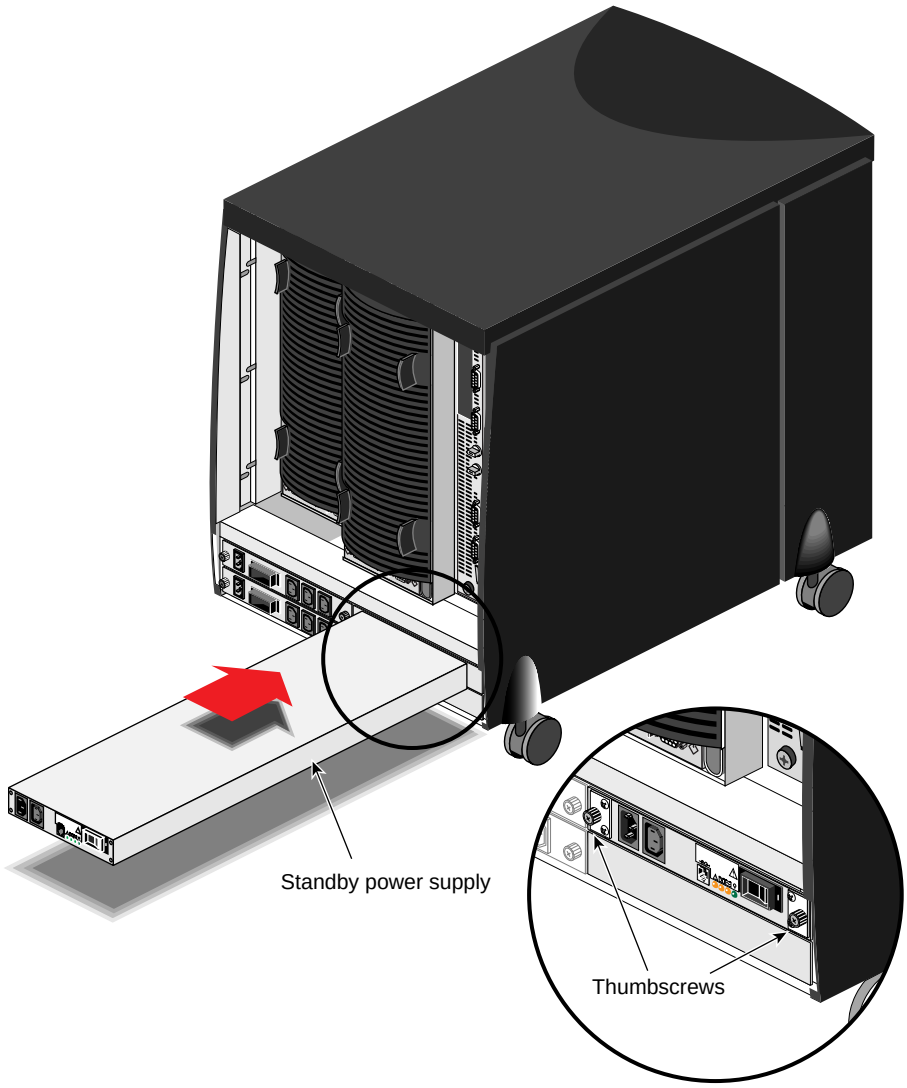


Figure 6-16 SPS Installation in the Deskside Fibre Channel RAID

5. Secure the left and right sides of the SPS with screws.
6. Cable the power supply following instructions in Section 4.4.2, “Widebody Power Cabling With SPS” in Chapter 4.

6.6 Replacing the FibreVault Power Distribution Unit (PDU)

The deskside FibreVault uses a PDU that mounts on the back of the tower unit below the enclosure. The PDU consists of an AC inlet, a circuit breaker, and three AC outlets. AC power enters the deskside FibreVault through the PDU when the power switch is in the on position. The AC outlets on the PDU(s) supply power to the enclosure's power supplies (see Figure 6-17).

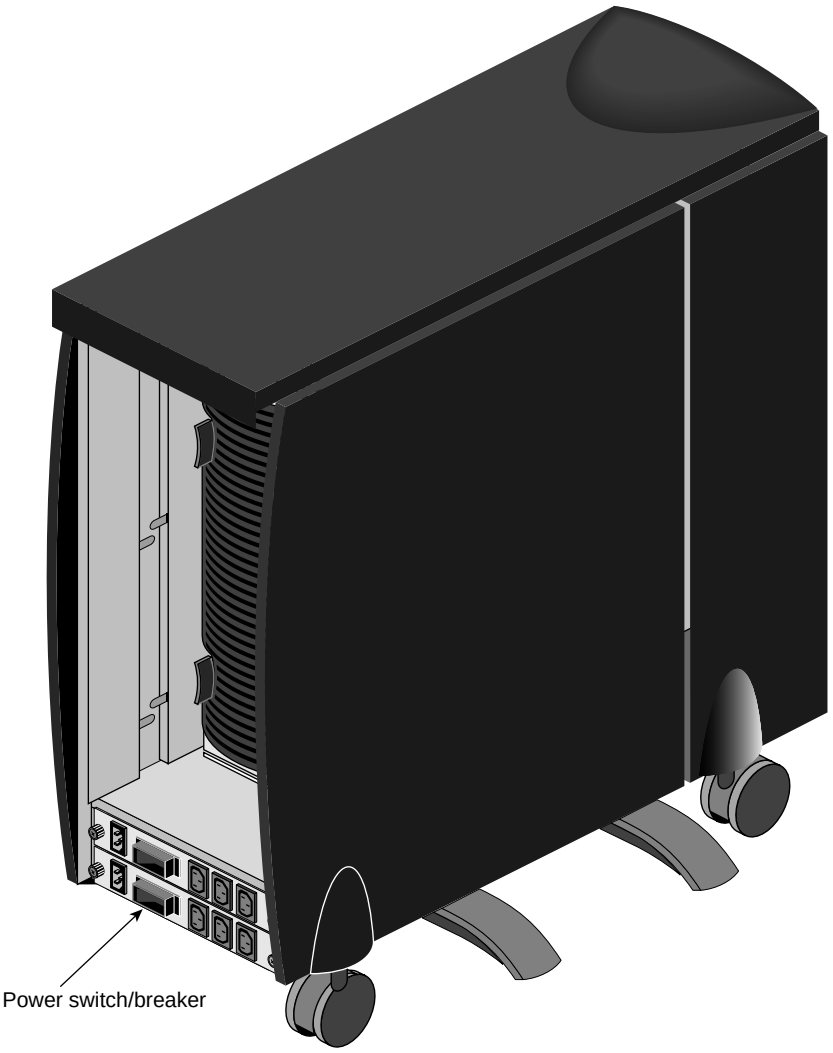


Figure 6-17 Deskside FibreVault Power Distribution Units (PDUs)

This procedure requires a #2 Phillips screwdriver.

To remove and replace this FRU, follow these steps:

1. Take the unit offline, shut off the main circuit breaker on the PDU, and unplug all the power cords.
2. With the #2 Phillips screwdriver, undo the two screws holding the unit in place and pull it out of the chassis (see Figure 6-18).

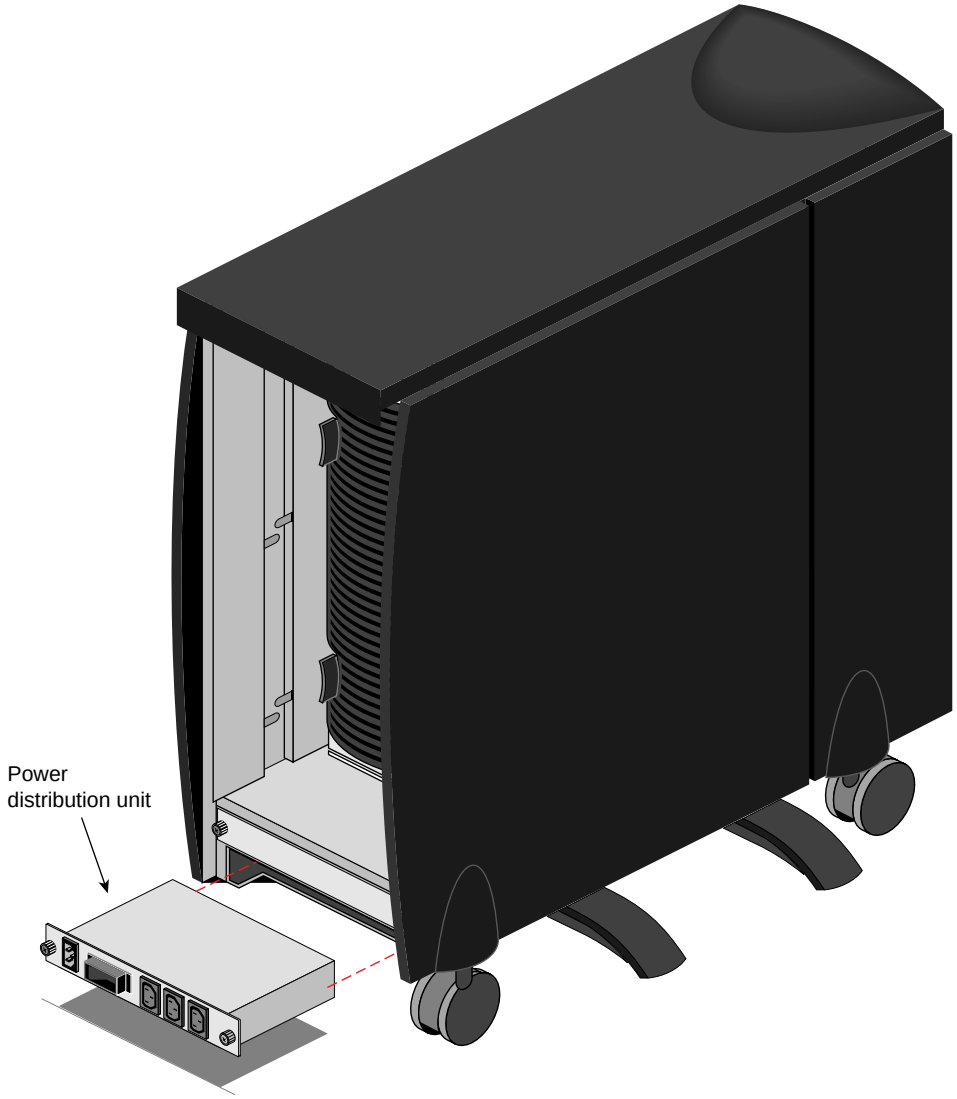


Figure 6-18 Removing the PDU from a Deskside FibreVault

3. Slide the replacement PDU into position and secure it with the two screws.
4. Reconnect all applicable power cords and turn on the PDU's circuit breaker.

6.7 Replacing the Deskside Fibre Channel RAID PDU

The deskside RAID tower uses one (or optionally two) power distribution units that mount on the back of the tower unit below the enclosure. The deskside RAID tower must have an optional second PDU to use redundant power sources and power supplies. Without the second PDU and power source, the system is not configurable as a high-availability unit.

This procedure requires a #2 Phillips screwdriver.

To remove and replace or add a PDU, follow these steps:

1. Take the unit offline, shut off the main circuit breaker on the PDU, and unplug all the power cords.
2. With the #2 Phillips screwdriver, undo the two screws holding the unit or blank panel in place and pull it out of the chassis (see Figure 6-19).

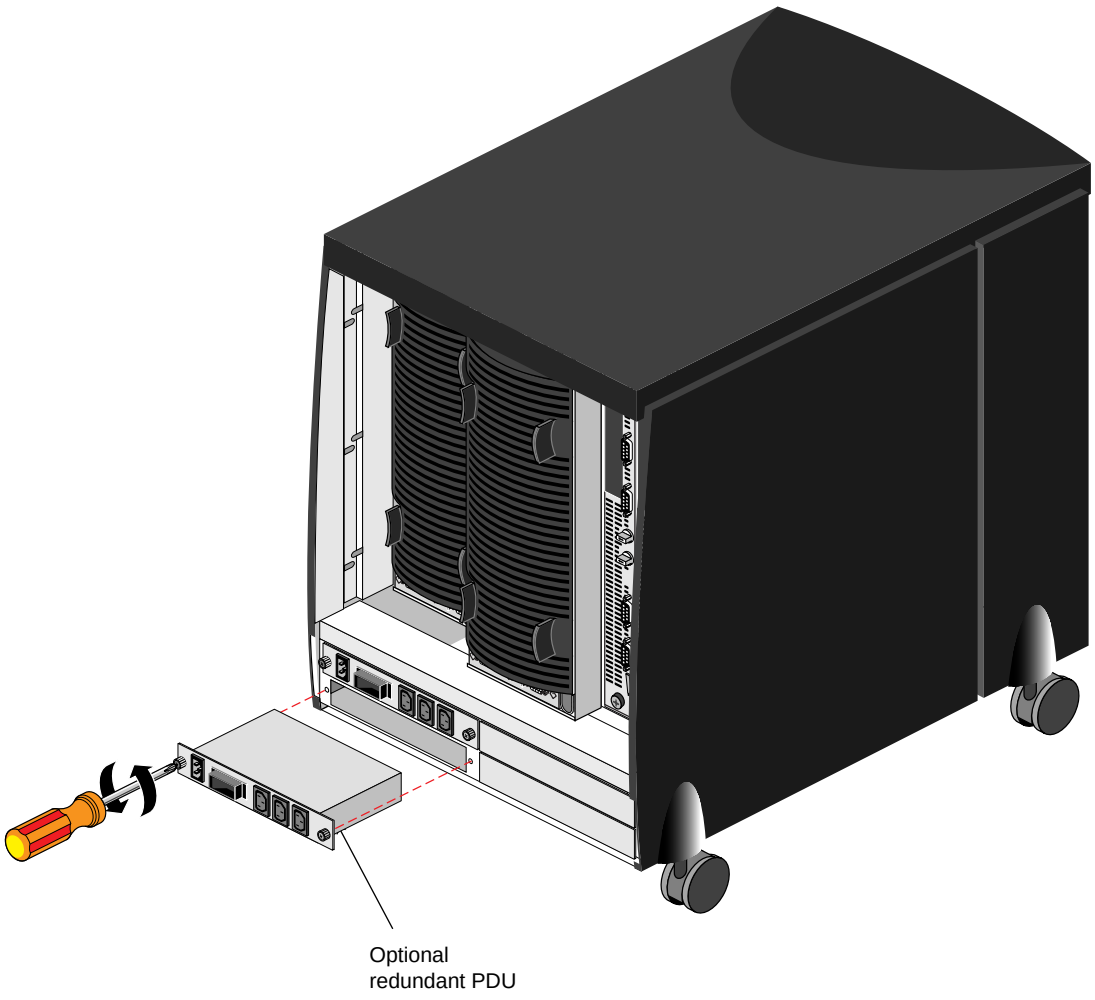


Figure 6-19 Deskside Fibre Channel RAID PDU

3. Slide the replacement or new PDU into position and secure it with the two screws.
4. Reconnect all applicable power cords and turn the PDU's circuit breaker(s) on.

6.8 Replacing or Adding an SP

This section explains how to replace a failed SP or add a second one as part of an upgrade for caching. Follow these steps:

1. If you are replacing a failed SP, confirm that the customer has fully backed up all information on the system.

   If you are adding a new second SP in a system that has a functional SP, proceed to step 9.

2. Work with the system administrator at the site to stop access to the SP's LUNs:
   - Verify that no bind, rebuild, or equalization of drives (rebuilding from a hot spare) is in process: check for flashing drive LEDs, which indicate an equalize operation.
   - Unmount all file systems and stop all outside accesses to the loops.
   - Close any open GUI sessions that are administering the array.
3. If you are replacing the only SP in the DPE, power off the DPE.

   Note: You do not need to turn off the power to any Fibre Channel RAID expansion enclosure (DAE) connected to the DPE. If you are adding a second SP to an array with a functional SP, you do not need to power off the array.

4. For a rackmounted DPE, detach cables from the failed SP.

5. Loosen the captured screw at either end of the SP panel; see Figure 6-20.
6. Move the levers out (see Figure 6-20); the SP pops out a short way.

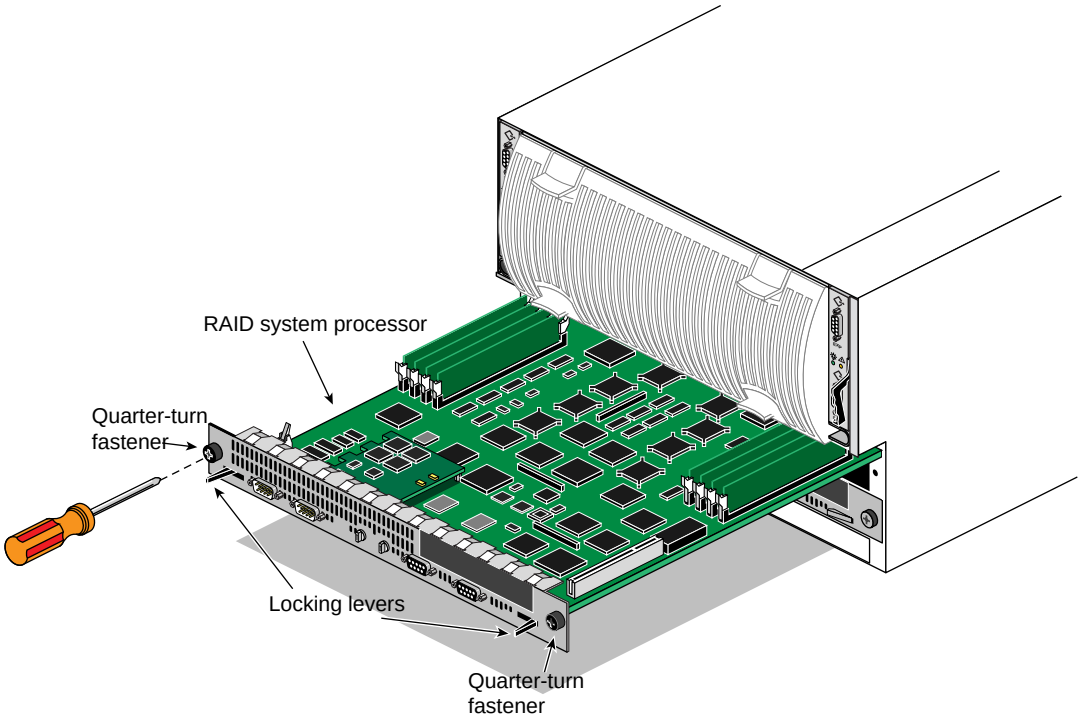


Figure 6-20 Removing an SP

7. Using a wrist strap and other ESD precautions, remove the failed SP.
8. If you are replacing a failed SP that has good DIMMs, transfer the DIMMs buffer-memory modules to the replacement SP following instructions in Section 6.9, "Adding, Replacing, or Moving Memory (DIMMs)."
9. Slide the replacement (or new) SP into the bay, making sure the levers on the panel are out.
10. Push the levers in; screw in the captured screws on each end of the SP.
11. Reconnect or connect cables as explained in Section 3.5, "Cabling Enclosures in the Fibre Channel Rack" in Chapter 3.
12. Power on the DPE, restart the GUI or CLI, and check LUN status. Use *ssmcli getlun* or click on the LUN to display its information windows. Consult the *Origin FibreVault and Fibre Channel RAID Administrators Guide.*

6.9 Adding, Replacing, or Moving Memory (DIMMs)

This section explains how to add DIMMs that the customer has ordered, replace defective DIMMs, and move DIMMs between read and write cache.

Typically, both SPs are removed ({and the system powered off) to add memory, because for most applications memory must be the same on the two SPs. However, if you are adding memory to only one SP and the second one is functional, you do not need to power off the system.

Follow these steps:

1. Check with the customer to make sure the correct size DIMMs are on hand:
   - All DIMMs in a specific memory bank (read cache or write cache) must be the same size.
   - Read caching requires at least 16 MB in the read cache.
   - Write caching requires at least 16 MB in the write cache (as well as certain other hardware). For write caching, the write cache locations on each of the DPE's two SPs must have the same amount of memory.
2. Working with the customer, determine whether the memory change requires reducing the amount of read or write cache. If it does, set the cache value to 0 or to the lowest value. See Chapter 3 of the *Origin FibreVault and Fibre Channel RAID Administrator's Guide*.
3. Work with the system administrator at the site to stop access to the SP's LUNs; see step 2 in Section 6.8, "Replacing or Adding an SP."
4. Power off the DPE; you do not need to power off the DAEs cabled to it. If you are adding memory to only one SP and the second one is functional, you do not need to power off the system.
5. For a rackmounted DPE, detach cables from the SP.
6. Remove the SP according to instructions in Section 6.8, "Replacing or Adding an SP."

Figure 6-21 shows DIMM locations.

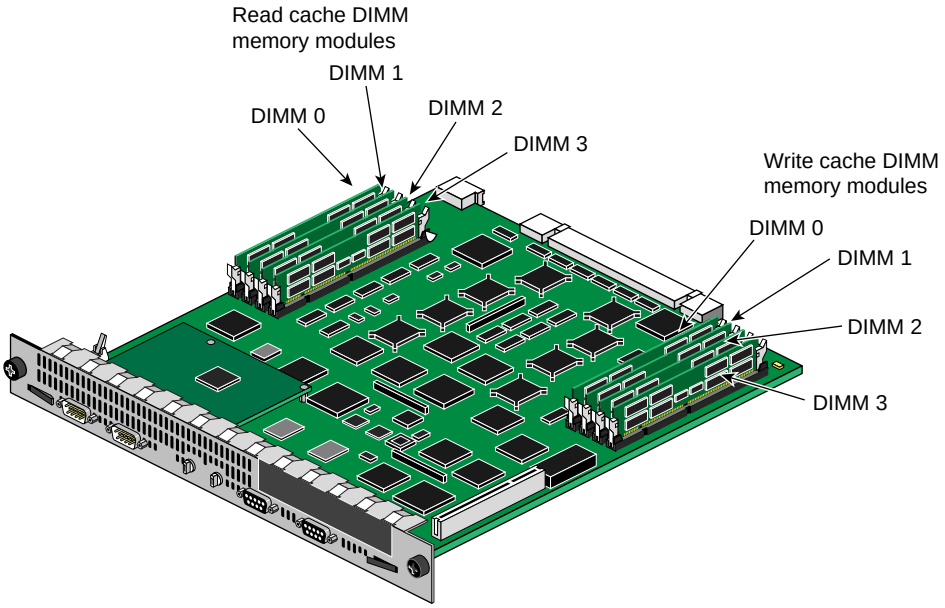


Figure 6-21 DIMM Locations

7. Make sure the levers for the DIMM slot you are using are pushed outward, as shown in Figure 6-22.

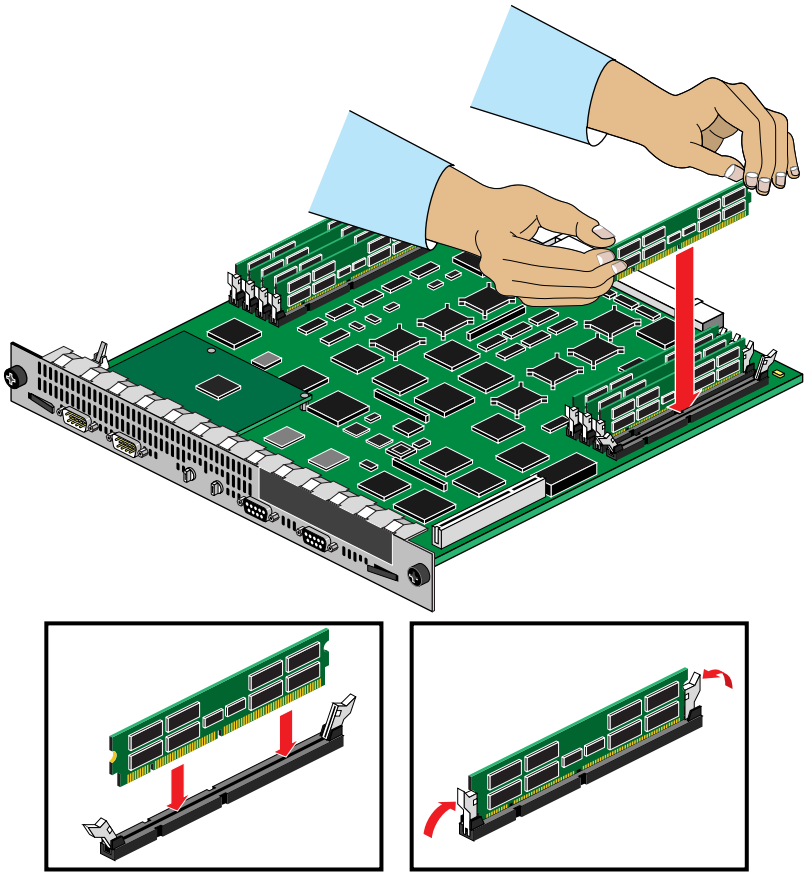


Figure 6-22 Installing a DIMM

The DIMM is keyed; align it correctly. Insert the DIMM straight into the slot; push evenly and firmly to seat the DIMM.

Note: Fill memory banks from left to right, as viewed from the front of the SP, going from location 0 to location 3.

8. When the DIMM is firmly seated, push the slot levers up.
9. Reinstall the SP and reconnect all cables, following instructions in Section 6.8, "Replacing or Adding an SP." Power on the DPE. Power on the DPE.
10. Restart the GUI or CLI, and check SP status. Use *ssmcli getcrus* **-spa** or **-spb**, or display the SP information windows; consult the *Origin FibreVault and Fibre Channel RAID Administrators Guide*.

Chapter 7

Installing and Replacing Components in a Fibre Channel Rack

The FibreVault or Fibre Channel RAID enclosure is designed to remain powered on and hot-repairable; that is, you can replace some redundant components without powering off the storage system or the host(s) to which it is attached. Each FibreVault or Fibre Channel RAID enclosure compartment should contain either a component (drive, power supply, and so on), or a filler panel to ensure EMI compliance and proper air flow over the components.

In a rackmounted DPE, you can add or replace a standby power supply. If a DPE has write caching and its only SPS fails, write caching is disabled until the SP detects a functional SPS. (If the system has a second SPS that is functional, write caching is not disabled.)

To replace the rack's power distribution unit, you must power off the rack.

This chapter consists of

- Section 7.1, "Installing or Removing a Standby Power Supply (SPS) in a Fibre Channel Rack"
- Section 7.2, "Replacing the Power Distribution Unit in a Fibre Channel Rack"

For information on removing and replacing other components in DAEs and DPEs, see Chapter 6, "Installing and Replacing Components in Rackmount and Deskside DAEs and DPEs." Table 1-1 at the beginning of Chapter 1 gives marketing codes and part numbers for fibre channel FRUs.

7.1 Installing or Removing a Standby Power Supply (SPS) in a Fibre Channel Rack

The rackmounted standby power supply (SPS) is a type of battery backup unit that is part of a high availability configuration. In some cases, such as when a customer requires write caching, an SPS must be present. The information in this section is applicable when the SPS was not originally ordered with the DPE in the Fibre Channel Rack, or when you must replace an existing unit.

Note that the SP board cannot use write caching unless a fully charged SPS is connected. If the SP does not detect a functional SPS, it automatically disables write caching, re-enabling it as soon as a functional SPS is detected. (If the system has a second valid SPS, write caching remains enabled.)

Write caching also requires two power supplies (VSCs). In a system with write caching, if one of the VSCs has failed along with the SPS, powering off the SPS also powers off the DPE, resulting in loss of access to data (but not data loss).

The SPS is used only with the Fibre Channel RAID enclosures. Each SPS supports a single DPE power supply. For a DPE installed in a Fibre Channel Rack, the procedure differs from that for a deskside DPE; the SPS mounts on a tray that accommodates two SPSs.

Note: The mounting tray occupies a 1-U space directly below the DPE. If the 1 U space is not available, you must move the DPE (also everything above it) up by 1 U to accommodate the SPS mounting tray. In this case, a second installer is required; do not attempt this procedure without a second trained and qualified installer.

This section consists of the following:

- Section 7.1.1, “SPS Kit Contents”
- Section 7.1.2, “Installing an SPS Mounting Tray”
- Section 7.1.3, “Mounting an SPS in a Tray”
- Section 7.1.4, “Connecting SPS Cables to the DPE”

This procedure requires

- a #2 Phillips screwdriver
- the help of another trained and qualified installer if a 1-U space is not available directly below the DPE

For an explanation of the SPS I/O panel, see Section 6.5, “Installing or Replacing a Standby Power Supply in the Deskside Fibre Channel RAID System (Widebody)” in Chapter 6.

7.1.1 SPS Kit Contents

The SPS mounting hardware for the Fibre Channel Rack is different from that used in the deskside RAID system. Note that an SPS field install kit always ships with hardware for mounting in either the deskside or rack; you will always have leftover hardware when the installation is completed.

The SPS tray uses approximately one NEMA unit (1 U) of vertical space (1.75 in. or 4.45 cm) in the rack. (See Section 3.2.3.1, "Mounting Hole Measurements" in Chapter 3 for additional information on proper mounting spaces.) This space must be available directly under the RAID enclosure (DPE); it is usually occupied by a 1-U filler panel.

The customer can order an initial SPS, which includes the mounting tray, or a second SPS, which includes different mounting hardware, or both. Table 7-1 summarizes the parts and their use.

Table 7-1 SPS and Mounting Tray Installation Hardware

Item	Initial SPS	Second SPS	Use
1-U mounting tray	One	None	Holds one or two SPSs.
M5 spring clips (clip nuts)	Six	None	Attach tray to rack rails: use one (perhaps two) per rail; if the rack has a 1-U filler panel, you can also reuse its spring clips.
L brackets (snap fingers)	Two	None	Attach tray to rack rails; if the rack has a 1-U filler panel, you can use the existing brackets.
Oblong plate with four holes	One	Two	Secures SPS to tray at back.
M5x16 screws	Six	None	Attach tray to rack rails: four for L brackets, two for rear rails.
Half-length filler panel, six holes	One	None	Blanks the space to the right of the SPS at the back of the rack when no second SPS is present; removed or not used if second SPS present.
M4x8 screws	Ten	Six	First SPS: eight to secure oblong plate and filler panel. Second SPS: four to secure two oblong plates. Both: two each to secure SPS to front of tray.
1-U filler panel	One	None	Use this if the rack does not already have a 1-U filler panel.

Note: If the 1 U space below the DPE is not available, units in the rack must be moved; in this case, a second installer is required.

7.1.2 Installing an SPS Mounting Tray

Before you install the SPS, a tray must be mounted directly below the DPE enclosure; it occupies a 1-U space. If the tray is already in place, go to Section 7.1.3, “Mounting an SPS in a Tray.”

Follow these steps to install the SPS tray in the Fibre Channel Rack:

1. Determine the mounting position of the SPS tray; it should be directly under the DPE RAID enclosure. See Section 3.2.3.1, “Mounting Hole Measurements” in Chapter 3 if you need more information.

   Note: If the 1-U space is not available, you must move the DPE (also everything above it) up by 1 U to accommodate the SPS mounting tray. In this case, a second installer is required; do not attempt this procedure without a second trained and qualified installer.

2. If the front 1-U filler panel is present, pull it off. With the #2 Phillips screwdriver, unscrew the mounting brackets; reserve them and the screws. Notice the spring clips (clip nuts) on the rails; each rail has one (perhaps two).

3. Identify the two holes in the vertical front channel rail that align with those in the SPS tray flange. Slide a spring clip onto each front rail at those locations, as shown in Figure 7-1. If the 1 U front filler panel was present, you can use its spring clips. Depending on how the holes line up with the tray location, you might use two spring clips per rail.

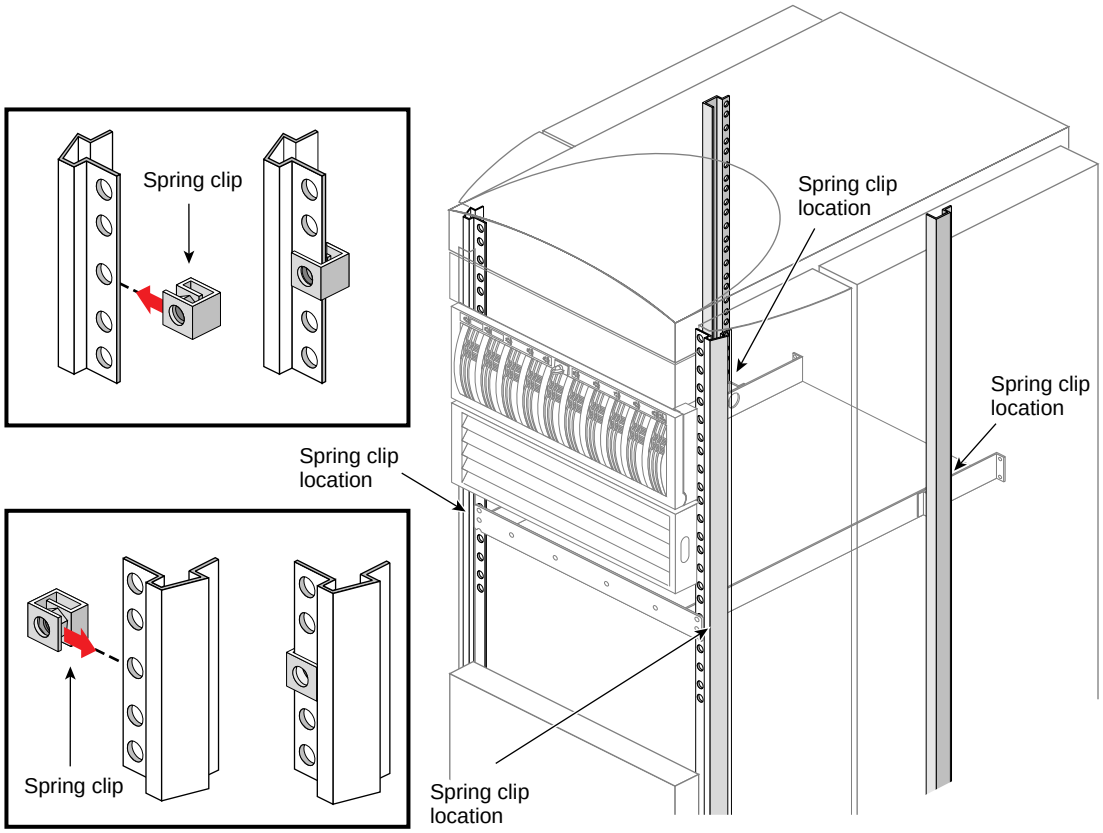


Figure 7-1 Attaching Spring Clips to Rails

4. Slide in the tray to determine the location for spring clips on the back rails:
   - At the rear of the rack, line up the end of the tray with holes in the rails; make sure that the rear end of the SPS tray is even with the front end.
   - Mark the holes and remove the tray.
5. Slide a spring clip onto each back rail at the hole you marked. See Figure 7-1. Use a second spring clip per rail if appropriate.
6. Slide the SPS tray into the rack from the front until the two front holes at each end of the front flange line up with the clip nuts.

7. Align the two holes on a filler panel L bracket over the clip nut holes, and secure it with two of the six M5x16 screws; see Figure 7-2. Repeat the process for the second bracket. Notice the orientation of the brackets.

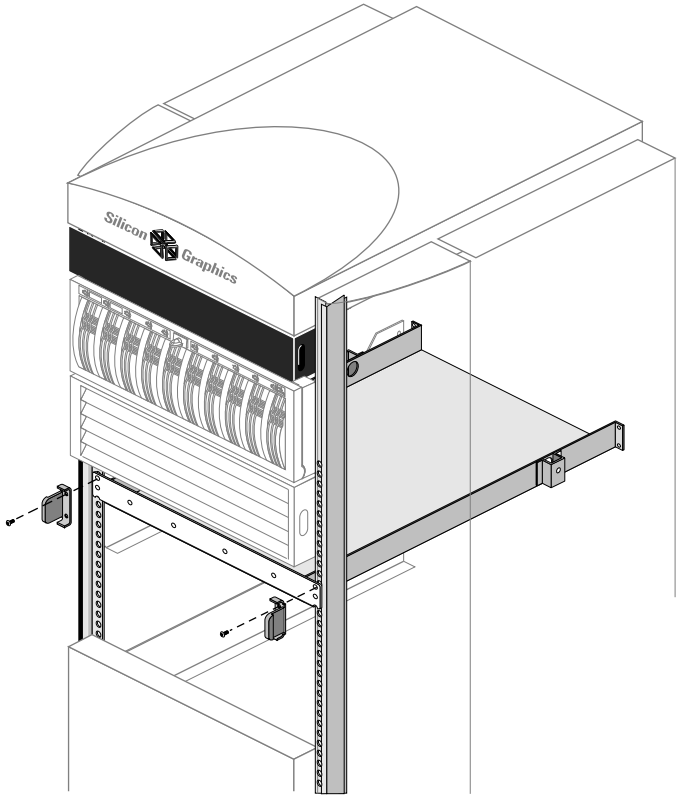


Figure 7-2 Attaching Mounting Bracket to Spring Clip on Front Rail

Note: The screws are a tight fit in the mounting brackets.

Repeat this process on the other front rail.

8. Level the tray so that the mounting holes on either side of the tray align with the proper hole in the rear rails.
9. Use the two remaining M5x16 screws to connect the back part of the tray to the rear rails s on each side. See Figure 7-3.

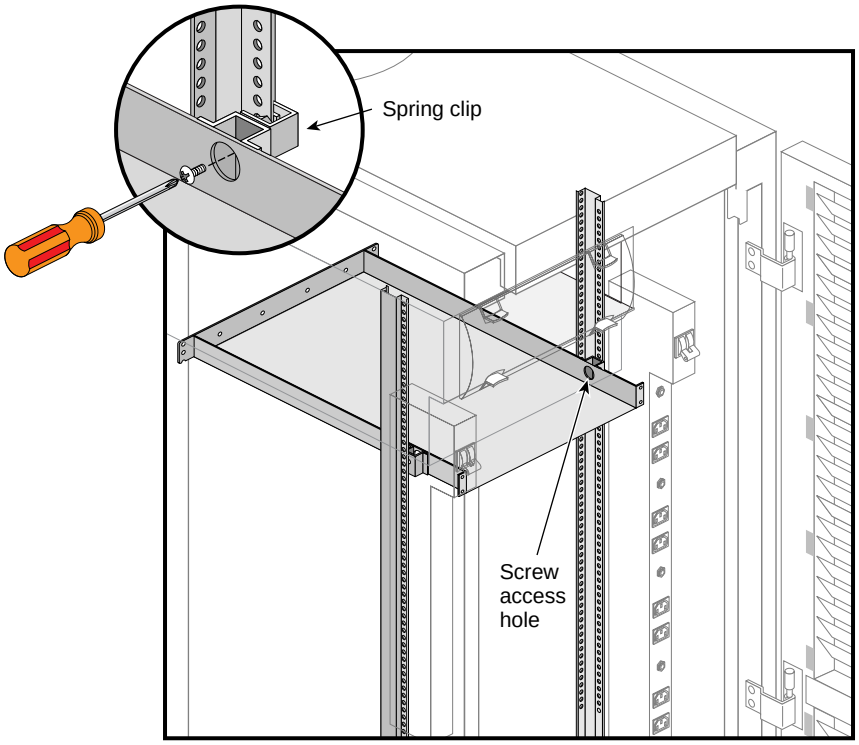


Figure 7-3 Securing the Rear Connections on the SPS Tray

Wait until the SPS is installed before attaching the filler panel to the mounting brackets on the front of the tray.

7.1.3 Mounting an SPS in a Tray

This section presumes that an SPS tray is mounted directly below the RAID enclosure; if it is not, see Section 7.1.2, “Installing an SPS Mounting Tray.” For installation consistency with factory practice, install the first SPS (supporting SP A) on the left side of the tray (looking from the back of the rack).

Follow these steps to install an SPS in the rackmounted tray:

1. Unpack the SPS. Locate the oblong mounting brackets and M4x8 screws, which are included with the mounting tray.
2. Slide the SPS into the tray from the rear of the rack, as shown in Figure 7-4. If you are installing one SPS, put it on the left side.

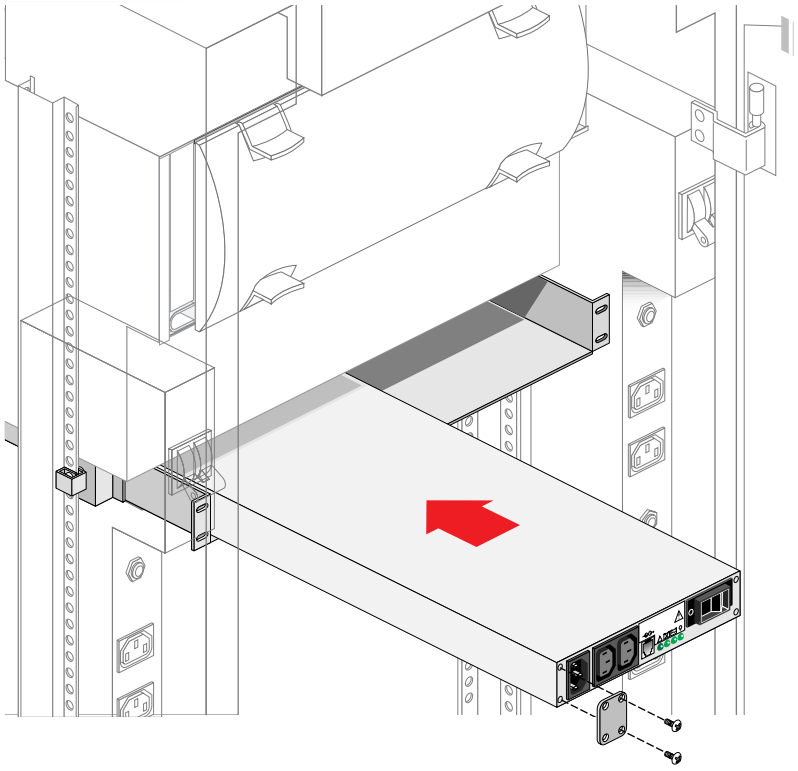


Figure 7-4 The SPS and Mounting Tray

3. Using two of the M4x8 screws, fasten an oblong mounting bracket to the holes on the left side of the SPS, as shown in Figure 7-4.

4. If you are installing only one SPS in the tray, attach the half-length filler panel, using four M4x8 screws as shown in Figure 7-8.

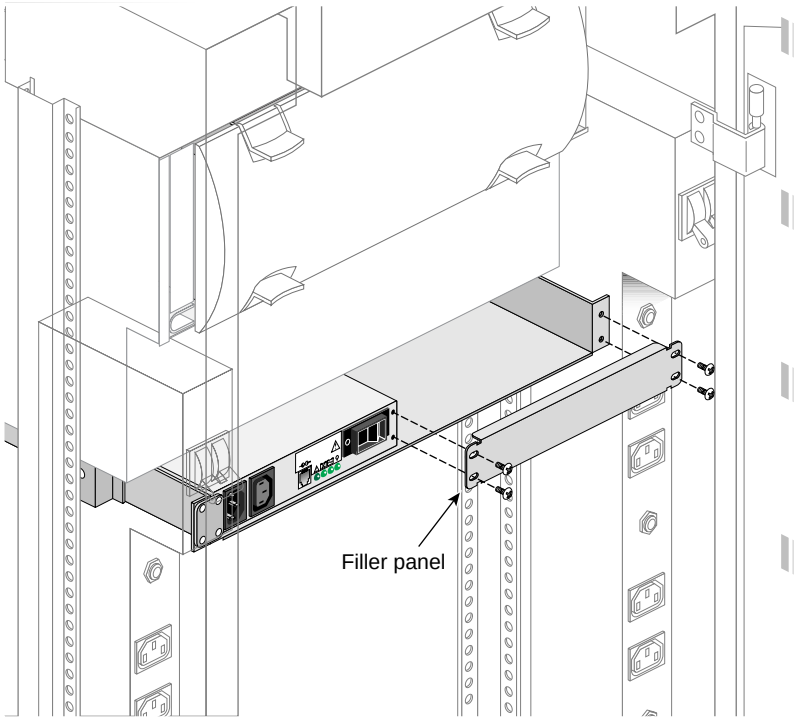


Figure 7-5 Attaching the Rear Half-Length Filler Panel

If you are mounting two SPS units in a tray at the same time:

- Slide the second SPS into the tray next to the first and fasten them together using four M4x8 screws and an oblong mounting plate.
- Attach the third oblong plate to the right side of the second SPS with two M4x8 screws.

Figure 7-6 shows the oblong plates attached.

5. Align the holes in the oblong plate(s) with the holes in the rear flange(s) of the tray.
6. Secure each SPS or filler panel to the tray; see Figure 7-6.
   - Insert M4x8 screws part way in to attach the oblong plate(s) or filler panel to the tray's rear flange(s).
   - At the front of the rack, insert two M4x8 screws part way in to secure each SPS to the tray's front panel.
   - Alternating at the various attachment points, tighten the screws.

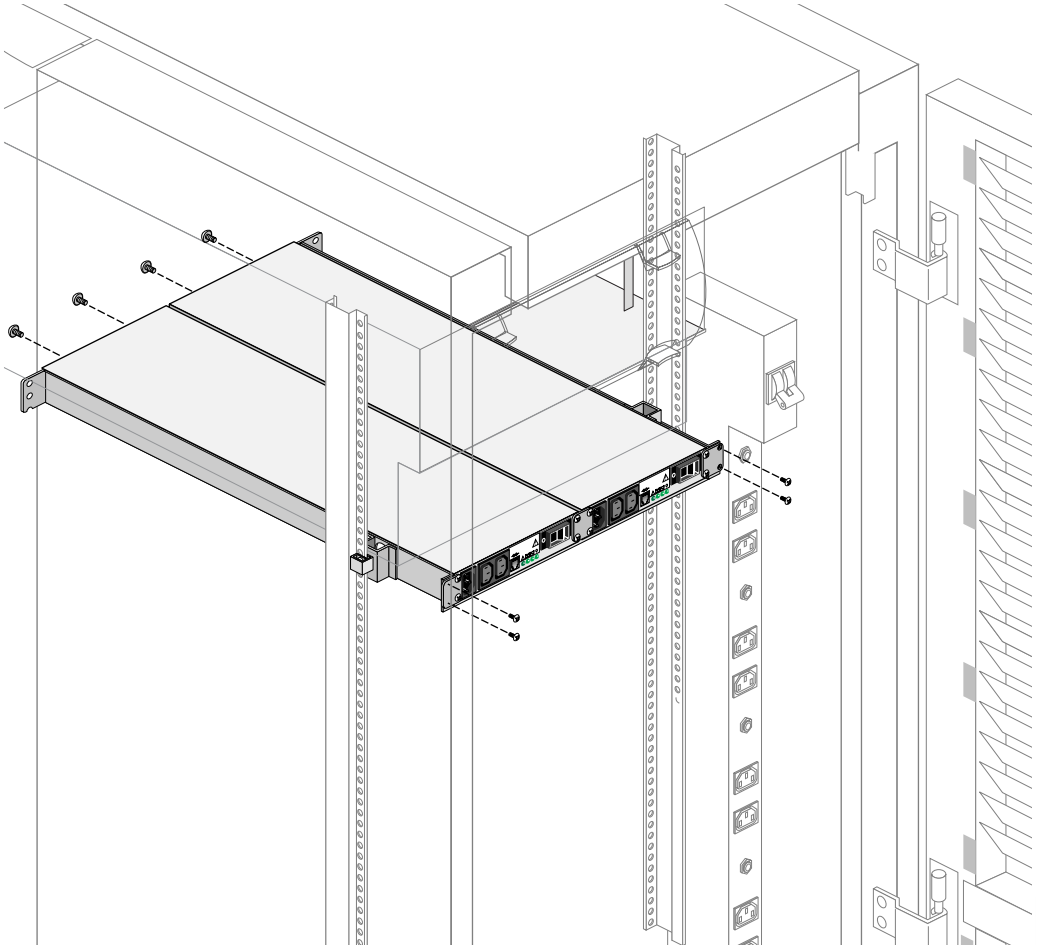


Figure 7-6 Securing the SPS Unit(s) in the Tray

7. Push the snap finger brackets together and slip the 1-U filler panel over them until it is firmly seated.

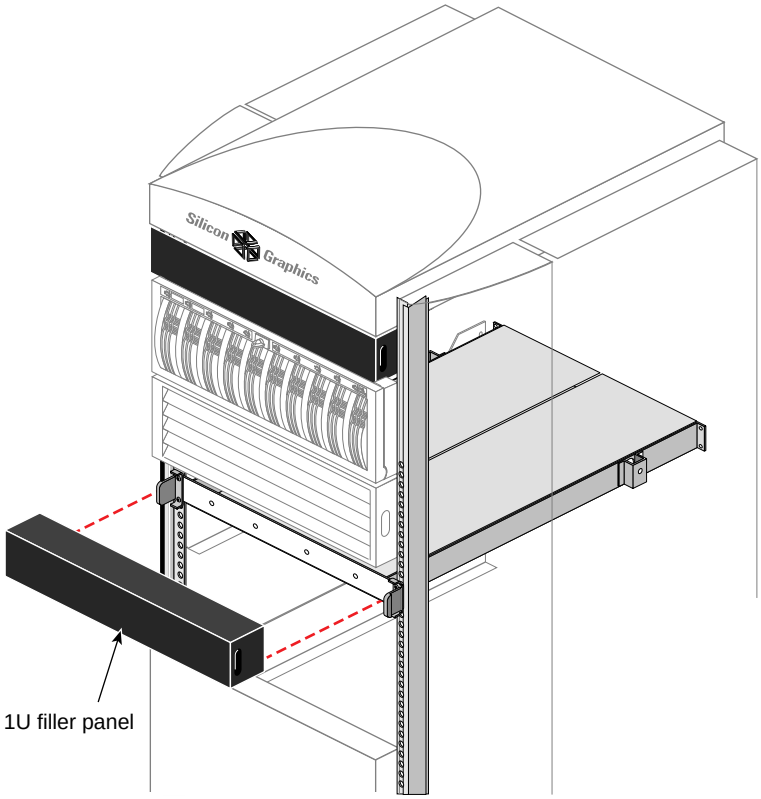


Figure 7-7 Attaching the 1-U filler Panel to the Front

8. Repeat all procedures for any additional SPS installations before you attach cables.

7.1.4 Connecting SPS Cables to the DPE

After you install all applicable SPS units, you must carefully connect the power and interface cables to ensure high availability. Follow these steps to connect each SPS to the DPE that it supports:

1. Locate the power cord and interface cable that shipped with the SPS.
2. In the unlikely event that one of the power supplies (VSCs) in the DPE has also failed, take the system offline.

   Caution: If one of the power supplies fails without being noticed, powering off the SPS also powers off the DPE, resulting in loss of access to data (but not data loss).

3. Plug one end of the power cord into the SPS AC outlet and the other end into power supply A (the bottom unit), as shown in Figure 7-8.

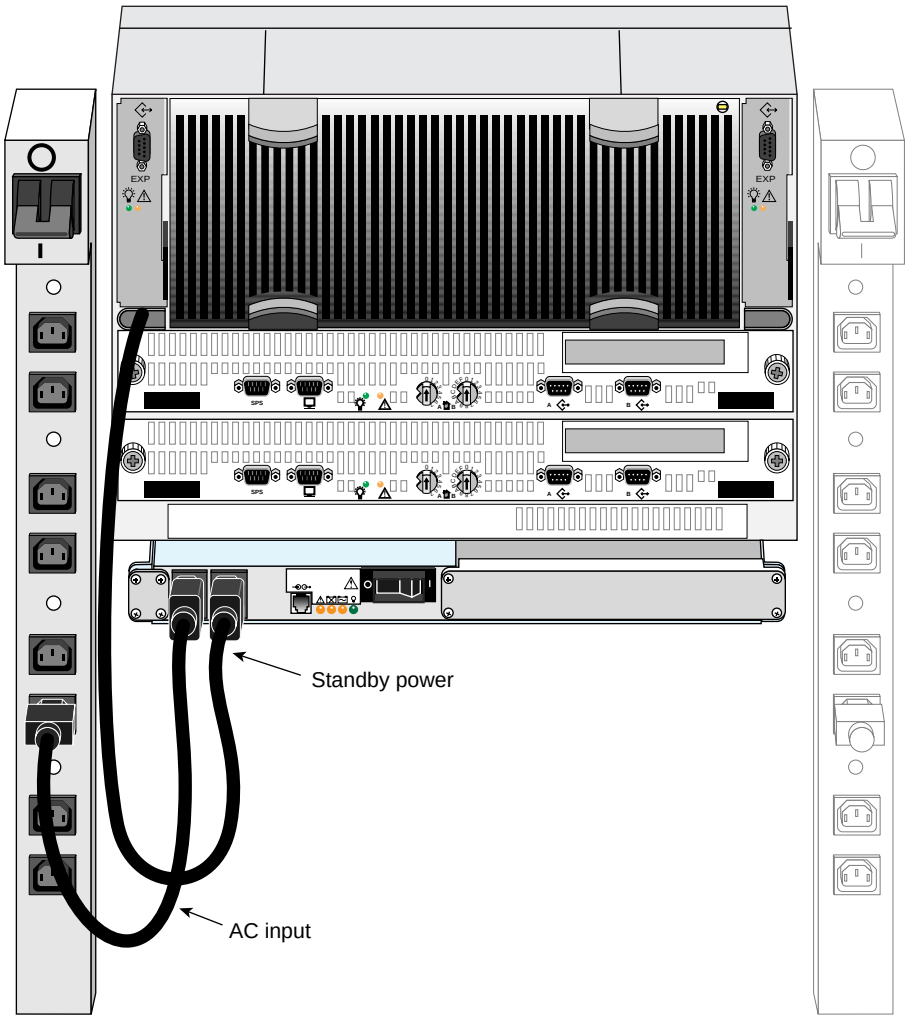


Figure 7-8 Connecting the Standby Power Supply (SPS) Power Cord: Rackmount

4. Connect the remaining power cable from the PDU to the far-left AC inlet on the SPS, as shown in Figure 7-8.

5. Connect the RJ-11 (jack) end of the interface cable to the SPS connection (left of the LEDs), as shown in Figure 7-9.

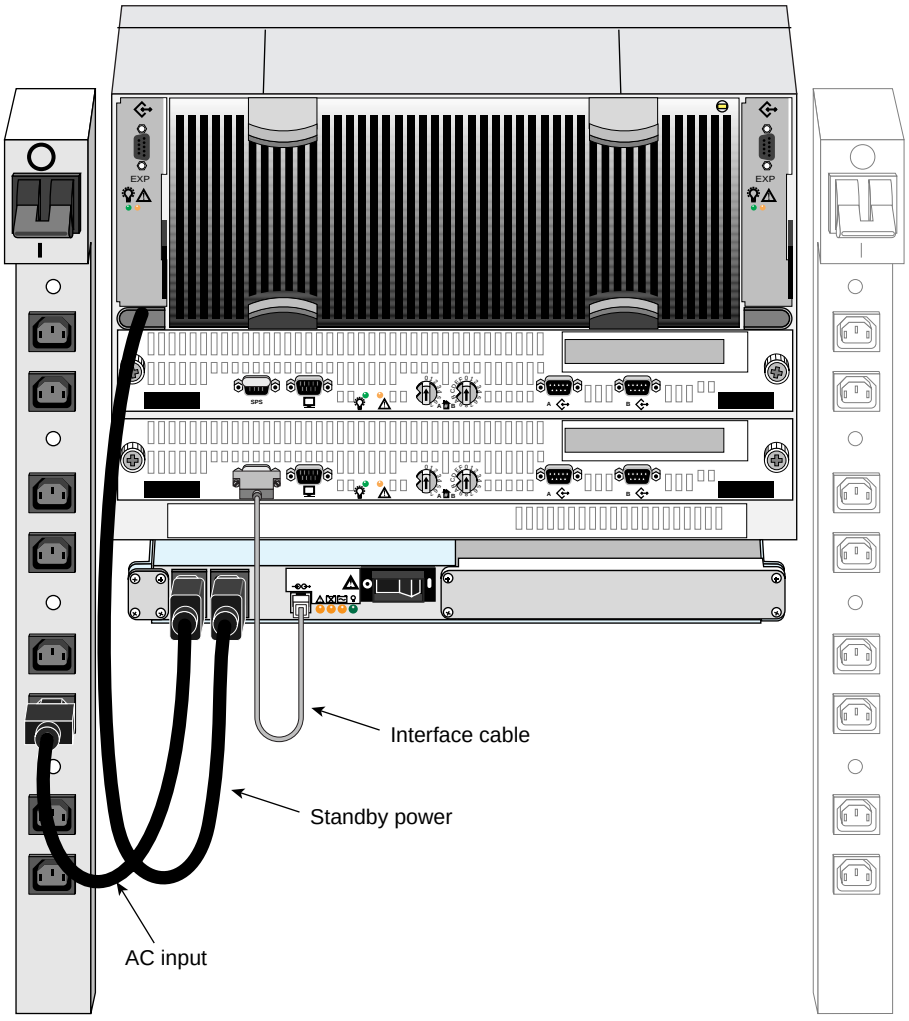


Figure 7-9 Connecting the Standby Power Supply (SPS) Interface Cable

6. Connect the 9-pin female end of the interface cable to the far left connection on the rear of SP A (it is labeled SPS), as shown in Figure 7-9.

7. Repeat these steps for a second SPS that connects to power supply B and SP B; see Figure 7-10.

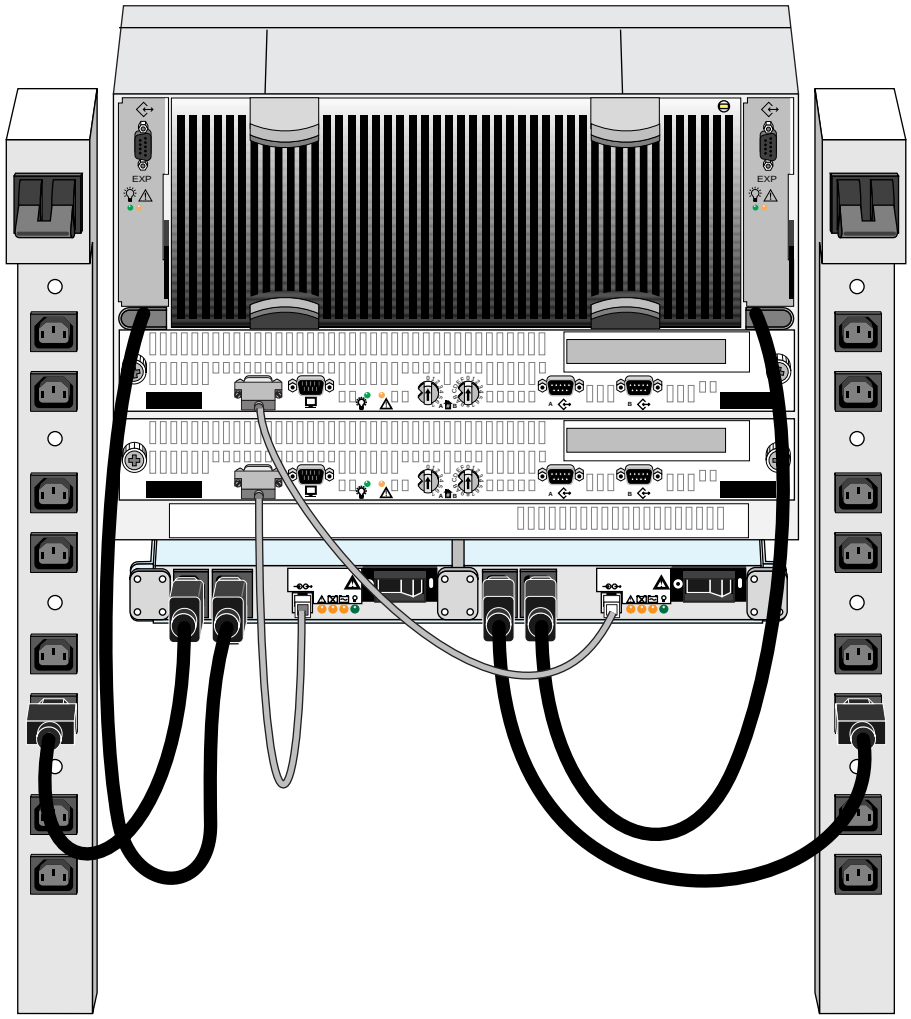


Figure 7-10 Standby Power Supply Power and Interface Cables

8. If you have no other tasks that require that the system be powered off, push the rocker switch to the on position to start power flowing through the SPS to the DPE's power supply.

The SPS begins charging as soon as the AC power is connected. The time needed for a full charge varies depending on how long the battery unit has been in storage. See Appendix A for technical specifications and information on the SPS units.

Note: Half an hour after power-on, the SPS performs a 10-minute self-test, during which write caching is disabled (unless the system has a functional second SPS).

7.2 Replacing the Power Distribution Unit in a Fibre Channel Rack

This section explains how to swap out a failed power distribution unit from the Fibre Channel Rack. These units are attached to the inner rear wall of the rack.

This procedure requires removing a side panel to access the screws that hold the PDU in position. If you are unable to remove the side panel, such as in the case of Fibre Channel Racks placed side by side, you must remove all enclosures in the Fibre Channel Rack to access the screws.

Warning: **Two persons are required to remove and replace disk enclosures in a Fibre Channel Rack. Do not undertake this procedure unless another trained and qualified installer is available.**

This procedure requires

- a #2 Phillips screwdriver
- another trained and qualified installer, if you cannot remove the Fibre Channel Rack side panel

Follow these steps:

1. Work with the system administrator at the site to shut down the rack.
2. Power off the rack and unplug all power cables from the power distribution unit(s).
3. Open the rear door.

   Note: The procedure should not require removing the rear door. Rehanging the rear door might require a second person because of the difficulty of lining up the pinlocks.

4. As shown in Figure 7-11, remove the rear side panel from the side of the rack where the PDU is located.

   - Grasp the bottom of the side panel and pull firmly outward. The ball locks on the panel should both release.
   - Lift the panel up and away from the chassis.

   Note: The panel scratches or mars easily, so set it aside carefully.

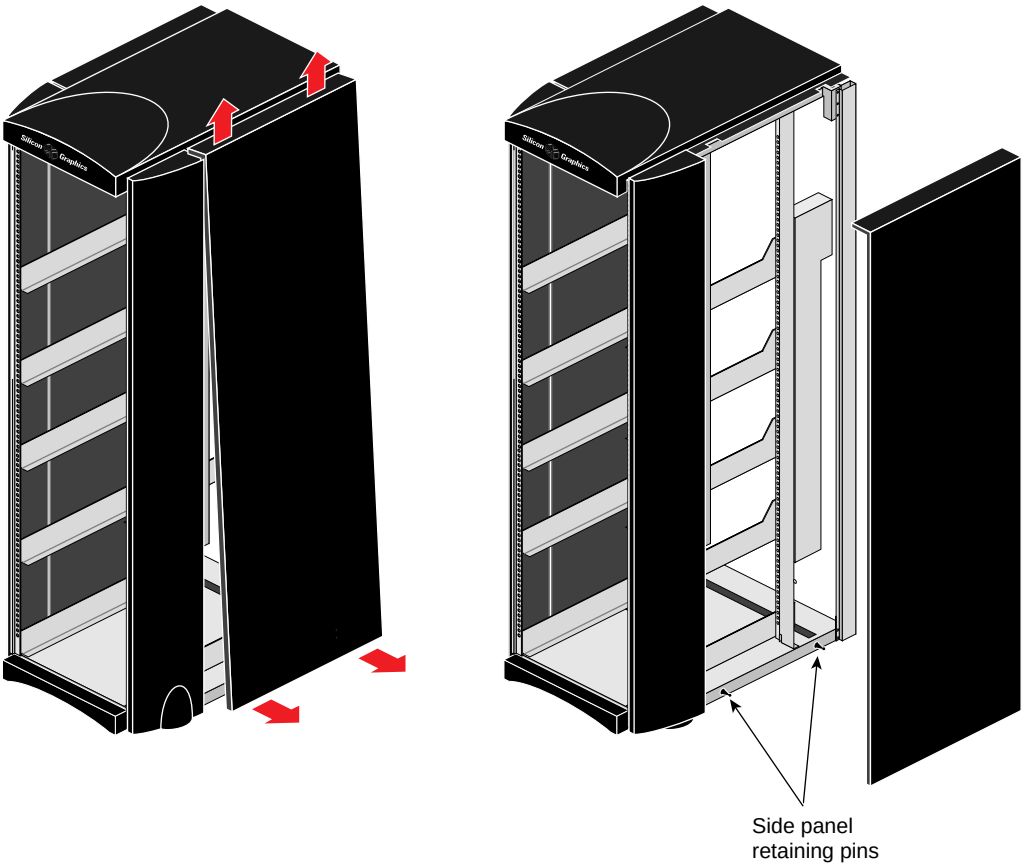


Figure 7-11 Removing the Fibre Channel Rack's Side Panel

If you are unable to remove the side panel, such as in the case of Fibre Channel Racks placed side by side, you must remove all enclosures in the Fibre Channel Rack to access the screws.

Warning: **Two persons are required to remove and replace disk enclosures in a Fibre Channel Rack. Do not undertake this procedure unless another trained and qualified installer is available.**

5. With the #2 Phillips screwdriver, undo the screws that attach the power distribution unit to the vertical bracket and remove it, as shown in Figure 7-12.

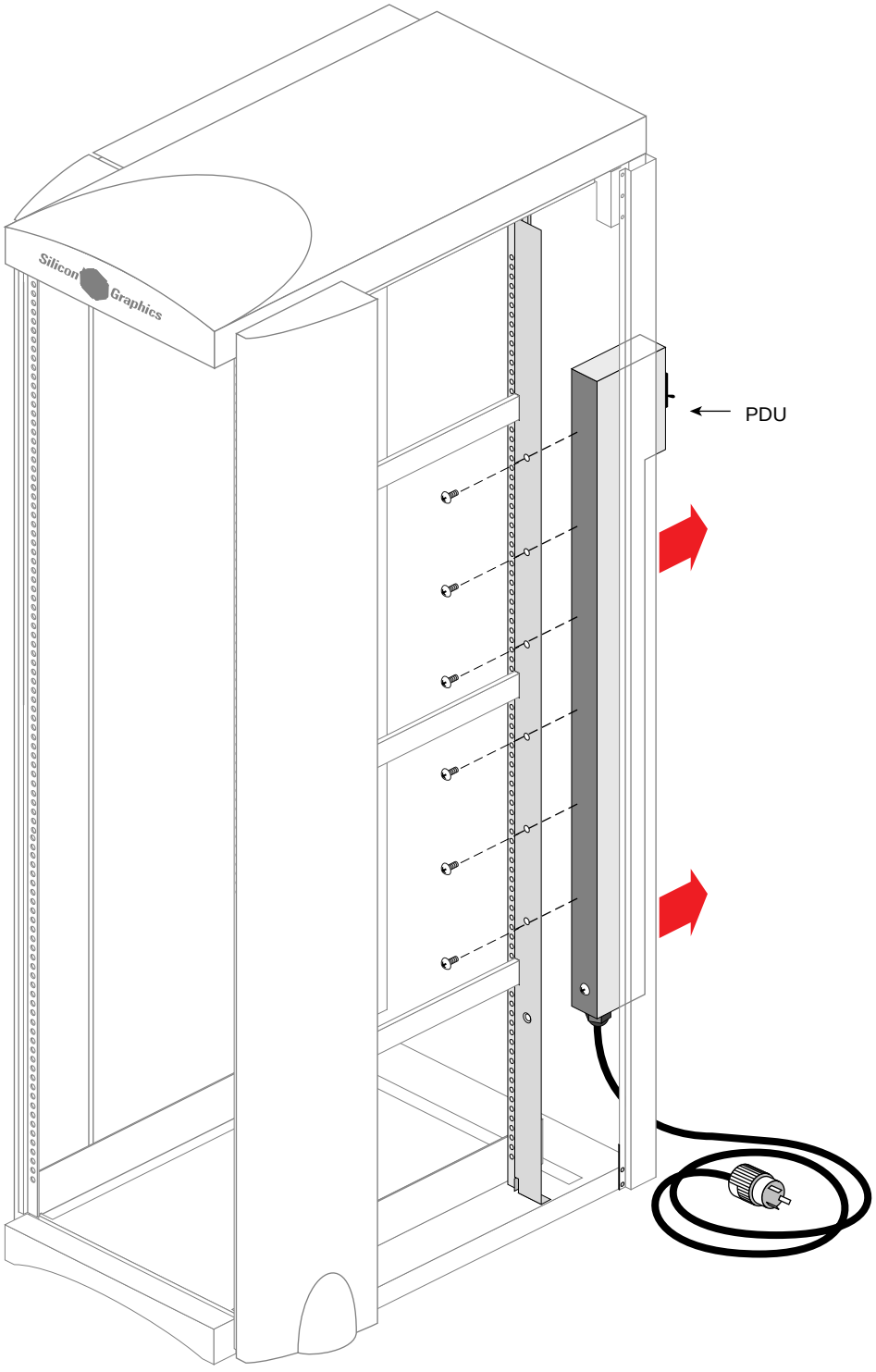


Figure 7-12 Removing the Fibre Channel Rack Power Distribution Unit

6. Attach the replacement power distribution unit.
7. Reattach the side panel, or reinstall the enclosures if you have had to remove them.
8. Close (or reinstall) the rear door, and plug in the main power cable and all enclosure power cables. Work with the system administrator at the site to power on the system.

Chapter 8

Installing a Non-RAID FibreVault in the Origin Rack

This chapter covers the information needed for installing the non-RAID FibreVault (DAE) into an Origin Rack. Note the following:

- The FibreVault is not supported in the Origin peripheral expansion rack.
- The Fibre Channel RAID enclosure (DPE) is not supported in the Origin Rack.

For information on installing the DAE in a Fibre Channel Rack, see Chapter 3, “Setting Up a Fibre Channel Rack.” Remove and replace procedures for LCCs, fan modules, and other components are the same for DAEs in the Origin Rack as they are for DAEs in the Fibre Channel Rack. For instructions, see Chapter 6, “Installing and Replacing Components in Rackmount and Deskside DAEs and DPEs.”

This chapter has the following sections:

- Section 8.1, “FibreVault Configuration Guidelines for the Origin Rack”
- Section 8.2, “Preparing the Origin Rack for the FibreVault Enclosure”
- Section 8.3, “Installing the Mounting Hardware”
- Section 8.4, “Installing the FibreVault Enclosure”
- Section 8.5, “Connecting Enclosure Power Cords in the Origin Rack”
- Section 8.6, “Cabling Enclosures in the Origin Rack”

Warning: **Two persons are required to install FibreVault enclosures in a rack. Do not undertake this procedure unless another trained and qualified installer is available.**

8.1 FibreVault Configuration Guidelines for the Origin Rack

The FibreVault enclosures install in the Origin or Onyx2 rack in the same location(s) and take up approximately the same space as the Origin Vault SCSI disk and tape unit. Table 6-1 provides a configuration overview for FibreVaults in an Origin Rack.

Table 8-1 Origin Rack FibreVault Configurations

Rack Type	Maximum	Installation Location
Origin data rack	3 FibreVaults	1 in place of the Origin Vault, plus 2 units above MMSC panel (if space available)
Onyx2 graphics rack	1 FibreVault	Replaces Origin Vault just below the MMSC panel

Redundant components are *not* supported in the FibreVaults you install in the Origin2000 data rack or Onyx2 rack. This means you do not install dual LCCs or dual power supplies. These restrictions are primarily because of the Origin Rack PDU:

- The older (fat) PDU restricts access to any LCC mounted in the left side of the FibreVault (you can't remove it from the back of the system).
- Origin Racks with a single PDU restrict the number of power connections you can make to the FibreVaults.

Without the thin PDU, any left-mounted LCC must be replaced by removing the entire FibreVault enclosure. An Origin Rack with a single PDU also limits the number of power connections you can make to the FibreVaults in the rack.

Note that the newer thin PDUs in Origin Racks have the following part numbers:

- North American host PDU (2 modules + 6 peripherals) P / N 013-2075-001
- International host PDU (2 modules + 6 peripherals) P / N 013-2178-001

8.2 Preparing the Origin Rack for the FibreVault Enclosure

Prepare to install a FibreVault enclosure in an Origin Rack with these steps:

Warning: Two persons are required to install disk enclosures in a rack. Do not undertake this procedure unless another trained and qualified installer is available.

1. Unpack the enclosure unit and verify that all parts are present. If they are not, notify the shipper of the missing parts. Note that enclosures ship with a maximum of 10 disks installed. Examine the disk bays carefully; the air-flow filler panels look similar to disk modules.
2. Open the front door of each enclosure you are installing (as needed) by unlocking the main latch and pushing the release. Temporarily removing the rear fan module also provides an extra hand-hold location for lifting the enclosure.

3. To reduce the weight of the enclosure for insertion into the rack, you can install it without disk modules. This reduces the total weight by approximately 2 lbs. (0.9 kg) per disk module.

   Remove the fan module and power supply from the rear of the enclosure if you wish to further reduce the enclosure's weight.

4. Working with the system administrator at the site, power off the rack by halting the host system and setting the rack's main circuit breaker switch to the off position.

5. Remove any filler panel installed at the first open location in the rack (see Figure 8-1). Always install FibreVault enclosures starting at the lowest open position, not at the top.

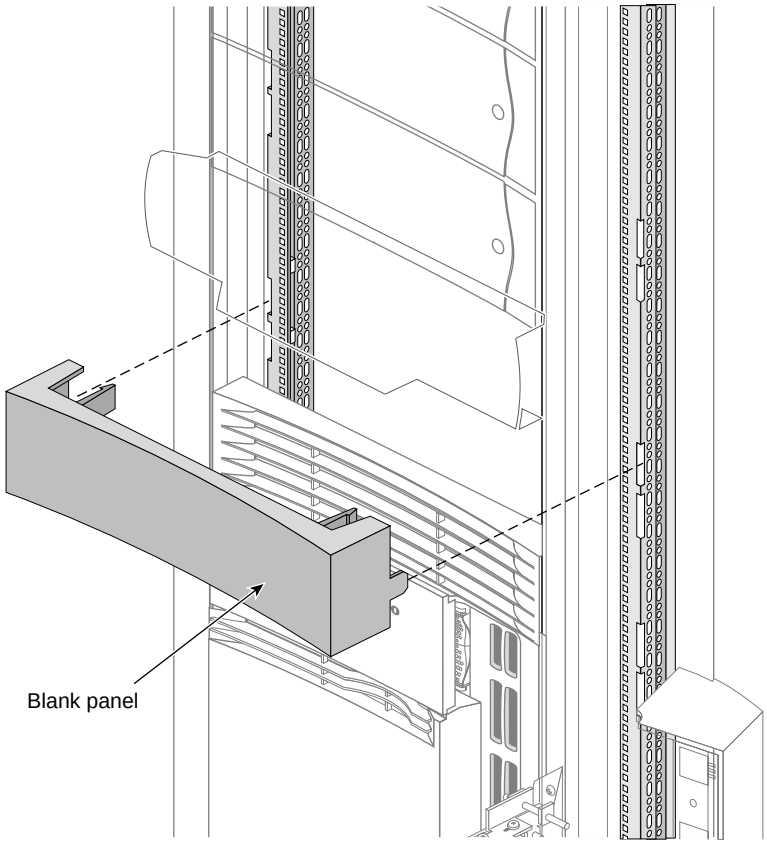


Figure 8-1 Origin Rack Blank Filler Panel

6. Determine whether the Origin Rack shipped with an Origin Vault SCSI enclosure. Remove it and its support rails if present. Mark the screw hole locations where you removed the SCSI vault rails. The FibreVault rails install in the next higher screw hole.

   If you are installing a FibreVault in the upper section (above the MMSC interface panel), remove the module mounting rails. Be sure to mark the screw hole locations where you removed the rails. The FibreVault rails install in the next higher screw hole.

   Note: You cannot use the SCSI Origin Vault or compute module mounting rails with the FibreVault.

8.3 Installing the Mounting Hardware

Each FibreVault enclosure mounts on a pair of uniform (straight) rails. The front and rear of the rails mount to the vertical channels with screws and nuts. The mounting kit for FibreVault in the Origin Rack consists of

- one left mounting rail (040-2097-001)
- one right mounting rail (040-2099-001)
- two front mounting brackets (040-2098-001)
- one plastic front bezel (050-0503-001)
- 10-32 mounting screws and #10 nuts

This procedure requires a #2 Phillips screwdriver (full-length, not stubby).

Follow these steps to install the mounting rails:

1. Calculate installation locations of the mounting rails carefully so that the Origin Rack FibreVault enclosures mount properly. Determine the appropriate rail mounting location for a new FibreVault enclosure:
   - For the FibreVault first time option (FTO), mark the screw holes on the vertical rails where the SCSI Origin Vault was mounted, then use the holes just above these positions to mount the FibreVault rails.
   - For the FibreVault hardware upgrade (HU), mark the screw holes where the mounting rails for the upper compute module fasten. Use the holes just above these positions to mount the FibreVault rails.

     Alternatively, you can use the template in Appendix C, “Measuring Templates for NEMA Units,” and cut a piece of stiff cardboard, sheet plastic, or foam to exactly 4U (7 in. or 17.8 cm) to determine the required space.
2. For easier access, remove the cabinet side panels if they are in place (this is not necessary to complete the procedure).

3. Position the left mounting rail so that the screw holes are aligned with the vertical rails in the Origin Rack. They should be in the holes just above the mount points of the SCSI Origin Vault rails (see step 6 in Section 8.2, “Preparing the Origin Rack for the FibreVault Enclosure”). See Figure 8-2 for an example.

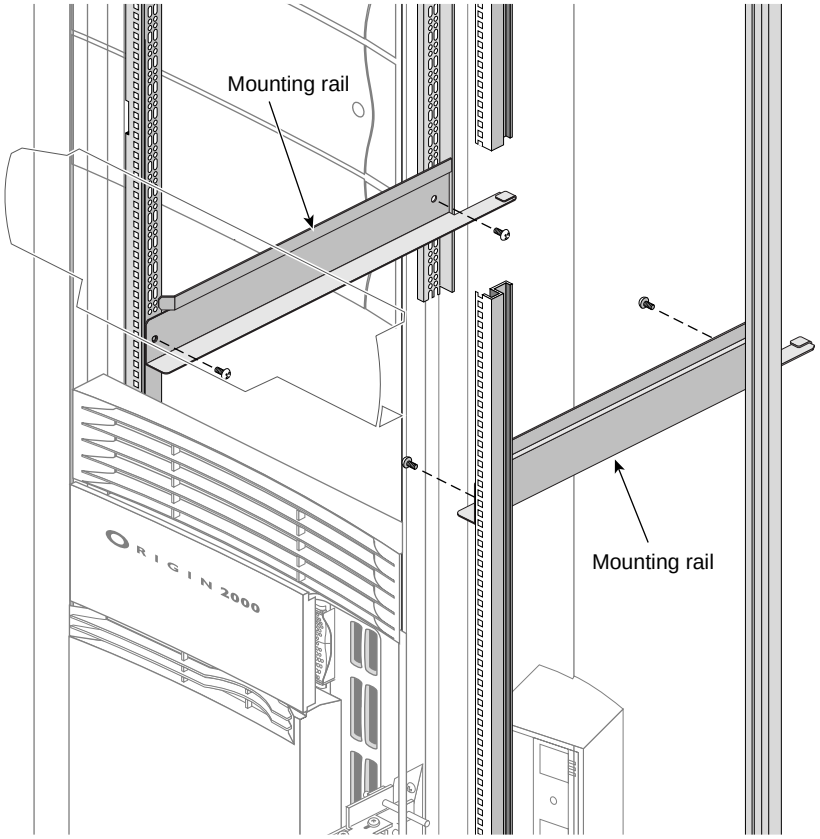


Figure 8-2 Installing Mounting Rails in the Origin Rack

4. Position a nut on the outside of the rail, and secure each rail mounting screw, as shown in Figure 8-2.
5. Repeat the procedure with the right-hand rail.

6. Install the front brackets as follows:

   - Position the bottom of the bracket so that it is flush with the horizontal plane of the mounting rail.
   - With the #2 Phillips screwdriver, secure the bracket to the front vertical mounting rail by screwing them into place. See Figure 8-3.

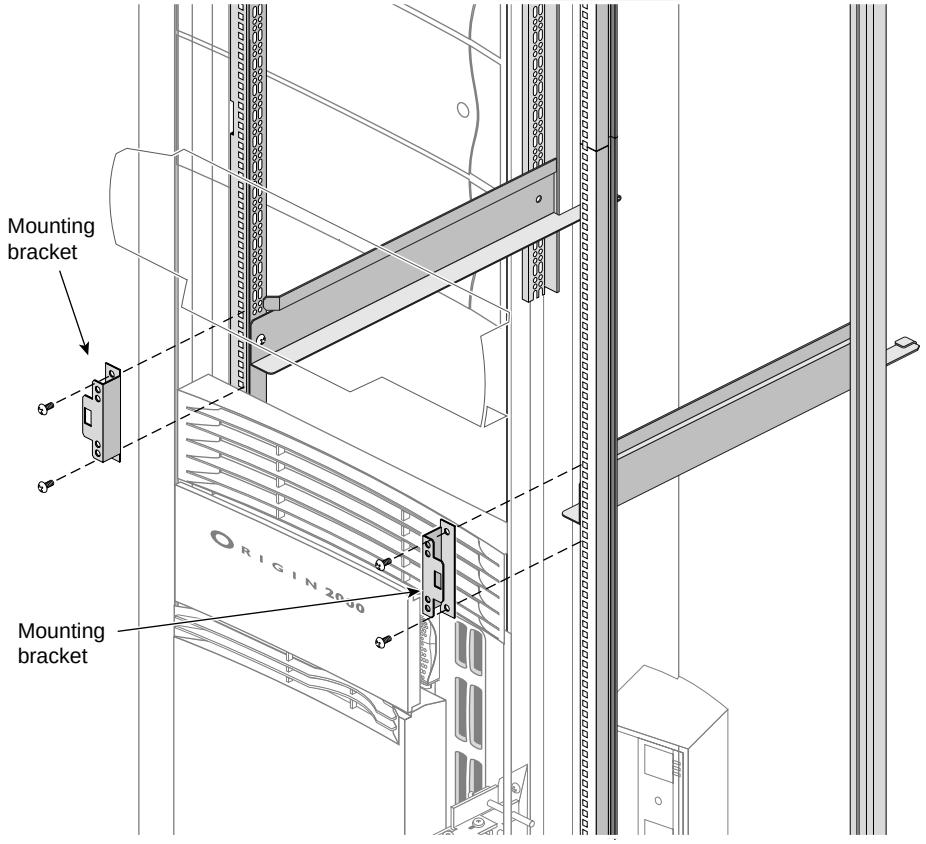


Figure 8-3 Installing FibreVault Mounting Brackets

8.4 Installing the FibreVault Enclosure

This procedure requires

- a #2 Phillips screwdriver
- the assistance of another trained and qualified installer

Warning: **Two persons are required to install disk enclosures in any rack. Do not undertake this procedure unless another trained and qualified installer is available.**

Follow these steps to install the FibreVault enclosure(s) into the rack:

1. Remove the rear fan module from the enclosure (see See Section 6.3, “Replacing a Fan Assembly,” in Chapter 6 if you need instructions). Removing the fan makes the enclosure much easier to grasp and maneuver.
2. Working with another installer, lift the enclosure and engage the rails in the Origin Rack with the bottom rear of the enclosure. Be careful not to damage the LCC handles or scrape the new enclosure against the rack or other components.

   Note: When installing an enclosure in the middle of other components, you must tilt the front of the enclosure downward before engaging the bottom sheet metal with the mounting rails.
3. Slide the enclosure into the rack as shown in Figure 8-4. Keep the FibreVault centered or it may snag on one of the front mounting brackets. The rear sheetmetal of the FibreVault should be captured in the sheetmetal hooks at the back of each mounting rail.

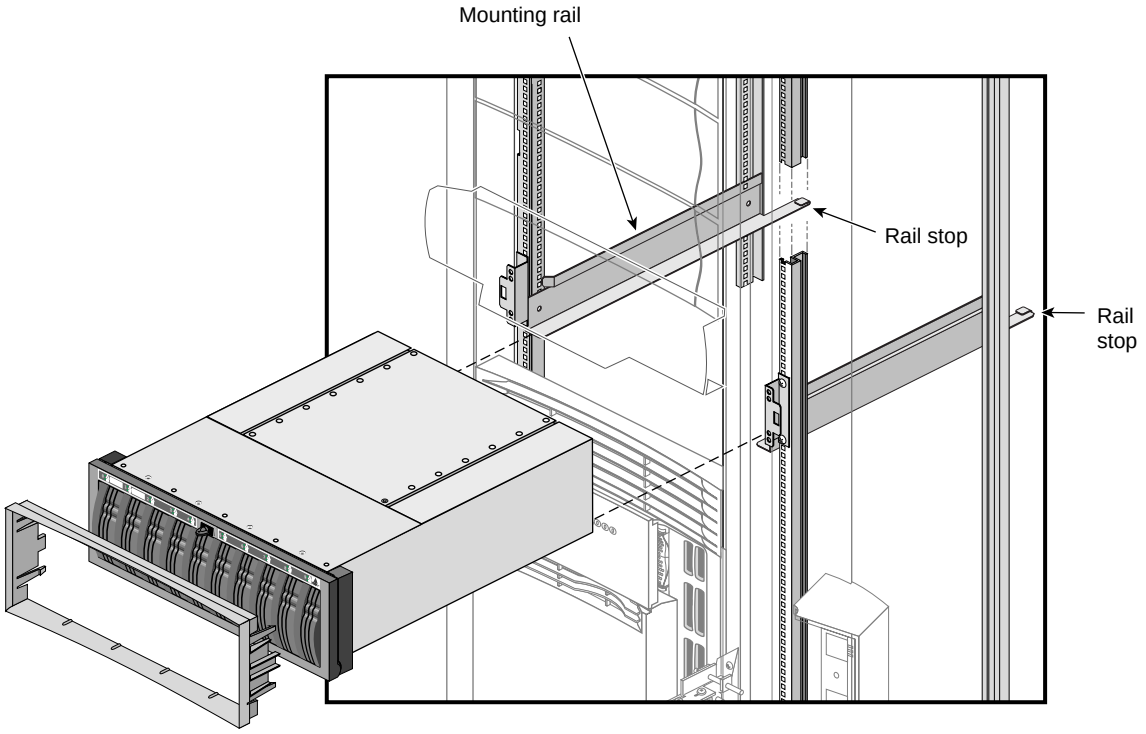


Figure 8-4 Inserting the FibreVault Enclosure

4. With the #2 Phillips screwdriver, secure the enclosure in the rack using two retaining screws on each of the front brackets. Note that the screws are inset; you cannot use a stubby Phillips screwdriver for this step.
5. Install the reversible plastic bezel over the front of the FibreVault by snapping the four tabs into place. (The bezel is easily removed by opening the FibreVault's front door and reaching in to unsnap the plastic retaining tabs.)
6. Install any disk modules, front fan module, or power supply that were removed as described in "Preparing the Origin Rack for the FibreVault Enclosure." Note that you may want to leave the rear fan module(s) out until you have installed each enclosure's power cord.
7. Repeat these steps for any additional enclosures to be installed. The rack holds a maximum of three FibreVaults.
8. Set enclosure addresses as explained in Section 3.3, "Setting the Enclosure Address" in Chapter 3.

8.5 Connecting Enclosure Power Cords in the Origin Rack

As a general rule, connect the power cord(s) after enclosures have been installed in the Origin Rack. The procedure is the same as for enclosures in a Fibre Channel Rack; see Section 3.4, “Connecting the Enclosure Power Cord(s),” in Chapter 3.

8.6 Cabling Enclosures in the Origin Rack

To cable multiple FibreVault enclosures in an Origin Rack, follow these steps:

1. Connect one end of the enclosure’s 0.3-meter cable to the expansion (**EXP)** port of the enclosure’s LCC, as shown in Figure 8-5.

   Note: To connect enclosures, use only the 0.5-meter (19.6-inch) copper cable supplied for this purpose. Daisy chaining to enclosures in other racks is not supported.

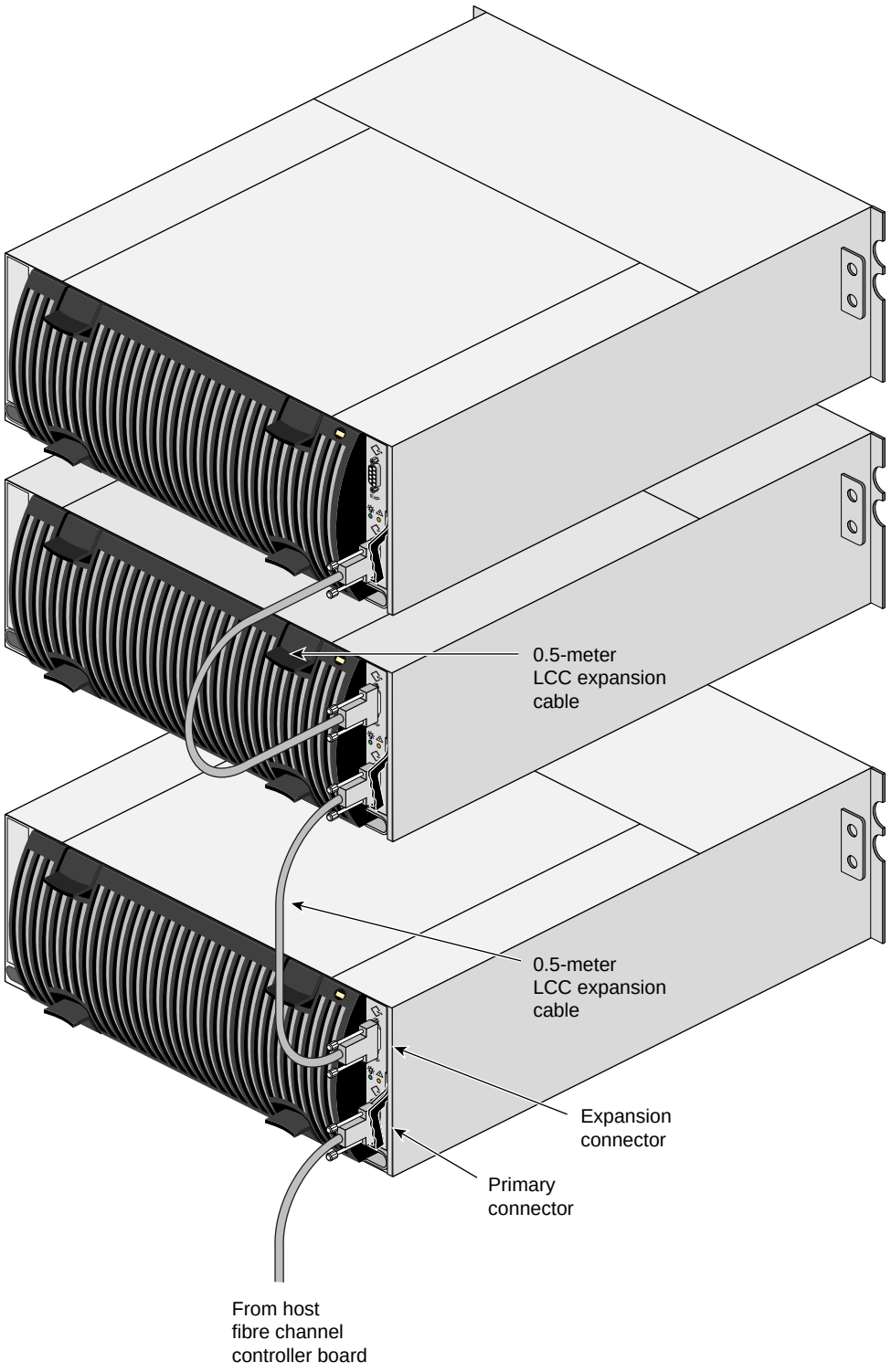


Figure 8-5 Cabling Additional LCC Loops in Origin Racks

2. Connect the other end of the enclosure cable to the primary (**PRI**) port of the next enclosure.

Figure 8-6 shows enclosures cabled in the rack.

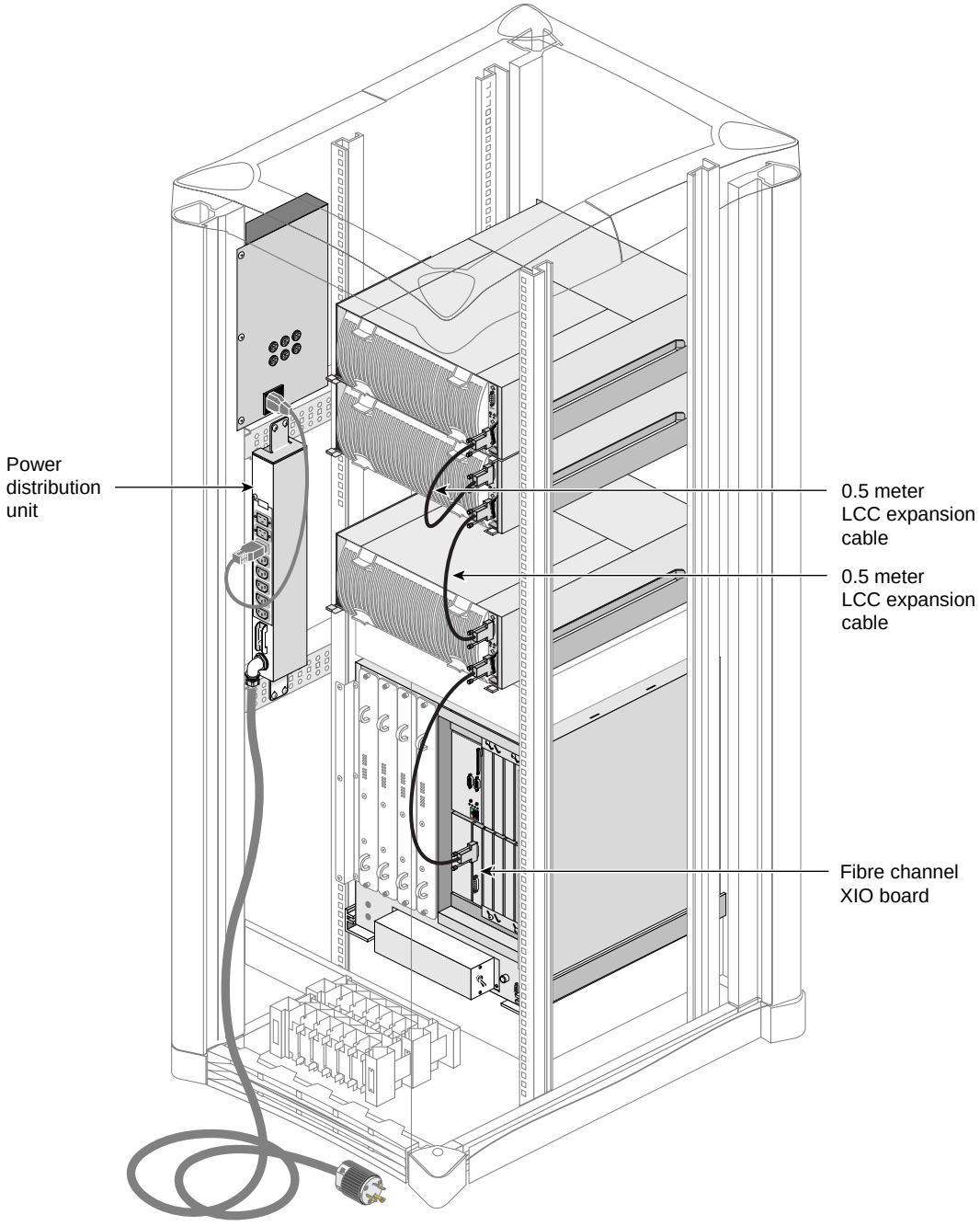


Figure 8-6 FibreVault in Origin Rack (Rear View)

Chapter 9

Upgrading Licensed Internal Code and PROM Code

This chapter explains how to update the licensed internal code (LIC) for SPs in the system:

- Section 9.1, “Checking Database Disk Module Status”
- Section 9.2, “Upgrading the LIC”
- Section 9.3, “Testing the Upgrade”

For CDs that include new PROM code, the procedures in this chapter also explain how to load the new PROM code.

Caution: Upgrading the firmware requires rebooting; work with the customer to make sure all users will be off the affected systems when the update occurs.

9.1 Checking Database Disk Module Status

When you install LIC, the SP tries to copy it to reserved areas outside operating system control on the first three disk modules in the DPE, which are 0:0, 0:1, and 0:2. These are called the *database disks*. Having multiple copies of the code offers higher availability if a disk module fails.

When you install LIC, at least two of the database disk modules must be fully powered up and not faulted (online); ideally, all should be online. To check the status of the database disk modules, use

```
ssmcli -d sc2d010 getdisk 0_0 -state
ssmcli -d sc2d010 getdisk 0_1 -state
ssmcli -d sc2d010 getdisk 0_2 -state
```

The state of at least two of the three database disk modules should be Ready, Enabled, or Unbound.

```
State: Ready
```

In the GUI, you can double-click on Enclosure 0 in the Components for Array window (choose Monitor from the Storage System Manager Array menu). Position the cursor over each database disk module and click for a status window. Figure 6-2 shows an example.

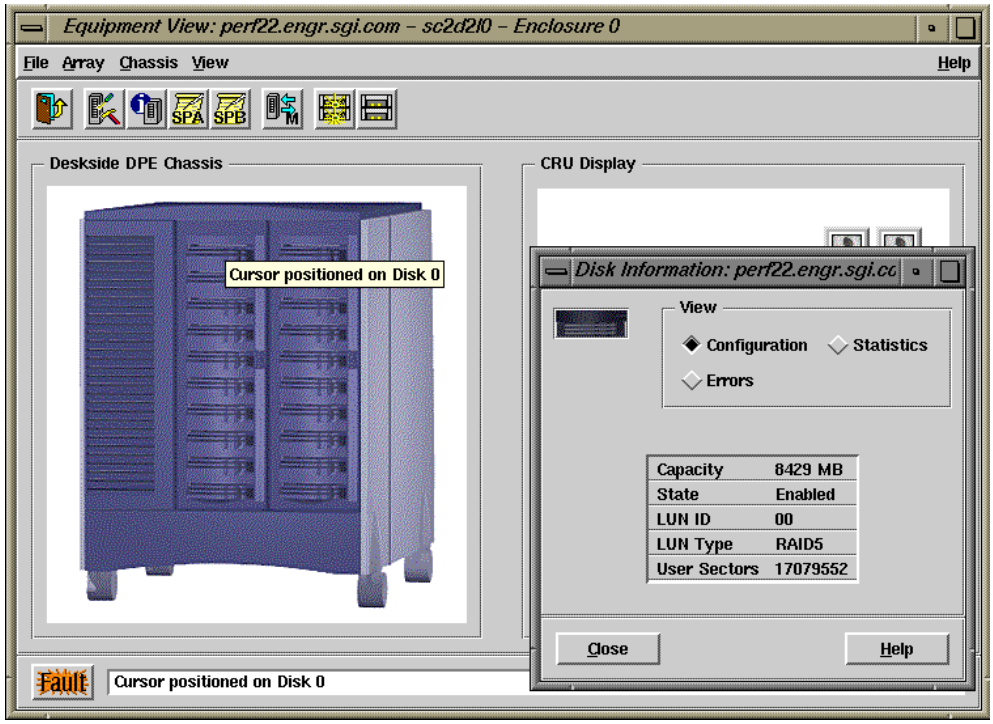


Figure 9-1 Checking Database Disk Module Status.

9.2 Upgrading the LIC

When you download new firmware, the PROM code is automatically upgraded as well. Follow these steps to upgrade the LIC (and PROM code):

1. Make sure all users are off the system. Unmount any filesystems or partitions on the array.

   Caution: Upgrading the firmware requires rebooting. The storage system is automatically rebooted after the code is downloaded to the SP(s).

2. Disable write caching using one of these methods:

   - In the CLI, enter

     `ssmcli -d` *deviceid* **`setcache -wc 0`**

   - In the RAID GUI's Storage System Manager window, double-click the icon of the array you are working on to open its Array Configuration window. In that window, choose Array > Write Cache State > Disable.

3. Load the CD containing the new LIC into the drive.

4. Install necessary patches.

5. Read the release notes on the CD for information on scripts for upgrading the LIC.

   To use the RAID CLI to upgrade the LIC (if applicable), enter

   `ssmcli -d` *deviceid* **`firmware`** *pathname* **`-r`**

   Caution: The **-r** option in this command reboots the storage system.

   To use the RAID GUI to upgrade the LIC (if applicable), follow these steps:

   - In the Array Configuration window, choose Firmware Download... in the Array menu. The Firmware Download window appears, as shown in Figure 9-2.

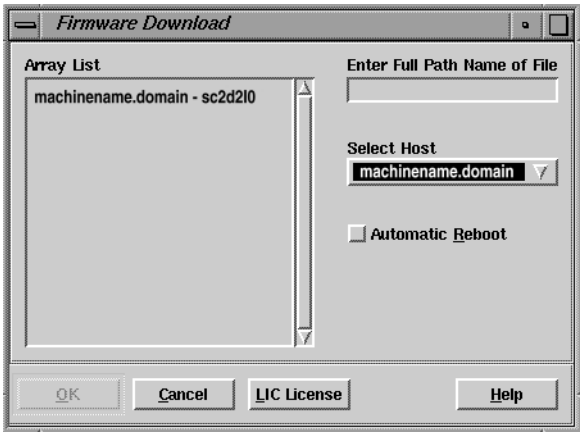


Figure 9-2 Firmware Download Window

   - In the array list, select the array whose LIC you want to update.
   - In the Enter Full Path Name of File field, enter the complete path of the file containing the revision of the LIC you want to download.
   - In the Select Host field, click the field list button and select the hostname from the list that opens.
   - If the customer wants automatic reboot, click the Automatic Reboot check box. (Figure 9-2 shows it disabled.)

     Caution: Rebooting restarts the SPs in the array, which terminates all outstanding I/O to it. If you enable automatic reboot, do not complete this procedure until you have unmounted any filesystems or partitions on the array.

6. Click *OK*.
7. In the confirmation window that appears, click *Yes* to start downloading the LIC to the selected arrays.

   Note: If the system has only one good database disk module, an error message indicating a check condition appears when you update the flare code.

8. Re-enable write caching:

   - In the RAID CLI, enter

     `ssmcli -d` *deviceid* **`setcache -wc 1`**

   - In the RAID GUI's Storage System Manager window, double-click the icon for the array you are working on to open its Array Configuration window. In that window, choose Array > Write Cache State > Enable.

   Note: Cache is automatically re-enabled as long as write memory is set to a value other than zero.

9.3 Testing the Upgrade

To check whether the revision level is correct, enter

```
/usr/ssm/bin/ssmcli getagent | egrep "Node|Revision|Prom" | paste -d"  -
-
```

Note that this command ends with two sets of double quotation marks followed by three dashes (minus signs).

In the output of this command, look for the entry after `Revision:`, which should show a FLARE code number greater than 2.02.08. In the example below, it is `2.03.09`.

```
Node: sc3d8l0 Revision: 2.03.09 Prom Rev: 4.15.00
Node: sc5d7l0 Revision: 2.03.09 Prom Rev: 4.15.00
Node: sc2d2l0 Revision: 2.03.09 Prom Rev: 4.15.00
Node: sc4d0l0 Revision: 2.03.09 Prom Rev: 4.15.00
Node: sc3d9l0 Revision: 2.03.09 Prom Rev: 4.15.00
Node: sc5d10l0 Revision: 2.03.09 Prom Rev: 4.15.00
```

The SP and PROM revision levels you see might not match those in this example.

Note: If the database drive that has the original code fails, replace the failed disk module to complete the upgrade process.

Appendix A

Technical Specifications

This appendix contains the following sections:

- Section A.1, “Site Requirements for the Fibre Channel Products”
- Section A.2, “Technical Specifications for the FibreVault Enclosure”
- Section A.3, “Technical Specifications for the FibreVault Deskside (Tower)”
- Section A.4, “Technical Specifications for the Fibre Channel RAID Enclosure”
- Section A.5, “Technical Specifications for the Fibre Channel RAID Deskside Tower”
- Section A.6, “Technical Specifications for the Fibre Channel Rack”
- Section A.7, “Technical Specifications for the Standby Power Supply”
- Section A.8, “Cabling Interfaces”

A.1 Site Requirements for the Fibre Channel Products

Before installing the Fibre Channel Rack or deskside systems, make sure the site meets the power and thermal requirements. See Table A-1 through Table A-7 for detailed information. See Section A.8 for cabling interface information.

FibreVault Deskside tower systems have essentially the same power requirements and technical specifications as the FibreVault enclosures in a rack system. Use the technical information in Table A-1 and Table A-2 for all questions regarding the deskside FibreVault.

A.1.1 Fibre Channel Rack Floor-Loading Requirements

The fully loaded Fibre Channel Rack weighs approximately 1100 lbs (500 kg). Its weight is distributed within a relatively small footprint of 6 ft2 (0.56 m2), with a potential maximum floor loading of 183 lbs / ft2 (893 kg / m2). Some sites have floor loadings as low as 50 lbs / ft2 (244 kg / m2). Check that the flooring, especially raised flooring, can properly support the distribution of the rack's weight. Particular care must be given to installations with more than one Fibre Channel Rack placed close together.

A.1.2 Enclosure Power Requirements

To determine an enclosure's power requirements, always use the power rating that on the chassis label as the final authority. This rating is the maximum power required for a fully loaded enclosure.

The input current, power (VA), and dissipation per enclosure are based on the maximum capability of the power supplies and cooling system to provide internal regulated power. Typical values are less, depending on the number and manufacturer of disk drives. These values represent either the values for the line cord of an enclosure with a single power supply or the total values shared by the line cords of two power supplies in the same enclosure, with the division between the line cords and supplies at the current sharing ratio. A failure of one of the two power supplies in the enclosure results in the remaining supply and cord supporting the full load. The FC rackmount cabinet's AC power distribution can handle these values for the number of enclosures that you will interconnect. The site must also have main branch AC distribution that can handle these values.

A.1.3 Enclosure Thermal Requirements

The ambient temperature specification is measured at the enclosure's front door inlet. (See Table A-2 for specifications.) The site must have air conditioning of the correct size and placement to maintain the specified ambient temperature range. The air conditioning must be able to handle the Btu requirements of the enclosure(s).

A.2 Technical Specifications for the FibreVault Rackmount Enclosure

Table A-1 lists specifications for the FibreVault enclosure (DAE). Note that these specifications are virtually identical for the deskside (standalone) FibreVault enclosure.

Table A-1 FibreVault Enclosure (DAE) Technical Specifications

Classification	Specification	Value
AC and current	AC line voltage	100 to 240 VAC single phase (47 to 63 Hz)
	AC line current	4.0 amps maximum at 100 VAC (fully configured)
	Input power	392 watts maximum (305 watts average)
	Inrush current	50.0 amps maximum for 0.5 line cycles (per power supply)
	AC circuit breaker	8 amps (thermal)
	AC inlet type	IEC320-C14 appliance coupler
	Drive module power	25 watts per bay maximum (seeking)
Operating limits	Ambient temperatures	10˚C to 40˚C (50˚F to 104˚F) 40˚C (104˚F) at 2,438 m (8,000 ft) 37˚C (98.6˚F) at 3,050 m (10,000 ft)
	Temperature gradient	10˚C per hour (50˚F per hour)
	Relative humidity	20% to 80% noncondensing
	Heat dissipation	1411 x 10^3 J / hr (1,340 Btu / hr) maximum
	Elevation	2438 m (8000 feet at 40˚C, 3077 m (10,000 feet) at 37˚C
Nonoperating limits	Ambient temp	–40˚C to 65˚C (–40˚F to 149˚F)
	Temp gradient	24˚C / hr (43.2˚F / hr)
	Relative humidity	10% to 90% noncondensing
	Elevation	7,625 m (25,000 ft)
Dimensions	Height	15.4 cm (6.06 in.) 3.5 U (NEMA units)
	Width	44.5 cm (17.5 in.)
	Depth	63.27 cm (24.9 in.) front door to back of fan pack
Weight	Minimum weight	26.4 kg (58 lbs) without redundant components
	Maximum weight	35.5 kg (78 lbs) in high-availability configuration

A.3 Technical Specifications for the FibreVault Deskside (Tower)

Table A-2 lists specifications for the standalone deskside tower version of the FibreVault. All environmental operating parameters are the same as those for the rackmounted FibreVault (see Table A-1).

Height, weight, and dimensions are the primary differences between the two products. Most other specifications are the same.

Table A-2 Deskside FibreVault Enclosure Technical Specifications

Classification	Specification	Value
AC and current	AC line voltage	100 to 240 VAC single phase (47 to 63 Hz)
	AC circuit breaker	8 amps (thermal)
	Inrush current	50.0 amps maximum for 0.5 line cycles (per power supply)
	AC inlet type	IEC320-C14 appliance coupler (3 outlets)
Dimensions	Tower height	67.95 cm (26.75 in.)
	Tower width without anti-tip legs	26.67 cm (10.5 in.)
	Depth	74.7 cm (29.5 in) front door to back of unit
Weights	Maximum weight	60.0 kg (132 lbs) fully configured
	Minimum weight	50.1 kg (112 lbs) minimum configuration

A.4 Technical Specifications for the Fibre Channel RAID Enclosure

Table A-3 lists specifications for the Fibre Channel RAID enclosure, also known as the disk-array processor enclosure (DPE).

Table A-3 Fibre Channel RAID Enclosure (DPE) Technical Specifications

Classification	Specification	Value/Type
AC and current	AC line voltage	100 to 240 VAC single phase (47 to 63 Hz)
	AC line current	8.0 amps maximum at 100 volts
	Input power	700 watts maximum (560 watts average)
	Inrush current	50.0 amps maximum for 0.5 line cycle (per power supply)
	AC circuit breaker	12 amp (thermal) in each power supply
	AC inlet	IEC320-C14 appliance coupler
	Drive module power	25 watts per bay maximum
Operating limits	Ambient temperatures	10˚C to 40˚C (50˚F to 104˚F) 40˚C (104˚F) at 2,438 m (8,000 ft) 37˚C (98.6˚F) at 3,050 m (10,000 ft)
	Temperature gradient	10˚C per hour (50˚F per hour) maximum
	Relative humidity	20% to 80% noncondensing
	Heat dissipation	2520 x 10^3 J / hr (2390 Btu / hr) maximum
Nonoperating limits	Ambient temperature	–40˚C to 65˚C (–40˚F to 149˚F)
	Temperature gradient	24˚C / hr (43.2˚F / hr)
	Relative humidity	10% to 90% noncondensing
	Elevation	7,625 m (25,000 ft)
Dimensions	Height	28.59 cm (11.25 in.) 6.5U (NEMA units)
	Width	44.5 cm (17.5 in.)
	Depth	70.02 cm (27.57 in.) front door to drive fan pack
Weights	Minimum weight	41.4 kg (91 lbs)
	Maximum weight	52 kg (114 lbs)

A.5 Technical Specifications for the Fibre Channel RAID Deskside (Widebody)

The deskside fibre channel RAID widebody houses one Fibre Channel RAID (DPE) and one RAID expansion FibreVault (DAE). It may contain as few as five or as many as 20 fibre disk drives. All figures cited in Table A-4 are maximum estimates unless otherwise specified.

Table A-4 Fibre Channel RAID Deskside Tower Technical Specifications

Classification	Specification	Value/Type
AC and current	AC line voltage	100 to 240 VAC single phase (47 to 63 Hz)
	AC line current	8.0 amps maximum at 100 volts (fully configured)
	Input power	700 watts maximum (865 watts average)
	Inrush current	50.0 amps maximum for 0.5 line cycle (per power supply)
	AC circuit breaker	12 amps (thermal) in each DPE power supply; 15 amps (thermal) at AC inlet (PDU)
	AC inlet	IEC320-C14 appliance coupler
	Drive module power	25 watts per bay maximum
Operational limits	Ambient temperatures	10˚C to 40˚C (50˚F to 104˚F)
	Temperature gradient	10˚C per hour (50˚F per hour)
	Relative humidity	20% to 80% noncondensing
	Max operational ambient temperatures at higher elevations	40˚C (104˚F) at 2,438 m (8,000 ft) 37˚C (98.6˚F) at 3,050 m (10,000 ft)
	Heat dissipation	3,920 x 10^3 J / hr (3710 Btu / hr) maximum
Nonoperating limits	Ambient temperature	–40˚C to 65˚C (–40˚F to 149˚F)
	Temperature gradient	24˚C / hr (43.2˚F / hr)
	Relative humidity	10% to 90% noncondensing
	Elevation	7,625 m (25,000 ft)
Dimensions	Height	68 cm (26.8 in.)
	Width	52.1 cm (20.6 in.)
	Depth	74.7 cm (27.57 in.) front door to drive fan pack
	Min. service clearances	30.3 cm (1 ft.) front, 60.6 cm (2 ft.) rear
Weights	Minimum weight	76.5 kg (168.6 lbs) with all disks, LCCs, and power supplies removed
	Maximum weight	152 kg (335 lbs) maximum configuration

A.6 Technical Specifications for the Fibre Channel Rack

Table A-5 lists specifications for the Fibre Channel Rack.

Table A-5 Fibre Channel Rack Specifications

Classification	Specification	Value
AC power requirements	Cabinet voltage	200 VAC to 240 VAC, single-phase 47 Hz to 63 Hz
	Current draw per enclosure @ 200 VAC	2.3 amps per FibreVault or RAID expansion 4.1 amps per Fibre Channel RAID enclosure
	Maximum current per rack	24.6 amps maximum
	Power consumption at 200 VAC	225 watts per FibreVault or RAID expansion 390 watts per Fibre Channel RAID enclosure
Power connector	Type	North America: L6-30P International: IEC Plug 309 2-P
Operating limits	Ambient temperature	10˚C to 40˚C (50˚F to 104˚F) 40˚C (104˚F) at 2,438 m (8,000 ft) 37˚C (98.6˚F) at 3,050 m (10,000 ft)
	Relative humidity	20 to 80% noncondensing
	Heat dissipation	3,168 x 10^3 J / hr (3,000 Btu / hr) maximum per chassis assembly
	Maximum heat dissipation for rack	19008 x 10^3 J / hr (18,000 Btu / hr)
	Shock	3 g @ 11 ms
	Vibration	0.25 g peak @ 5 Hz to 500 Hz
Nonoperating limits (shipping and storing)	Ambient temperature	-40˚C to 65˚C (-40˚F to 149˚F)
	Temperature gradient	24˚C / hr (43.2˚F / hr) maximum
	Relative humidity	10% to 90% noncondensing
	Elevation	7,625 m (25,010 ft)
Physical	Cabinet dimensions	Height: 192 cm (75.3 in.)
		Width: 65 cm (25.5 in.)
		Depth: 87 cm (34.25 in.)
	Max weight (loaded)	About 500 kg (1,100 lb)
Service clearance	Front access	91.5 cm (36 in.)
	Rear and side access	76.2 cm (30 in.)
Buses	External host fibre bus	Fibre channel (up to 1 GBps transfer rate)

A.7 Technical Specifications for the Standby Power Supply

The optional standby power supply (SPS) installs in the Fibre Channel Rack or RAID deskside (widebody) system.

Table A-6 Standby Power Supply Technical Specifications

Classification	Specification	Value
AC power	AC line voltage	100 to 240 VAC single phase (47 to 63 Hz) auto-ranging
	Current draw	11 amps (maximum) sat 100 VAC (fully loaded)
	AC inlet type	IEC320-C14 appliance coupler
	AC outlet type	IEC320-C13 appliance coupler
Charge times	After power outage	30 minutes maximum
	After offline storage	12 hours maximum
Transfer time		16 milliseconds maximum
Operating limits	Ambient temperature	10˚C to 40˚C (50˚F to 104˚F) 40˚C (104˚F) at 2,439 m (8,000 ft)
	Relative humidity	20% to 80% noncondensing
Nonoperating limits (shipping / storing)	Ambient temperature	-40˚C to 65˚C (-40˚F to 149˚F)
	Temperature gradient	24˚C / hr (43.2˚F / hr) maximum
	Relative humidity	10% to 90% noncondensing
	Elevation	7,625 m (25,010 ft)
Dimensions	Height	4.02 cm (1.58 in.)
	Width	20.1 cm (8.25 in.)
	Length	69.9 cm (27.5 in)
Weight		10.9 kg (24 lbs)
	Minimum weight	36.0 kg (80 lbs) empty
Interface Cable	Type	Half-duplex (9-pin and RJ-11)
	Baud rate	9600
	Parity	None
Service clearance		81.3 cm (32 in.) at front and rear

Thirty minutes after power-on, and once a week thereafter at 1 am Sunday local time, the SPS performs a 10-minute no-load battery test. This test does not verify battery capacity, but does check connectivity and functionality.

The battery test is transparent to other components in the SPS and DPE. During the 10 minutes of the test, write caching is disabled, unless the DPE has a second functional SPS.

If a power cutoff occurs during the test, the test is terminated and the unit automatically goes to On-battery mode.

Each time a DPE powers on, the licensed internal code initiates a full power test. If the SPS battery is charging at the time of the weekly test, the test is deferred until the next scheduled time period.

A.8 Cabling Interfaces

Because the native interface for the FC-AL disk drives is copper, the Silicon Graphics fibre channel option uses a copper interface with a male DB9 connector.

To support longer distances and provide a fallback in case of grounding and EMI issues with copper, an optional fiber optic interface using a media interface adapter (MIA) is available.

Table A-7 summarizes characteristics for the copper twinax and fiber optic cables.

Table A-7 Fibre Channel Cable Characteristics

Characteristic	Copper Twinax	Fibre Optic
Variant	100-TW-EL-S full duplex (quad conductor)	62.5 µm Type: 780 nm
Range	25 meters maximum	300 meters maximum
Transmitter	PECL	100-M5-SL / N-I
Medium	150 ohm	0.002-0.5
Range	25 m	300 m
Connector	Male DB9	SC duplex connector
Maximum length	Enclosure to server: 25 m Enclosure-to-enclosure: 0.3 m or 0.5 m	Enclosure to server: 300 m. Fiber optic cables are not used for enclosure-to-enclosure connections

The optical interface (known as the media interface adapter, or MIA) uses a shortwave laser (CD-ROM laser) with a wavelength of 780 nm. Silicon Graphics supports optical cabling distances of 25 to 300 meters (between the host and the enclosure). This interface is used with 62.5 µm optical cable, and the distance is about 60% of a 50 µm cable. Silicon Graphics fibre products support a maximum distance of 300 meters.

The copper twinax cable is a fully shielded, full-duplex, balanced cable capable of supporting distances of 25 meters at the 1.0625 Gbaud transfer rate.

A copper cable connecting a fibre enclosure to the host system is either 3, 10, or 25 meters. Cables longer than 10 meters must be equalized.

Fibre enclosures are connected only by copper cables, which must be no longer than 10 m (0.3 or 0.5 meters is the Silicon Graphics standard). Fibre enclosure interconnections must maintain LCC consistency: One FC loop should interconnect all and only the LCC As, and the other FC loop should interconnect all and only LCC Bs.

The connectors for both ends of the twinax cable are male DB9 connectors that plug in at the host and the enclosure. The shield on each end of the cable connects directly to the connector shield, providing a DC ground on both ends. With a system and a fibre enclosure on separate building grounds, there is a potential for grounding problems when this cabling is connected with a copper cable utilizing a DC ground shield on both ends. In this case, use the optional fibre optical cabling to link the host and enclosure.

Appendix B

Error Recovery and Event Log Error Codes

This appendix is organized as follows:

- Section B.1, “Restarting the Agent”
- Section B.2, “Re-Establishing Communication With an Array”
- Section B.3, “Recovering From an Incorrect Bind”
- Section B.4, “Event Log Error Codes”

B.1 Restarting the Agent

You might have to restart the agent after any of the following events occur:

- changing an array so that communication between the front end and back end is affected; for example, attaching an array after the agent has been started
- restarting licensed internal code (LIC)
- partitioning RAID 3 memory
- modifying the */etc/config/ssmagent.config* file
- rebooting, unless you have configured the system to start the agent automatically

To determine whether restarting the agent is necessary, enter

`scsicontrol -i` *sc<controllerid>d<driveid>l<lunid>*

For example:

```
scsicontrol -i sc6d6l0
```

You do not need to restart the agent if you see output such as

```
sc2d0l0:  Disk          SGI     RAID 5          0130
ANSI vers 2, ISO ver: 0, ECMA ver: 0; supports:  synch linkedcmds
cmdqueing
```

You need to restart the agent if you see a message such as `No such device` or `Cannot open`.

To start *ssmagent*, enter

```
/etc/init.d/ssm stop
/etc/init.d/ssm start
```

Depending on the number of RAID arrays you administer, it takes the agent from 30 seconds to several minutes to finish launching and become ready to administer them.

B.2 Re-Establishing Communication With an Array

Communication with the array is lost if you have rebooted a server for which there are no LUNs bound, or if all three database disk modules are inadvertently removed at the same time. To re-establish communication with the array, follow these steps:

1. Obtain a serial cable: see Appendix B in the *Origin FibreVault and Fibre Channel RAID Administrator's Guide* for the pinout for the server you are using.
2. Connect the serial cable to a tty port on the server, such as tty2 (see the owner's guide for the server if necessary) and the serial port on the array.
3. In */etc/config/ssmagent.config*, comment out the line that specifies the device name and specify the tty port instead. For example:

   ```
   # # device specifications
   # *close* at the end is needed for low level (devscsi) support.

   #device sc2d2l0  Unit-spA "Unit 8"
   ttydevice tty2
   ```

4. Stop the agent; enter

   `/etc/init.d/ssm stop`

5. Restart the agent:

   `/etc/init.d/ssm start`

6. After you establish communication with the array, set up at least one LUN for the default SP.
7. In */etc/config/ssmagent.config*, remove the comment symbol from the line that specifies the device name and remove the line that specifies the tty port.

If the driver loses communication with the agent (for example, because of a broken cable connection between the host and the storage system, or if a host bus adapter is turned off), the driver on the host times out and logs off. To reinitialize the loop, enter

`scsiha -lp` *controllernumber*

For example:

```
scsiha -lp 2
```

B.3 Recovering From an Incorrect Bind

To stop a bind that is in progress, use the RAID CLI *rebootsp* subcommand: see the description of the *rebootSP* command in the *Origin FibreVault and Fibre Channel RAID Administrator's*. Alternatively, you can use the GUI or CLI to determine which drives are in the binding state and to remove all drives in the bind.

B.4 Event Log Error Codes

The SP unsolicited event log displays hexadecimal codes and brief messages. There are four series of codes:

- informational codes (600h series) that do not indicate an error condition and require no action, but can help in establishing history
- soft codes (800h series): most of these codes require no operator action unless they occur frequently
- error codes (900h series) that indicate a serious error condition
- fatal error codes (A00h series) that indicate a fatal error condition

For explanations of the error codes, see the product release notes. The release notes also contain information on the event log columns headed `Sense Key` and `Ext Code` (extended code).

For information on how to view the SP log, see the *Origin FibreVault and Fibre Channel RAID Administrator's Guide*:

- RAID GUI: "Displaying an SP Event Log" in Chapter 4
- RAID CLI: "getlog" in Chapter 6

Note: For configurations with multiple disk enclosures, you can cause the LEDs on specific disk modules to flash as an aid to locating them. In the Components window or Equipment View toolbar, use the second button from the right to start flashing the disk module LEDs. Use the button at the far right to stop LED flashing.

Appendix C

Measuring Templates for NEMA Units

This appendix consists of templates for measuring NEMA units in a Fibre Channel Rack in which you are installing a DPE, DAE, or mounting tray for SPSs. You can use the templates as shown in Figure C-1.

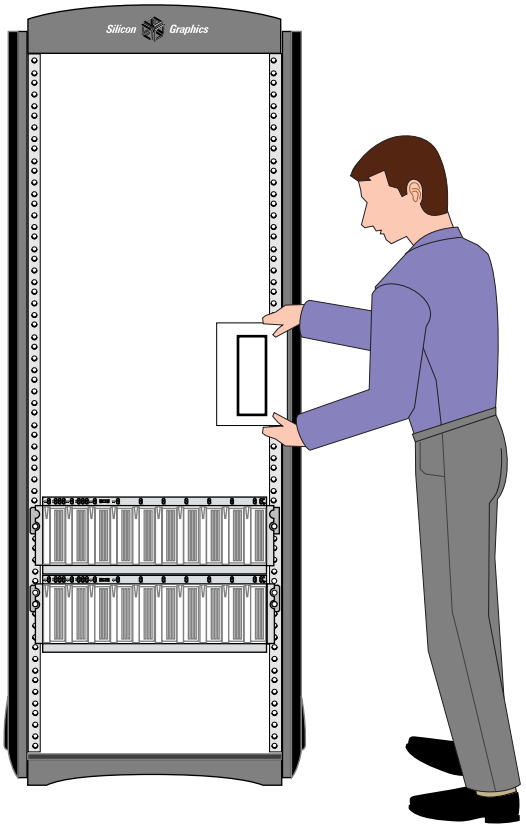
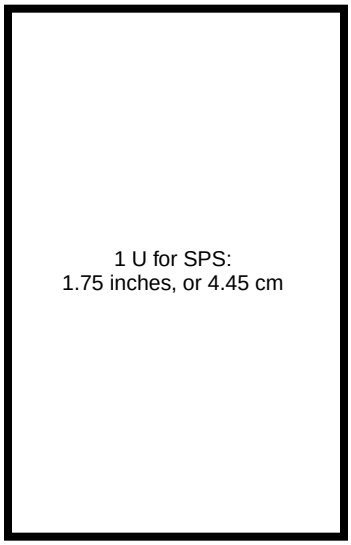
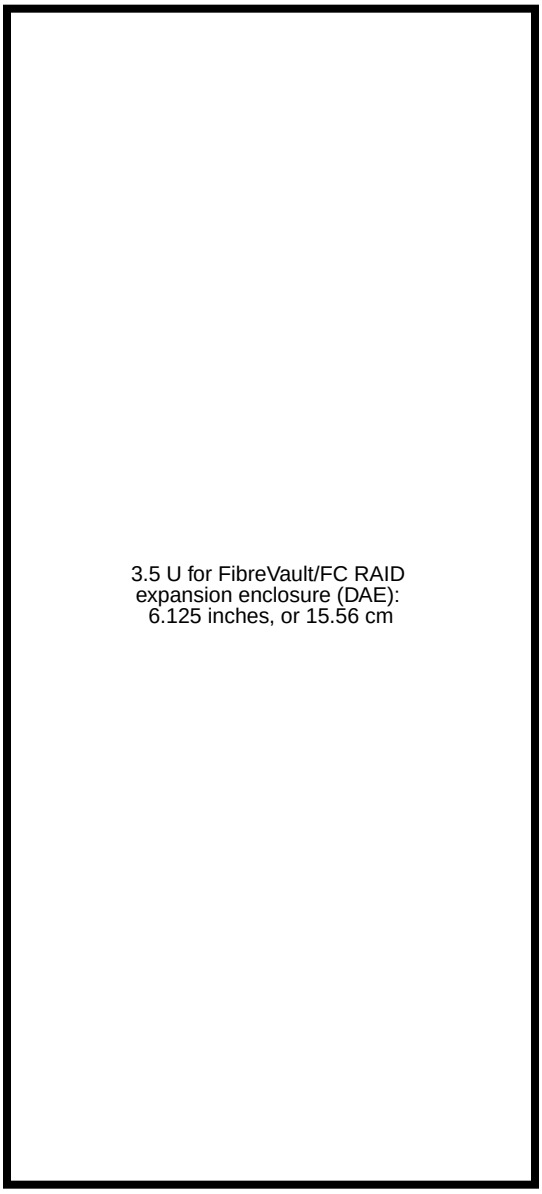
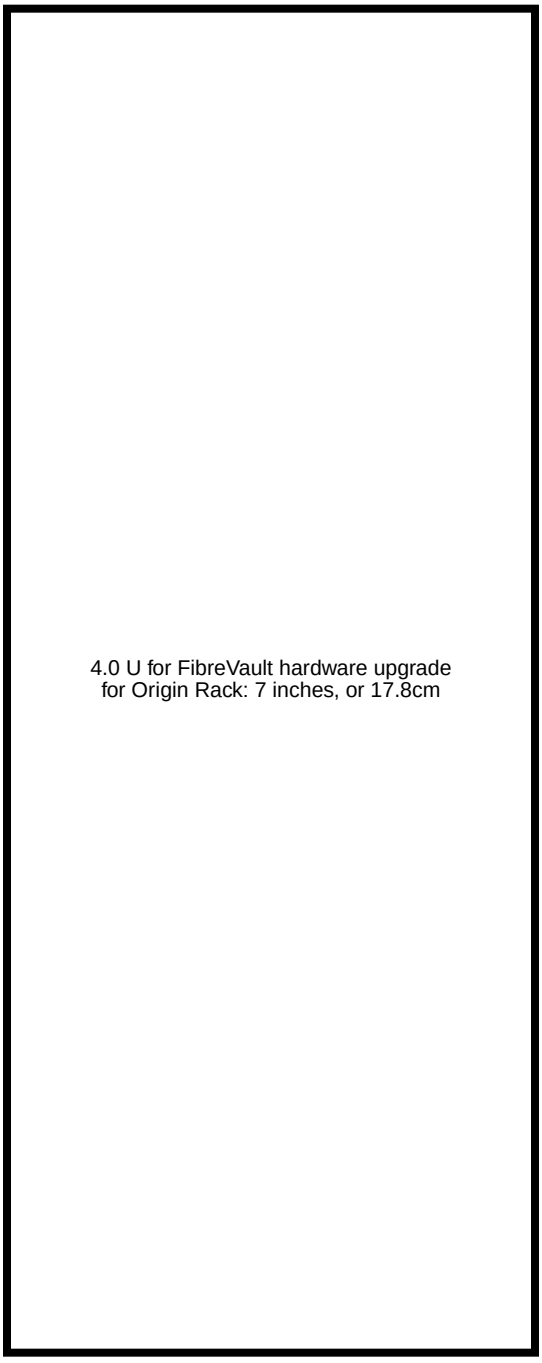


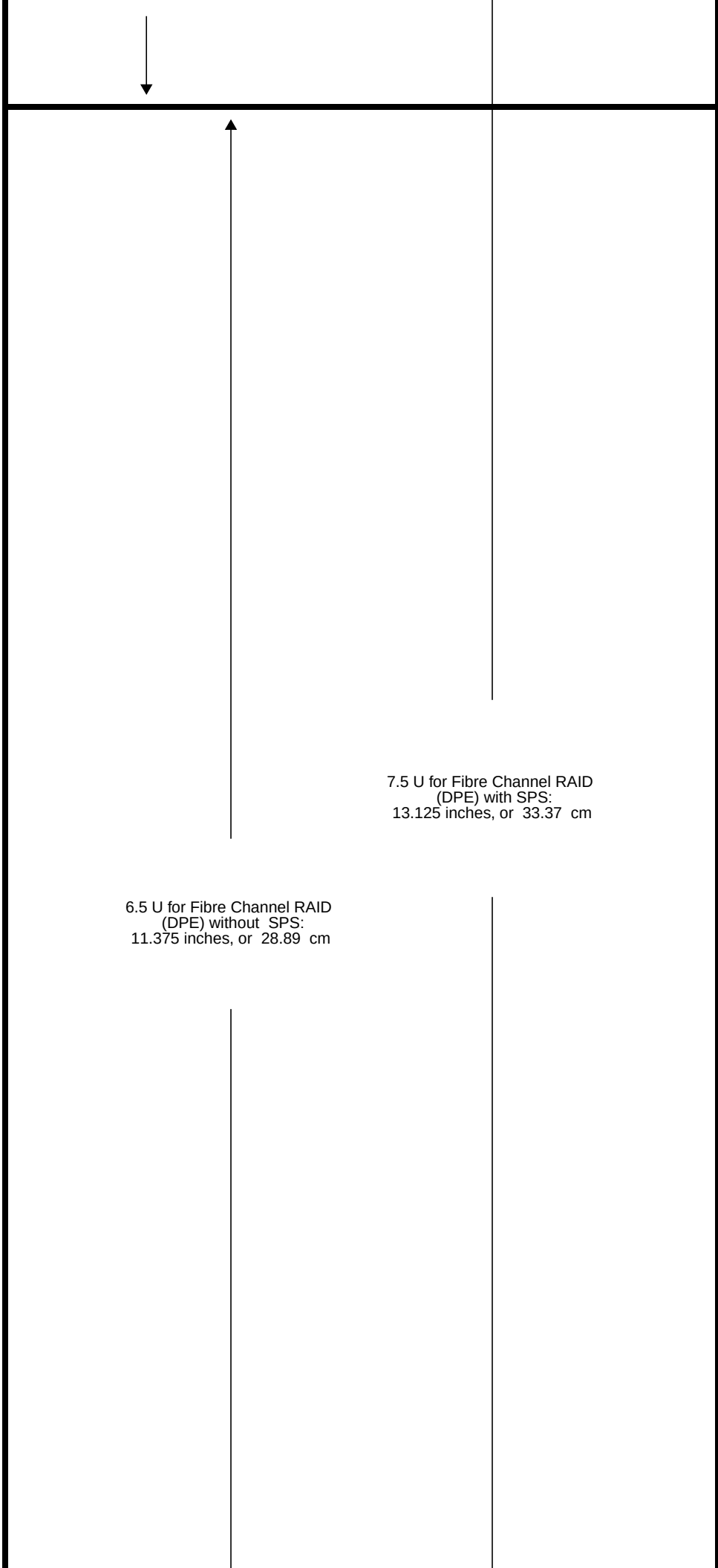
Figure C-1 NEMA Unit Template Use

Note: The last page of this appendix is extra wide to accommodate the 7.5U template for the Fibre Channel RAID (DPE) chassis (11.375 inches (28.29 cm). If you are printing this manual from a PostScript file, that page will probably not print correctly.


1 U for SPS:
1.75 inches, or 4.45 cm


3.5 U for FibreVault/FC RAID
expansion enclosure (DAE):
6.125 inches, or 15.56 cm


4.0 U for FibreVault hardware upgrade
for Origin Rack: 7 inches, or 17.8cm


7.5 U for Fibre Channel RAID
(DPE) with SPS:
13.125 inches, or 33.37 cm
6.5 U for Fibre Channel RAID
(DPE) without SPS:
11.375 inches, or 28.89 cm

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