

HP A3311A/12A/12AZ

High Availability Storage Systems

Installation/Service Manual



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About this Manual

This manual describes the installation, operation, and service of the HP A3311A deskside, A3312A field rackmount, and A3312AZ factory rackmount storage systems.

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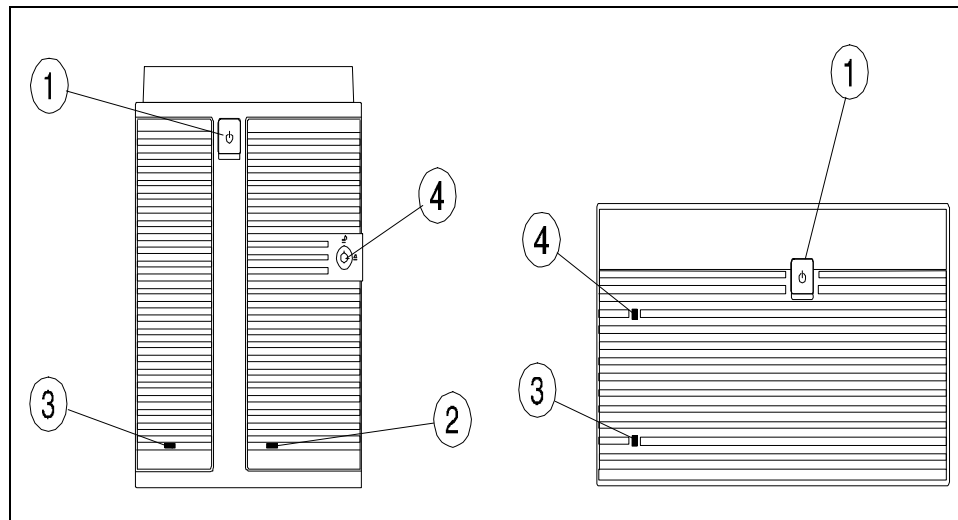
Chapter 1. Product Information

This chapter includes a product overview, base product information, and product features for rackmount and desktside storage systems.

Product Overview

The HP A3311A desktside, HP A3312A field rackmount, and HP A3312AZ factory rackmount high availability storage systems are scaleable mass storage systems optimized for high availability (see Figure 1). They are designed for use on the HP 9000 Series 700 and 800 with HP-UX, and the HP 3000 Series 900 with MPE-iX, Version 5.0/Express 3. These storage systems support single-ended (SE) disk modules, fast/wide differential (DF) disk modules and single-ended digital data storage (DDS) tape modules. Both single-ended and differential storage modules can reside within the same storage system on independent buses. The HP A3312A can be installed into a 1.1-meter, 1.6-meter, or 2.0-meter EIA cabinet.

Figure 1. Storage Systems, Front View



A3311A Desktside

A3312A/12AZ Rackmount

- 1 - Power Switch Cover
- 2 - Security Lock (A3311A Only)

- 3 - P1 Power Module Status Light
- 4 - P2 Power Module Status Light

Key Features

The key features of the storage systems are:

- Dual wide SCSI bus, either single-ended or fast/wide differential
- Two redundant fan modules (shipped standard)
- Two redundant power modules (one shipped, one optional)
- Up to eight 1-inch-high, or four 1.6-inch-high slots
- Optimized for high availability

High Availability

The storage systems are optimized for high availability with the following features:

- Dual SCSI bus
- Hot pluggable, front-accessible modules
- Redundant fan and power modules
- Can mirror disks in the same storage system
- Can be integrated with mirrored disks in an HP-UX environment with MC/LockManager and ServiceGuard
- Can be integrated with diagnostic tools to allow remote monitoring and troubleshooting.

SCSI Buses

The storage system contains two separate wide SCSI buses. One bus is connected to the slots in bay A and the other bus is connected to the slots in bay B. Each bus can be used independently, or can be connected together via an external SCSI cable to form one common bus. In a common bus configuration, four 1-inch disk modules can be installed in each bay for a maximum of eight devices per bus, or two 1.6-inch disk modules or DDS tape modules can be installed in each bay for a maximum of four devices per bus.

Modular Design

Each storage system contains the following modular components: fans, power supplies, disk drives, and DDS tape drives. Each component is housed in a plastic module. Each storage system contains two slots for fan modules, two slots for power modules, and eight 1-inch-high slots for disk modules or DDS tape modules. Each module is easily removed by pulling out a locking lever, is installed or removed from the front of the storage system, and can be used in any of the three storage system enclosures.

Fibre Channel (FC) SCSI Multiplexer (MUX) Connection

Fibre channel host connection is available through a Fibre Channel (FC) SCSI Multiplexer (MUX). Configurations of the FC are detailed in the HP 9000 Enterprise Servers Configuration Guide. For

information regarding the Fibre Channel technology, refer to the *Fibre Channel SCSI Multiplexer Service and User Manual*, part number A3308-90005.

NOTE! The term *hot pluggable* refers to modules that can be replaced while the host and storage system are operating, without disrupting their operation. Not all modules are hot pluggable, and some modules require the use of command line utilities before the module is removed, and after the module is replaced. The storage systems do not support installation of additional disk modules or DDS tape modules while the host and storage system are operating.

Fan Modules

The storage system is shipped with two fan modules, which provide redundant cooling. If one fan fails, the remaining fan will provide enough cooling capacity for the storage system. Fan modules are hot pluggable. Failed fan modules should be replaced as soon as possible.

Power Modules

The storage system is shipped with one power module. Two power modules provide redundant power for the storage system. If one power module fails, the storage system continues operating on one power module. If two power modules are used, both share the load. Power modules are hot pluggable.

Disk Modules

The storage system can contain any combination of 1-inch-high and 1.6-inch-high disk modules. A 1-inch disk module occupies one slot in the storage system, and a 1.6-inch disk module occupies two slots. The disk modules are available with either a single-ended (SE) or fast/wide differential (DF) SCSI interface. The disk module is enclosed in a plastic module, so SCSI address (ID) jumpers are not accessible. SCSI ID switches on the rear of the storage system are used to set the disk module SCSI ID.

DDS Tape Module

A 1.6-inch-high, single-ended DDS tape module can also be installed into the storage system. The DDS tape module occupies two slots. The DDS tape module is enclosed in a plastic module, so tape module jumpers and SCSI address (ID) jumpers are not accessible. SCSI ID switches on the rear of the storage system are used to set the DDS tape module SCSI ID.

Base Product Configuration

The storage system base product configuration includes the following:

- one storage system (A3311A/12A/12AZ)
- two security keys (deskside only - located inside storage system door)
- door lock (A3311A only)
- bumper feet (A3311A only - located inside storage system door)
- two fan modules
- one power module and power cord

Product Information
Storage System Modules

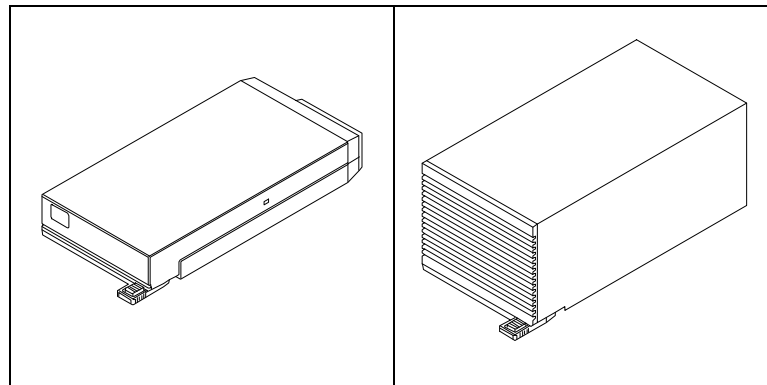
- SCSI bus label kit
- *HP A3311A/12A/12AZ High Availability Storage Systems Installation/Service Manual*

Storage System Modules

The following modules are supported in the storage systems (see Figure 2):

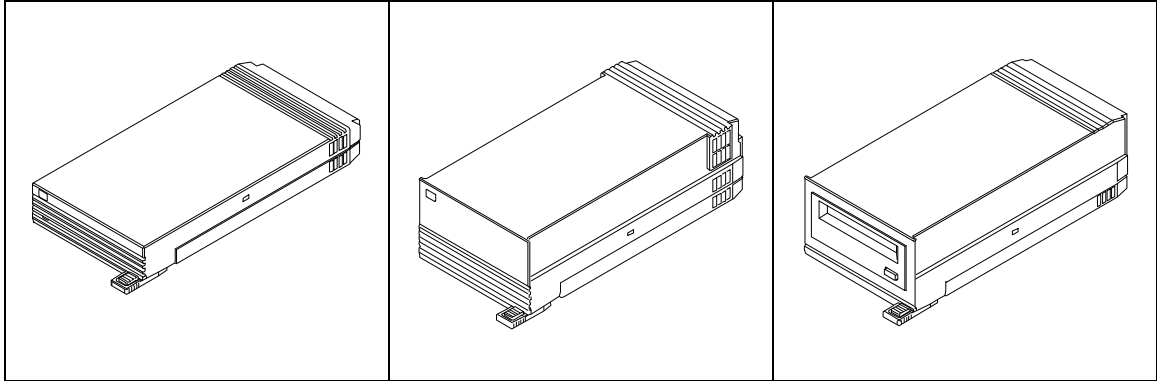
- fan module
- power module
- 1-inch disk module
- 1.6-inch disk module
- DDS tape module

Figure 2. Storage System Modules



Fan Module

Power Module



1-Inch Disk Module

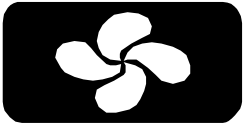

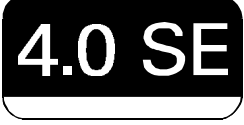

1.6-Inch Disk Module

DDS Tape Module

Module Icons

Icons are used to identify the disk, fan, and power modules. They are located in the upper left corner of the module (see Figure 3).

Figure 3. Module Icons

	<p>Fan Module Blue icon on black background</p>
	<p>Power Module Red icon on black background</p>
	<p>Disk Module, 4.0-Gigabyte, Single-Ended (SE) Yellow icon on black background Yellow color bar on bottom</p>
	<p>Disk Module, 4.0-Gigabyte, Differential (DF) Purple icon on black background Purple color bar on bottom</p>

Chapter 2. Installation & Configuration

CAUTION! The A3312A storage system should only be installed by an HP service representative. See “Installing the A3312A into an EIA Cabinet”.

This chapter tells how to install and configure the desktside and rackmount storage systems. It includes information on:

- installing the storage system
- installing additional storage modules
- setting SCSI ID switches
- connecting SCSI cabling
- applying SCSI bus labels
- connecting power cords
- powering-on the storage system

The term *hot pluggable*, refers to storage modules that can be replaced while the host is operating. Not all modules are hot pluggable, and some modules require the use of command line utilities before the module is removed, and after the module is replaced. Table 1 shows the HP systems that support hot pluggable modules.

You cannot install additional disk modules or DDS tape modules while the host and storage system are operating. When installing a new storage system, you must shut down the host *before* you connect power to and power-on the storage system.

Table 1. HP System Support of Hot Pluggable Modules*

Module Type	HP 3000 Series 900 MPE-iX, Version 5 with Express 3	HP 9000 Series 700, C-Series and J-Series	HP 9000 Series 800 with Strict Mirroring
Fan	Yes	Yes	Yes
Power	Yes	Yes	Yes
DDS Tape	No	No	No
SE Disk	No	No	No
DF Disk	Yes	No	Yes

*Yes = Hot Pluggable; No = Not Hot Pluggable

Installation Overview

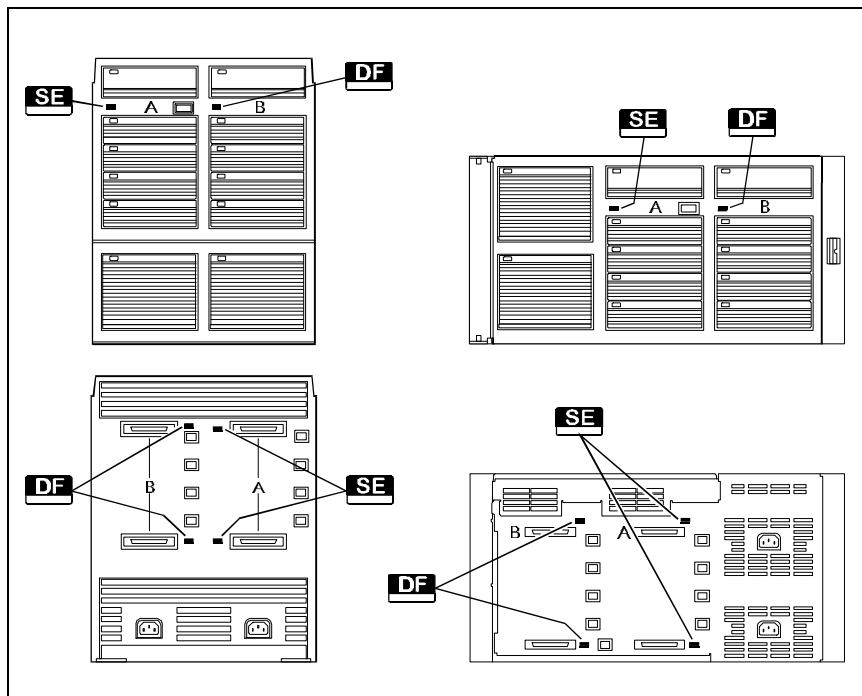
CAUTION! Shut down the host before connecting and powering-on the storage system.

1. Place the storage system close to an ac power outlet. Leave some space behind the storage system, so you can set SCSI IDs and attach SCSI cables.
2. **A3311A Only:** Open the door by grasping the security lock tab and pulling the door toward you. Remove the keys and bumper feet behind the door and install the bumper feet under the storage system.
A3312A Only: Install the A3312A storage system into an EIA cabinet (see Appendix A).
3. Re-seat all factory-installed storage modules.
4. Apply SCSI bus labels to the storage system bays.
5. Install additional storage modules into the storage system.
6. Set the SCSI ID switches for the storage modules.
7. Shut down and power-off the host.
8. Connect the SCSI cables and terminators.
9. Apply SCSI bus labels to the SCSI cables.
10. Power-on your computer, then power-on the storage system. If your boot device is located in the storage system, *you may need to reboot your computer.*
11. Perform an `ioscan` to see if the host will recognize any newly installed disk or tape modules.

Applying Bay Labels

A SCSI bus label kit is included with the storage system, which enables you to identify the type of SCSI bus associated with each bay (A or B). Apply the bay labels on the front and rear of the storage system. Figure 4 shows how to differentiate bay A for single-ended devices and bay B for differential devices. This is just an example of one configuration for the storage system. Your storage system may have two single-ended buses, two differential buses, or a different bus for each bay.

Figure 4. Applying Bay Labels



Installing Additional Modules

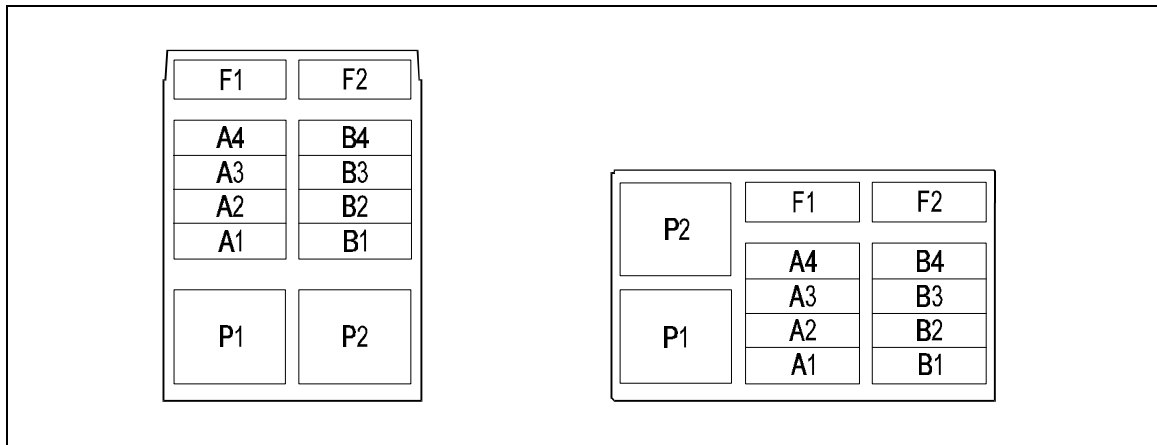
CAUTION! Do not touch the rear connector on a module. The module is susceptible to electrostatic discharge (ESD) and damage to components may occur.

CAUTION! Do not install a single-ended (SE) module into a differential (DF) bus or a DF module into an SE bus. The SCSI bus will hang and damage to the host bus adapter (HBA) may occur.

NOTE! You should install storage modules in the order from bottom to top and from left to right.

The storage system is shipped with two fan modules and one power module. An additional power module, disk modules, and DDS tape modules can be installed. Figure 5 shows the storage systems with their 1-inch slot reference designators. 1-inch disk modules can use any of the 1-inch slots in bay A (A1 through A4) and bay B (B1 through B4). 1.6-inch disk modules and DDS tape modules use two 1-inch slots. 1-inch and 1.6-inch modules can be installed in a storage system in any combination of slots in bay A and bay B.

Figure 5. Storage Module Slots



- F1, F2:** Fan module slots (numbers not embossed on storage system).
- A3, A4, B3, B4:** Upper 1-inch module slots. Disk modules use delayed spin-up in order of SCSI ID. 1-inch disk modules use SCSI ID switches A3, A4, B3, B4.
- A1, A2, B1, B2:** Lower 1-inch module slots. Valid boot device slots. Disk modules spin-up simultaneously. 1-inch disk modules use SCSI ID switches A1, A2, B1, B2.
- P1, P2:** Power module slots (numbers not embossed on storage system).

Installing a Fan Module

NOTE! The storage system is shipped with two fan modules. See Chapter 4 for information on replacing a fan module.

Installing a Power Module

The storage system is shipped with one power module.

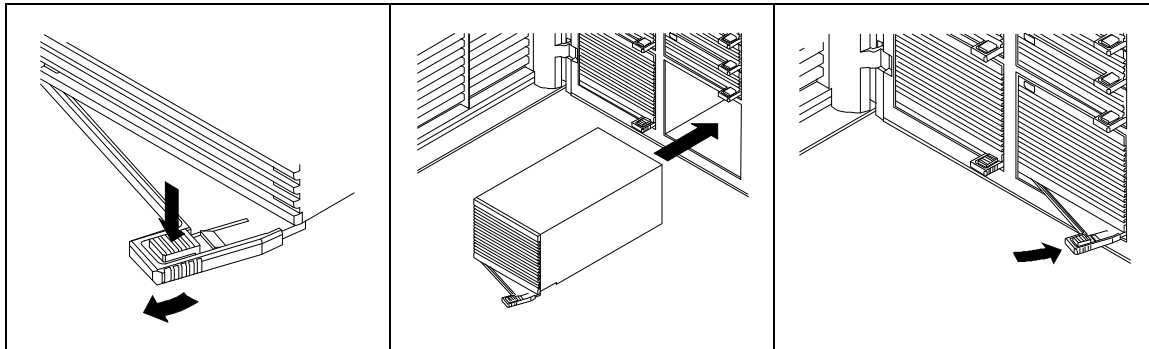
To install a second power module for redundancy:

1. Pull out the module lever (see Figure 6).

CAUTION! Pull the module lever all the way out, or the module will jam in the slot.

2. Install the power module into slot P2.
3. Push in the module lever until it clicks to lock the module in place.

Figure 6. Installing a Power Module



Installing a Disk Module

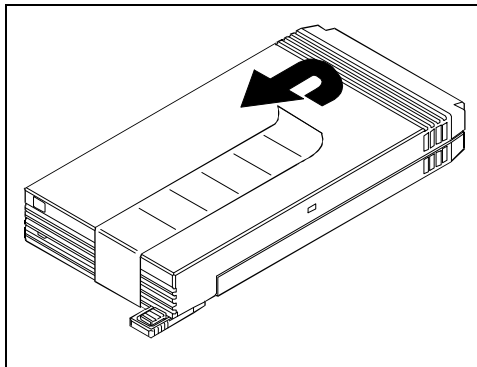
CAUTION! The disk modules located in slots A1, A2, B1, and B2 will power-on first, so a boot device should only be installed in one of those slots.

NOTE! Replacement of a disk module is not the same as installing additional capacity in an operating storage system! To add capacity, follow the steps below. To replace a disk module, see Chapter 4.

To install a disk module:

1. Shut down the host and power-off the storage system.
2. Read and remove the module “Attention” label (see Figure 7).

Figure 7. Removing the Attention Label

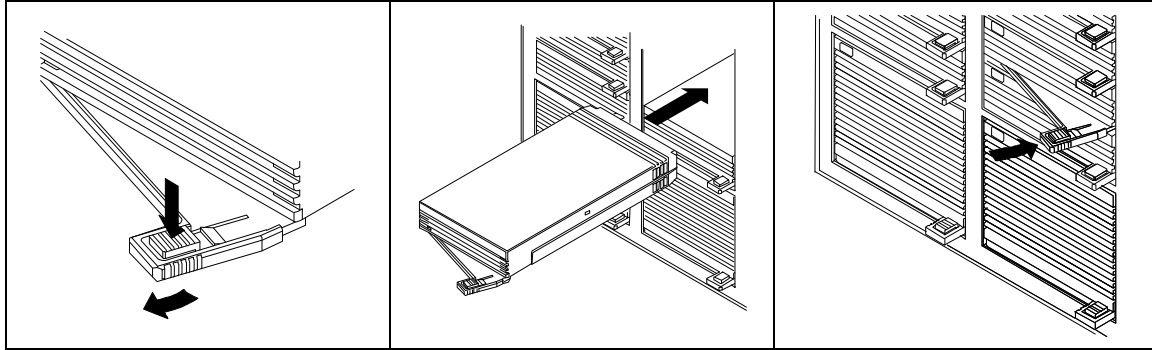


3. Pull out the module lever (see Figure 8).

CAUTION! Pull the module lever all the way out, or the module will jam in the slot.

4. Install the disk module into the storage system.
5. Push in the module lever until it clicks to lock the module in place.

Figure 8. Installing a Disk Module



Installing a DDS Tape Module

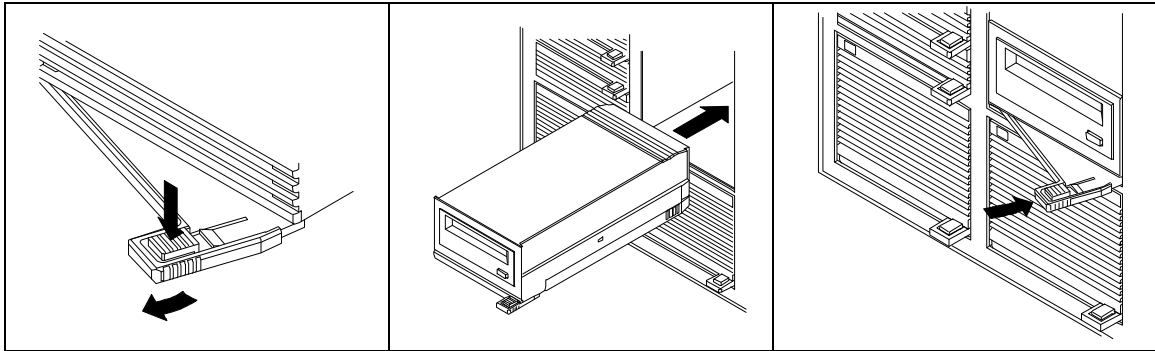
To install DDS tape module:

1. Shut down the host and power-off the storage system.
2. Read and remove the module “Attention” label (see Figure 7).
3. Pull out the module lever (See Figure 9).

CAUTION! Pull the module lever all the way out, or the module will jam in the slot.

4. Install the DDS tape module in a single-ended (SE) slot.
5. Push in the module lever until it clicks to lock the module in place.

Figure 9. Installing a DDS Tape Module



Setting SCSI ID Switches

CAUTION! Do not set SCSI ID switches A3, A4, B3, or B4 to ID 0. If their IDs are set to 0, an over-current condition will occur during the power-on sequence and the power module will shut down.

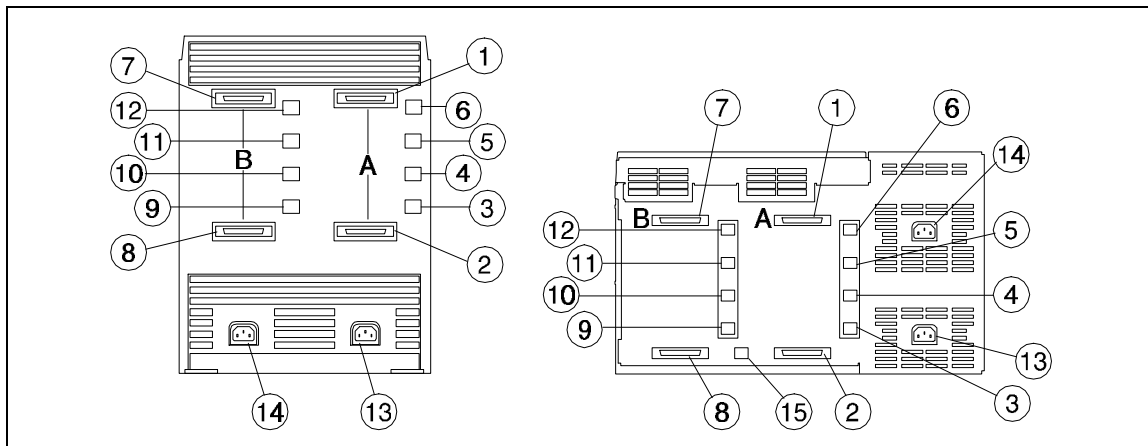
CAUTION! All storage modules and host bus adapters (HBAs) must have unique SCSI IDs. If two or more devices have the same SCSI ID on the SCSI bus, the host will not recognize those devices.

NOTE! SCSI ID 7 is normally reserved for the host bus adapter (HBA). SCSI IDs 8 through 15 are used only by fast/wide differential (DF) modules.

To set SCSI ID switches for the disk and tape modules:

1. Perform an `ioscan` (HP-UX) or `sysgen` (MPE-iX) to determine which SCSI IDs are already in use.
2. Locate the SCSI ID switch for the device (see Figure 10, items 3 through 6 and 9 through 12).
3. Set the SCSI ID switch to an ID number not in use by another device (see Figure 11 and Figure 12):
 - When setting SCSI IDs for 1-inch modules, use the SCSI ID switch that corresponds to the slot number occupied by the module. For example, if a disk module occupies slot A4, use SCSI ID switch A4.
 - When setting SCSI IDs for 1.6-inch modules, use the SCSI ID switch that corresponds to the lowest slot occupied by the module. For example, if a DDS tape module occupies slots A1 and A2, use SCSI ID switch A1.

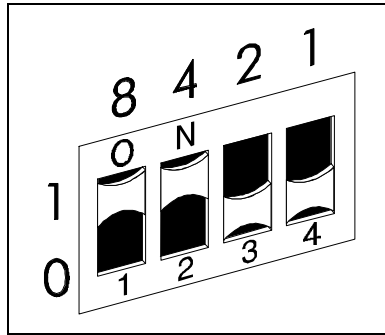
Figure 10. Storage Systems, Rear View



- | | |
|---|---|
| 1 - Bus A Upper SCSI Connector (68-pin) | 9 - SCSI ID Switch B1 |
| 2 - Bus A Lower SCSI Connector (68-pin) | 10 - SCSI ID Switch B2 |
| 3 - SCSI ID Switch A1 | 11 - SCSI ID Switch B3 |
| 4 - SCSI ID Switch A2 | 12 - SCSI ID Switch B4 |
| 5 - SCSI ID Switch A3 | 13 - P1 AC Power Connector |
| 6 - SCSI ID Switch A4 | 14 - P2 AC Power Connector |
| 7 - Bus B Upper SCSI Connector (68-pin) | 15 - SCSI Bus Reset Switch (Factory Set Only) |
| 8 - Bus B Lower SCSI Connector (68-pin) | |

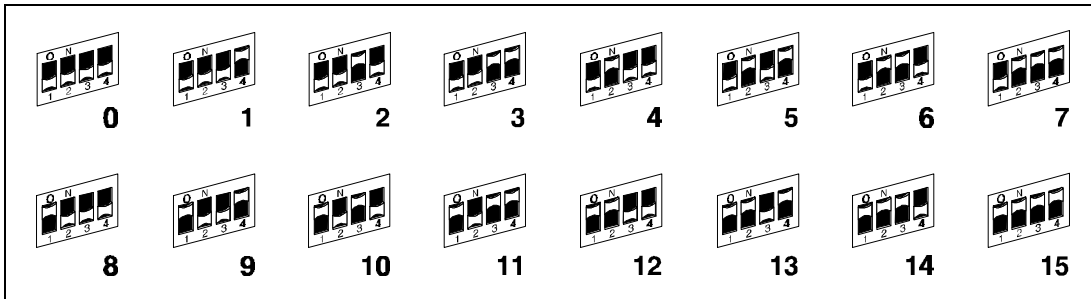
CAUTION! Changing default factory settings on the SCSI bus reset switch may cause operating system conflicts for the host. Therefore, the SCSI bus reset switch is covered with a label that states "Factory Set Only".

Figure 11. SCSI ID Switch Labels



8421 = SCSI ID bits (LSB=1)
1 = ON (Slide switch up to enable bit)
0 = OFF (Slide switch down to disable bit)

Figure 12. SCSI ID Switch Settings



Connecting SCSI Cables and Terminators

CAUTION! Before connecting SCSI cabling, shut down the host, power-off the host, then power-off the storage system.

CAUTION! If your host has an HP 28696A adapter, you must have current firmware, or the differential (DF) disk modules will not be hot pluggable. Contact your HP service representative to get the current version.

NOTE!

To optimize SCSI bus performance:

- The cable between bus A and bus B must be 0.9 meters in length minimum.
 - The cable between two A33xxAx storage systems must be 2.5 meters in length minimum.
-

The storage system contains two separate internal SCSI buses: bus A and bus B (see Figure 10). These buses are isolated, so two different SCSI interfaces can be supported in the same storage system. Bus A supports four devices in bay A (slots A1 through A4). Bus B supports four devices in bay B (slots B1 through B4). When a single bus is required, a 0.9-meter SCSI cable can be used to connect bus A and bus B, forming one bus that supports eight devices.

A SCSI bus consists of the following components. All of these components must be of the same type, single-ended (SE) or fast/wide differential (DF):

- a host bus adapter (HBA) card
- devices on the bus
- SCSI cabling
- a SCSI terminator (SF or DF)

Table 2 shows the SCSI bus requirements for the storage system.

Table 2. SCSI Bus Requirements

Interface Type ¹	SCSI Cabling Total Length ²	Number of Devices ³	SCSI Terminator ⁴
SE	6 m	HBA + 7	SE (Active)
DF	25 m	HBA + 15	DF (Passive)

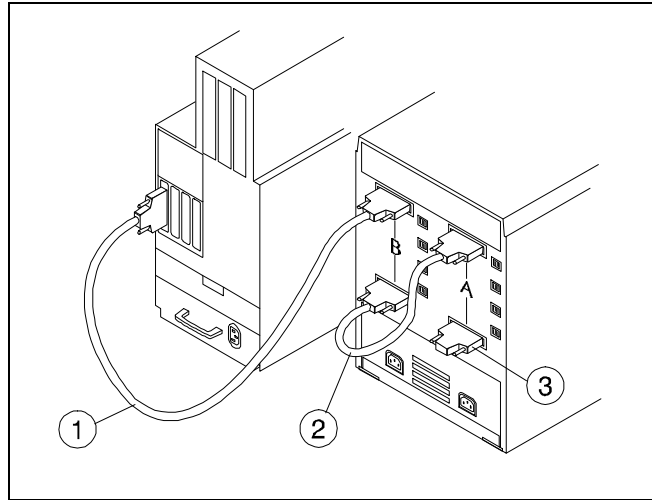
Notes:

- SE = single-ended narrow; DF = fast/wide differential.
- The total length of SCSI cabling is equal to the equivalent internal cable length (0.9 meter per internal bus, or 1.0 meter per storage system) plus the external cable length. To connect internal buses A and B, a bus interconnect cable is required.
- Depending on the type of interface used, you may not be able to fully load the storage system with 1-inch storage modules. For example, on a single-ended bus, you must leave one slot empty, since only seven devices are supported in addition to the HBA. If two storage systems are connected on a differential bus, eight slots can be filled in the first storage system and seven more slots can be filled in the second storage system.
- Each end of the SCSI bus must be terminated. The HBA card is one end of the bus. It includes its own termination and also provides termination power. The other end of the bus is one of the SCSI connectors on the rear panel of the storage system. Depending on the configuration, a 68-pin high density SCSI terminator must be connected to one or both of these connectors. Refer to your host system documentation for exact terminator specifications.

Connect SCSI cables (see Figure 13 through Figure 15) and SCSI terminators (see Figure 16) to the storage system in one of the following configurations:

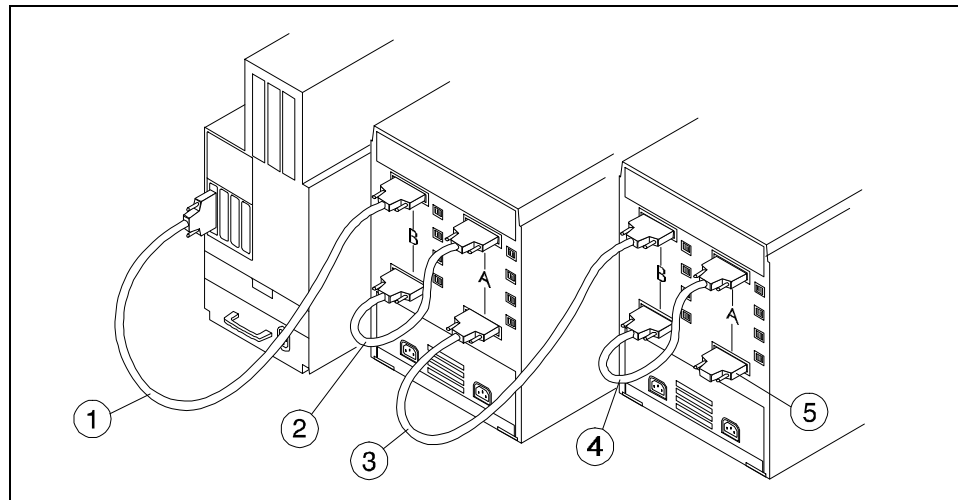
- **Single Bus:** Bus B is connected to one host bus adapter (HBA), bus B and bus A are interconnected, and bus A is terminated with a SCSI terminator (see Figure 13). Two storage systems can be connected together on a common SCSI bus (see Figure 14).
- **Split Bus:** Bus A and bus B are connected to two separate HBAs, each terminated with a SCSI terminator (see Figure 15). Both buses can have the same SCSI interface or can have different SCSI interfaces.

Figure 13. One Storage System on a Single Bus



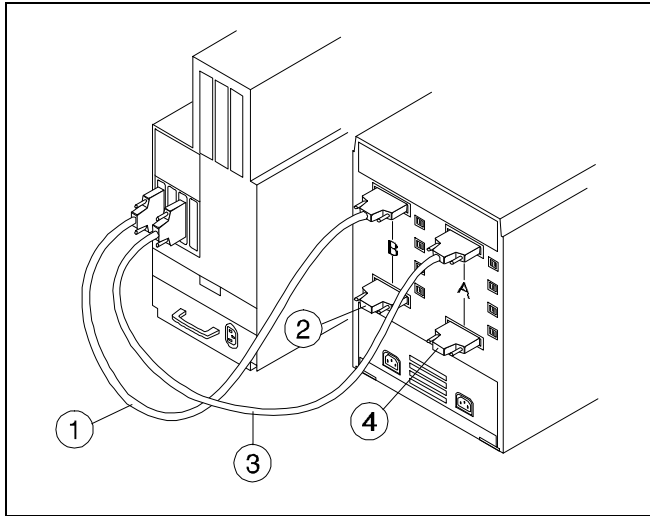
- 1 - HBA to Bus B (1 m)
- 2 - Bus B to Bus A (0.9 m)
- 3 - Bus A Terminator

Figure 14. Two Storage Systems on a Single Bus



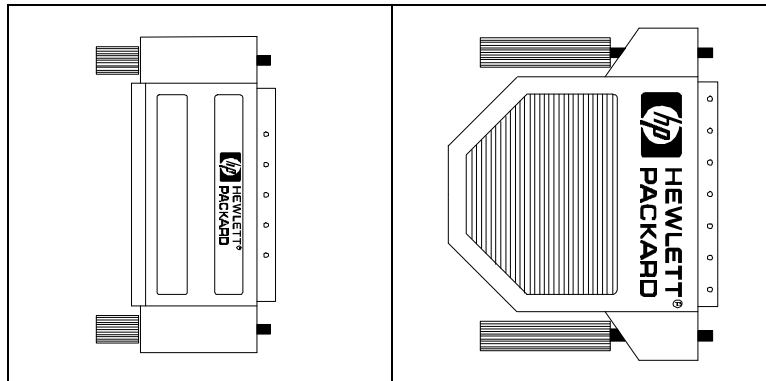
- 1 - HBA to Bus B1 (1 m)
- 2 - Bus B1 to Bus A1 (0.9 m)
- 3 - Bus A1 to Bus B2 (1 m)
- 4 - Bus B2 to Bus A2 (0.9 m)
- 5 - Bus A2 Terminator

Figure 15. One Storage System on Split Buses



- 1 - HBA1 to Bus B (1 m)
- 2 - Bus B Terminator
- 3 - HBA2 to Bus A (1 m)
- 4 - Bus A Terminator

Figure 16. SCSI Terminators



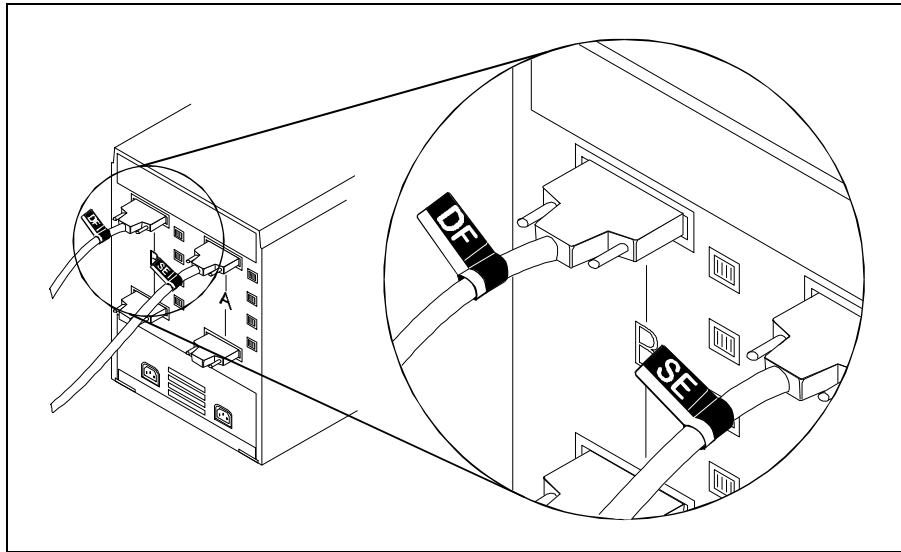
SE Terminator

DF Terminator

Applying SCSI Cable Labels

Apply the SCSI cable labels included in the SCSI bus label kit (see Figure 17).

Figure 17. Applying SCSI Cable Labels



Connecting Power Cords

WARNING! The storage system power cords are used as main disconnect devices. To ensure that the power cords can be disconnected quickly, locate the storage system near an easily accessible power outlet.

WARNING! To avoid a fire hazard, the ac branch service must be properly current-protected by either a fuse or a circuit breaker. Use only UL/CSA approved power cord, SVT type, rated for suitable voltage and current. These power cords have two conductors and a ground. Failure to use the proper power cord may result in a shock or fire hazard.

NOTE! A fully loaded storage system can run on one power module. If the storage system has two power modules for redundancy, we recommend that you plug the power cord for each power module into a separate uninterruptable power supply (UPS). This will allow the storage system to continue operating if one of the ac power sources fails.

To connect power cords:

Connect power cords to the P1 and P2 ac power connectors on the rear of the storage system (see Figure 10). In a redundant power module configuration, if one power module fails, the other power module will provide power for the entire storage system.

Powering-On the Storage System

CAUTION! The storage system should be powered-on first to allow access to all filesets during the boot process. The disk modules in the four upper slots have delayed spin-up, so if the boot process starts before all the disks are online, some of the filesets may not be mounted.

CAUTION! Do not operate the storage system if it has been exposed to temperature extremes. Damage to the disk and tape modules may occur if the storage system does not stabilize at room temperature for two hours before operation.

To power-on the storage system:

1. Lift the storage system power switch cover if the front door is closed.
2. Press in the storage system power switch to the power-on position.
3. **A3312A/12AZ Only:** Press the cabinet power switch to the power-on position (see Figure 58).
4. The storage system will perform the power-on sequence (see “Power-On Sequence”).

Power-On Sequence

1. The four lower storage modules power-on and begin simultaneous self-tests for approximately 20 seconds.
2. The four upper storage modules power-on and begin self-tests in the order of their SCSI IDs. The disk module status lights are green.
3. When the self-tests have completed, the disk module status lights and DDS tape module status lights will be off.

Powering-Off the Storage System

WARNING! When the power switch is in the standby position, the dc power output circuits within the power modules are off, but the ac power input circuits are still active.

To power-off the storage system:

1. Lift the power switch cover.
2. **A3312A/12AZ Only:** Press the cabinet power switch to the power-off “0” position (see Figure 58).
3. Press the storage system power switch then release the switch to the out (standby) position

Configuring the Host System

CAUTION! The computer system should be powered-on, then the storage system should be powered-on to allow access to all filesets during the boot process. The disk modules in the four upper slots have delayed spin-up, so if the boot process starts before all the disks are online, some of the filesets may not be mounted

1. Power-on your computer, then power-on the storage system. If your boot device is located in the storage system, *you may need to reboot your computer*. Refer to your system administration manual or owner's guide for information on how to power-on and configure the storage system (see "Documentation References").
2. Follow these tips on utility commands needed to configure different systems:

HP 3000 Series 900 Systems

Perform one of the following procedures:

- Run `SYSGEN` to configure the logical device and device type, then reboot the system.
- Run `ioconf` to configure logical devices. In this case, no reboot is necessary.

HP 9000 Series 700 Systems

To install the drivers, `regen` the operating system kernel. This activates the device drivers and the card drivers. Then reboot the system.

HP 9000 Series 800 Systems

To install the drivers, `regen` the operating system kernel. This activates the device drivers and the card drivers. Then reboot the system.

Documentation References

HP-UX Manuals

Reference manuals for Logical Volume Management (LVM):

- *How HP-UX Works: Concepts for the System Administrator*, part number B2355-90029.
- *System Administration Tasks*
- *Solving HP-UX Problems*

Installation & Configuration
Configuring the Host System

Reference manuals for System Administration Management Tool (SAM):

- *How HP-UX Works: Concepts for the System Administrator*
- *System Administration Tasks*
- *Solving HP-UX Problems*

Reference manuals for peripherals:

- *Installing Peripherals, HP 9000 Series 800 Computers*, part number B3108-90004.
- *Configure HP-UX for Peripherals for 10.01*, part number B2355-90053.

MPE-iX Manuals

Reference manuals for the HP 3000 Series 900 Computer:

- *Performing System Manager Tasks*, part number 32650-90040
- *Configuring Systems for Tapes, Printers and other Serial Devices*, part number 32022-61000
- *System Start-up, Configuration, and Shutdown Reference Manual*, part number 32650-90042
- *Mirrored Disk/iX User's Guide*, part number 30394-90003

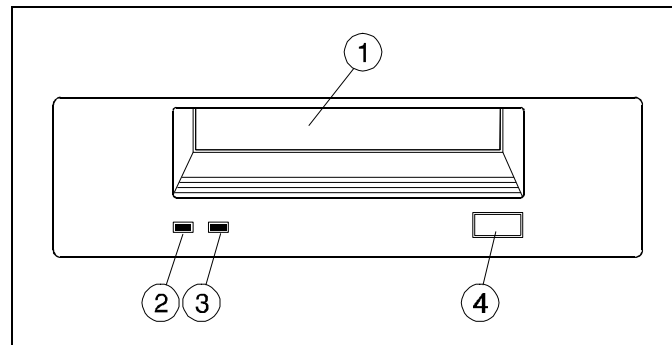
Chapter 3. DDS Tape Module

This chapter describes how to operate the digital data storage (DDS) tape module in the storage system.

DDS Tape Module Front Panel

Figure 18 shows the front panel of the DDS tape module.

Figure 18. DDS Tape Module Front Panel



1 - Cartridge Slot
2 - Tape Light

3 - Clean Light
4 - Cartridge Unload Button

Self-Test

When the storage system is powered-on, the DDS tape module performs a diagnostic self-test. During the self-test, the tape light flashes green. When the tape light goes off, the DDS tape module is ready to accept a DDS tape cartridge. If the clean light changes to steady amber, the self-test has failed and you should contact your HP service representative.

Status Lights

Table 3 lists the status light indications and actions for the tape light and clean light.

Tape Light

The tape light monitors the following tape parameters:

- tape loading or unloading
- tape loaded or unloaded
- self-test in progress
- read/write activity

Clean Light

The DDS tape module monitors the number of errors occurring during read and write operations. If the number of errors exceeds the error limit, the clean light flashes amber. This condition can be caused by a hard read or write error, dirty tape heads, or the tape nearing the end of its useful life.

If the clean light flashes amber:

1. Clean the tape heads.
2. Repeat the last operation and see if the clean light flashes again.
3. If the clean light flashes again, copy the data from the old tape onto a new tape then discard the old tape. The clean light is cleared after you load a cleaning cartridge, or when the DDS tape module is power cycled.
4. If the clean light flashes after cleaning the tape heads, you should service the DDS tape module.

Table 3. DDS Tape Module Status Light Indications

Tape Light	Clean Light	Indication/Recommended Action
Off	Off	No power or passed self-test.
Flashing Green (1 flash/second)	Off	Tape loading or unloading, or self-test in progress.
Flashing Green (2 flashes/second)	Off	Tape loaded and read/write activity.
Green	Off	Tape loaded. Ready.
Amber or Green	Flashing Amber (1 flash/second)	Tape heads are dirty. Copy the data to a new tape, discard the old tape, and clean the tape heads.
Amber or Green	Amber	Drive fault. Replace the DDS tape module.

Loading a DDS Tape Cartridge

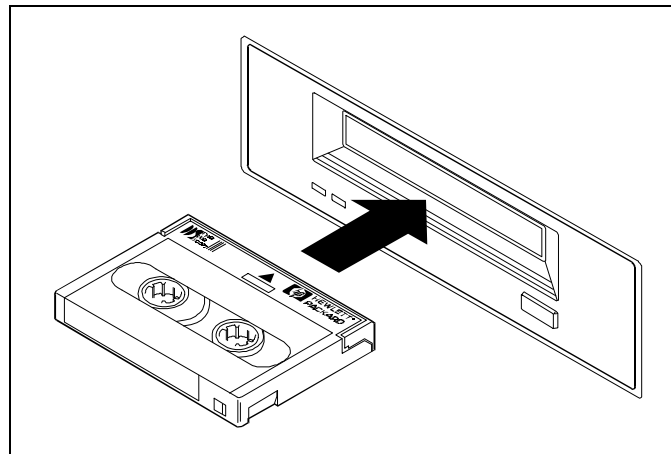
CAUTION! Only cartridges labeled "DDS" should be used in the DDS tape module. Do not use cartridges labeled "DAT". They will jam in the tape mechanism and damage to the mechanism will not be covered by the warranty. Also, only apply one label to a DDS tape cartridge to avoid jamming the tape mechanism.

NOTE! Do not try to force the DDS tape cartridge into the cartridge slot. If it does not load properly, the cartridge will be ejected after 10 seconds. You can then load the DDS tape cartridge again.

To load a DDS tape cartridge (see Figure 19):

1. Insert the DDS tape cartridge squarely into the cartridge slot in the direction of the embossed arrow on top of the cartridge.
2. Gently push the DDS tape cartridge into the cartridge slot until the autoloading mechanism takes the cartridge. The load sequence takes about 20 seconds. During the load sequence, the tape light flashes green. When the load sequence has completed, the tape light will turn steady green.

Figure 19. Loading a DDS Tape Cartridge



Unloading a DDS Tape Cartridge

To unload a DDS tape cartridge:

Press the cartridge unload button. This starts the unload sequence which winds the tape to the beginning, unthreads the tape, and ejects the cartridge. The unload sequence takes about 25 seconds for a write-enabled DDS tape cartridge and 10 seconds for a write-protected DDS tape cartridge. During the unload sequence, the tape light flashes green.

Forcing DDS Tape Cartridge Ejection

CAUTION! You may lose data if you force the ejection of a DDS tape cartridge. Also, the tape may not be formatted during a forced ejection because the end-of-data (EOD) area may not have been written on the tape.

If you press the cartridge unload button when the DDS tape module is busy, it may take some time to respond because it will finish the operation it is performing first. This ensures that the operation is terminated in a controlled manner and no data is lost. However, you may need to unload a DDS tape cartridge immediately, even if you risk losing data.

To force DDS tape cartridge ejection, perform one of the following:

- Press the cartridge unload button three times within a five-minute period.
- Hold the cartridge unload button down for at least five seconds.

Following either of these actions, a 35-second delay occurs, starting from the first time the cartridge unload button is pressed. Then, the tape is unthreaded, the cartridge is ejected, and the DDS tape module is reset as though the power had been cycled.

Write-Protecting a DDS Tape Cartridge

CAUTION! The tape log on a DDS tape cartridge contains a history of tape usage. If the DDS tape cartridge is write protected, the tape log will not be updated during its use and cannot indicate when the cartridge is nearing the end of its useful life.

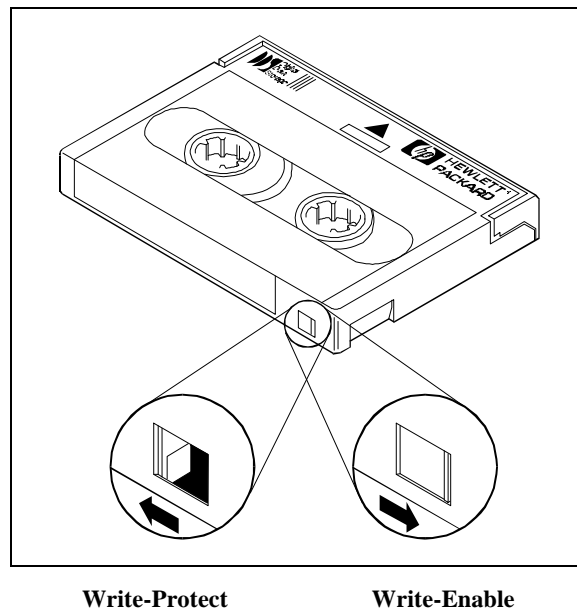
To write-protect the data on a DDS tape cartridge (see Figure 20):

Slide the write-protect tab to the left side.

To write-enable data on a DDS tape cartridge (see Figure 20):

Slide the write-protect tab to the right side.

Figure 20. Write-Protecting a DDS Tape Cartridge



Controlling Data Compression

The DDS tape module is shipped with the following default data compression parameters:

- Data compression is enabled at power-on.
- Host control of data compression is enabled after power-on.

After the DDS tape module is powered-on, the host can control data compression via device files on HP-UX and MPE operating systems.

Care of DDS Tape Cartridges

Handling DDS Tape Cartridges

The following precautions will ensure the data integrity and long life of DDS tape cartridges:

- Always store the cartridge in its protective case. Do not drop it or handle it roughly.
- Always keep the cartridge in a clean environment. Do not expose it to dirt, moisture, or high humidity.
- Operate the cartridge at temperatures between +5° and +45° C (41° to -104° F). After moving it from one temperature extreme to another, allow it to stabilize for at least two hours before using.
- Do not place the cartridge in direct sunlight or in places where magnetic fields are present (under telephones or near transformers).
- Do not place a label outside the recessed area on the cartridge. Doing so may cause interference with the tape loading mechanism. Write on the label before adhering the label to the cartridge. Always remove the old labels before adhering new ones.
- Do not touch the tape, or attempt to clean the tape path or tape guides inside the cartridge.
- Rewind the tape fully before removing the cartridge for storage.
- Do not use excessive force when inserting or removing the cartridge from the module.
- Use only data grade DDS tape cartridges, marked DDS-3, DDS-2, or DDS-1. Always label the cartridge and record the number of uses. Discard the cartridge after 100 uses.
- Do not use a cartridge beyond its useful life.

Storing DDS Tape Cartridges

DDS tape cartridges can be stored for a period of 10 years without loss of data. You should give each DDS tape cartridge in storage a full pass in the tape module at least once a year to prevent the tape media from sticking to itself. Store cartridges in a cool, dry environment.

Backup Routines

Your backup routine depends on how frequently the data changes, how extensive the changes are, and how valuable the data is. It is essential that you follow a routine, so data backup is regular and trouble-free. The following three models present routines which are commonly used. In each model, a "set" of DDS tape cartridges is the smallest number of cartridges that will hold a full or partial backup. Keep a record of the number of times each set is used, so a set can be replaced when its recommended write life (100 insertions) is reached. The replaced set can still be kept for read-only use, but should not be used for writing.

Model 1: Daily Backup

Number of cartridges needed: 1 set for full backup

This is the simplest backup model. All of your data is backed up onto a single set of cartridges at the end of each work day. If data is lost, it is simply restored from the previous day's backup. It is the least secure backup model because if the cartridge is lost, destroyed, or damaged, the data is lost forever.

Model 2: Weekly Rotation with Daily Backup

*Number of cartridges needed: 2 sets for full backup
4 sets for partial backup*

In this model, you perform a full backup every Friday, and a partial backup on Monday, Tuesday, Wednesday, and Thursday. Partial backups are made only on those files that have changed since the previous backup.

Two sets of cartridges, A and B, are used in rotation for the weekly full backups. On the first Friday, you make a full image copy of your disks on set A. On the second Friday, use set B for a full backup. On the third Friday, use set A again. This way, there are always two generations of full backup in existence. Store the sets off-site, preferably in a fire-proof safe.

Four sets of cartridges are used for the daily backups, one set for each day. Because only changed files are saved, these backups are very quick.

Model 3: Monthly and Weekly Rotation with Daily Backup

*Number of cartridges needed: 6 sets for full backup
4 sets for partial backup*

The backup model which offers optimum data protection uses six full backup sets (three monthly and three weekly), and four sets for daily partial backups. This model is recommended if you compile large quantities of data where loss would be disastrous. It also provides the best method of securing data from software viruses.

The four sets of cartridges for daily partial backup are labeled Monday, Tuesday, Wednesday, and Thursday, as in model 2.

Three sets of cartridges are used in rotation for a weekly full backup on Fridays. Two of these sets are stored off-site. After a full backup is made on Friday, the set of cartridges is taken off-site and exchanged for the oldest backup set in storage. Next Friday, the backup is made using this oldest set of cartridges. In this way, at any moment, three generations of a full weekly backup exist; the two most recent are off-site, and the oldest is on-site ready for the next backup.

The final three sets of cartridges are used for a full backup on the first working day of each month, again in rotation. This is in addition to the usual backup that would be made that day, so the normal routine is maintained. As with the weekly cartridges, the monthly sets should be stored off-site.

Cleaning Tape Heads

CAUTION! Only use the HP 92283K Cleaning Cartridge to clean the tape heads. Do not use cotton swabs or other tools to clean the heads.

Table 4 shows the proper intervals for cleaning the tape heads in the DDS tape module. You should also clean the tape heads if the clean light flashes. Once your backup routine has been established, you should know how many DDS tape cartridges are used each day. Using Table 4, you can estimate how often the heads will need cleaning and build the cleaning operation into the backup routine.

Table 4. Cleaning Intervals for Tape Heads

Number of Cartridges Used/Day:	1	2	3	4 +
Cleaning Interval:	8 weeks	4 weeks	3 weeks	weekly

To clean the tape heads:

NOTE! The cleaning cycle takes about 30 seconds. If the cleaning cartridge ejects in less than 20 seconds and the media caution light is still lit, no cleaning has occurred. Replace the cleaning cartridge and repeat the process.

1. Slide the cleaning cartridge into the cartridge slot. The cartridge is automatically loaded and the heads are cleaned. At the end of the cleaning cycle, the cleaning cartridge is automatically ejected. Note the date on the cartridge label so you know how many times it has been used.
2. After the cleaning cartridge is ejected, write the date on the cartridge label. This record tells you how many times the cleaning cartridge has been used. Discard the cleaning cartridge after it has been used 50 times.

Ordering DDS Tape Cartridges

CAUTION! To ensure data integrity, use only Hewlett-Packard DDS tape cartridges. Only cartridges with the DDS logo meet the quality standards required for reliable data storage. DDS tape cartridges have more stringent reliability standards than DAT cassettes, which are only tested for audio use.

DDS/MRS Logos

To identify computer-grade DDS tape media, look for the DDS logos (see Figure 21). The Media Recognition System (MRS) enables the DDS tape module to identify DDS-grade tape media. DDS/MRS tape cartridges have four stripes after the DDS logo and a line underneath the logo that states “Media Recognition System”.

Figure 21. DDS/MRS Logos





	DDS-1 Logo
	DDS-1/MRS Logo
	DDS-2/MRS Logo
	DDS-3/MRS Logo

Table 5 lists the DDS tape cartridges you can order from Hewlett-Packard. Any of the DDS tape cartridges listed may be used. However, the DDS-3/MRS data cartridges are recommended for use in the DDS-3 tape module.

Table 5. DDS Tape Cartridges and Accessories

HP Part No.	Capacity*	Description
C1517A	12 GB	Box of 5 DDS-3/MRS data cartridges (125 m)
92300A	4 GB	Box of 5 DDS-2/MRS data cartridges (120 m)
92283B	2 GB	Box of 5 DDS-1/MRS data cartridges (90 m)
92283A	1.3 GB	Box of 5 DDS-1/MRS data cartridges (60 m)
92283K	N/A	Box of 2 cleaning cartridges
92283L	N/A	Lockable storage box (holds 12 DDS tape cartridges)
*Capacity is for 1:1 data compression; N/A = Not Applicable.		

DDS Tape Module
Ordering DDS Tape Cartridges

Chapter 4. Troubleshooting & Diagnostics

This chapter includes procedures for troubleshooting and replacing fan modules, power modules, disk modules and DDS tape modules.

Troubleshooting Overview

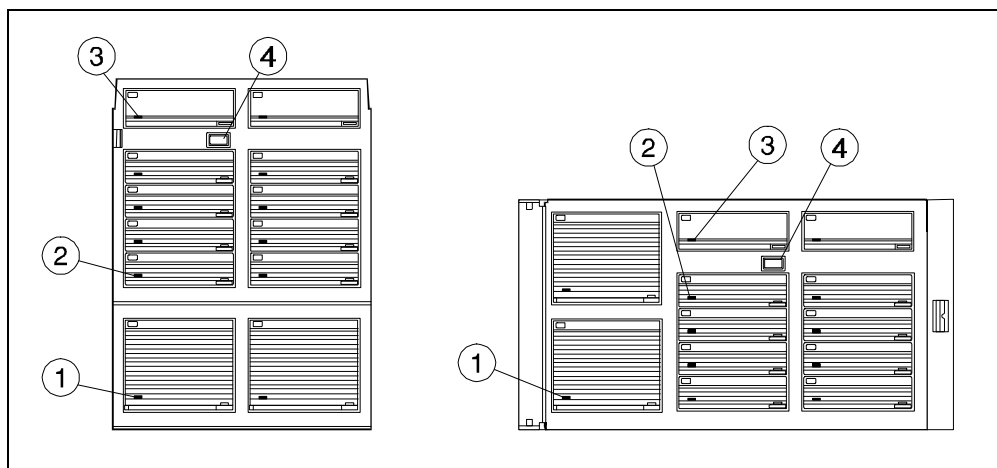
The following troubleshooting steps are recommended to identify and resolve storage system failures:

1. Gather failure information by checking:
 - host system error logs
 - host system error messages
 - module status lights (see “Module Status Lights” in this chapter)
2. Check host/device communication on the SCSI bus.
3. Check device operation with no host connection (see “Self-Test Diagnostics” in this chapter).
4. Troubleshoot the suspect device (see “Troubleshooting Procedures” in this chapter).
5. Replace the suspect device (see “Module Replacement Procedures” in this chapter)..
6. Check storage system operation with host connection.
7. Contact your HP service representative.

Module Status Lights

Each module within the storage system has at least one status light on its front panel (see Figure 22). The DDS tape module has two status lights (see Figure 23). Status lights show the results of power-on self-tests and indicate the functional status of the device within the module. Table 6 through Table 9 list the status light indications and recommended actions for the modules.

Figure 22. Module Status Lights and Power Switch



1 - Power Module Status Light
2 - Disk Module Status Light

3 - Fan Module Status Light
4 - Power Switch

Table 6. Fan Module Status Light Indications

Status Light	Indication	Recommended Action
Off	No power or fan not operating.	
Green	Normal operation.	None required.
Amber	Fan failure. Fan speed is too slow or the fan has stopped blowing air.	Replace the fan module.

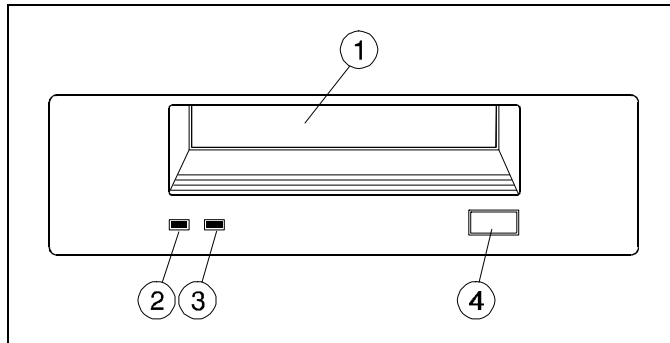
Table 7. Power Module Status Light Indications

Status Light	Indication	Recommended Action
Off	No power or power module not operating.	Check to see if power cords are plugged in. Check to see if storage system power switch is turned on.
Green	Normal operation.	None required.
Amber	Both fans are missing or failed, over-current condition, or power supply failure.	See “Power Module Troubleshooting Procedures” in this chapter.

Table 8. Disk Module Status Light Indicators

Status Light	Indication	Recommended Action
Off	No power, disk module failed, or self-test passed.	Check storage system power. If power is present and self-test passed, no action is required. If the disk module failed, replace the disk module.
Flashing Green	Disk module is reading or writing data. Normal operation.	None required.
Green	Drive fault ¹ or self-test ² is running.	If there is a drive fault, replace the disk module. If self-test is running, no action is required.
Notes: <ol style="list-style-type: none"> 1. A solid green status light at any time other than during a self-test indicates a disk module fault. Replace the disk module. 2. Termination problems can prevent successful completion of a self-test. Verify there are no termination problems on the SCSI bus. See “SCSI Bus Troubleshooting Procedures”. 		

Figure 23. DDS Tape Module Front Panel



- 1 - Cartridge Slot
- 2 - Tape Light
- 3 - Clean Light
- 4 - Cartridge Unload Button

Table 9. DDS Tape Module Status Light Indications

Tape Light	Clean Light	Indication/ Recommended Action
Off	Off	No power, tape module failed, or self-test passed. Check storage system power. If power is present and self-test passed, no action is required. If the tape module failed, replace the tape module.
Flashing Green (1 flash/second)	Off	Tape loading or unloading or tape self-test is running. No action required.
Flashing Green (2 flashes/second)	Off	Tape loaded and read/write activity. No action required.
Green	Off	Tape loaded. Tape module ready.
Amber or Green	Flashing Amber (1 flash/second)	Tape heads are dirty. Copy the data to a new tape, discard the old tape, and clean the tape heads. See Chapter 3 for detailed cleaning instructions.
Amber or Green	Amber	Drive fault. Replace the tape module.

Troubleshooting Procedures

This section contains troubleshooting procedures for the storage systems.

SCSI Bus Troubleshooting Procedure

If the host cannot access any of the devices connected to the SCSI bus, check the following:

1. Check SCSI cables for loose connections and bent pins.
2. Check SCSI terminator connections. A differential terminator on a single-ended bus or a single-ended terminator on a differential bus will cause the bus to hang. If a terminator is missing, storage system modules may not pass power-on self-test.
3. Check the SCSI ID switches for conflicting SCSI ID numbers.
4. Check the host bus adapter to see if it includes on-board termination and termination power, or if they must be supplied externally.
5. Reseat all storage modules.

If there is a SCSI bus problem with a disk module, see Table 10.

Table 10. Disk Module/SCSI Bus Troubleshooting

Condition	Recommended Action*
Disk module not recognized by host or fails power-on self-test.	Check for SCSI bus termination. Check for correct terminator type. Check for bent pins on terminators or SCSI cables. Check for SCSI ID conflicts. Ensure that a SCSI cable does not exceed 6 meters on a single-ended bus or 25 meters on a wide differential bus. Ensure that a DF disk module has not been connected to an SE host bus adapter, or that an SE disk module has not been connected to a DF host bus adapter.
Disk module not recognized by host during operation	Check for a green status light on the disk module. If it is a DF disk module, perform the hot plug procedure under “DF Disk Module Replacement/Recovery Procedure (HP 3000 Series 900)” prior to replacing it. If it is an SE disk module, shut down the operating system prior to replacing it. Check the power supplies (see “Power Module Troubleshooting Procedures”).
Wide differential SCSI bus hangs immediately after a disk module is replaced.	Ensure that an SE disk module is not installed in a wide differential slot, or that a WD disk module is not installed in a single-ended slot. A DF disk module on a single-ended bus is usually transparent to the host.
A new DF disk module is not recognized by the host. I/O subsystem errors are logged after a system boot.	Ensure that the DF disk module is not installed in a single-ended slot. A DF disk module on a single-ended bus is usually transparent to the host. The SE disk modules on the single-ended bus will operate normally.
*SE = single-ended narrow; DF = fast/wide differential	

Fan Module Troubleshooting Procedure

CAUTION! To maintain proper cooling within the storage system, a failed fan module must remain in the fan slot until a replacement fan module is installed. A missing fan module will cause the storage system to overheat and power off.

NOTE! The storage system is designed to operate with two fan modules, regardless of the number of storage modules installed.

If a fan module fails (see Table 6), check the following:

1. An amber status light indicates the fan speed is too slow, or the fan has stopped blowing air.
2. If both fan modules fail, the power modules will automatically power off in 3 to 7 seconds to avoid overheating. A SCSI bus reset will occur at this time.

Power Module Troubleshooting Procedures

CAUTION! The following conditions will cause a power module to power off in 3 to 7 seconds: (1) two failed fan modules, (2) a power supply internal fan failure or other internal component failure, or (3) an over-current condition caused by a faulty storage system module, a device in one of the four upper slots set to SCSI ID 0, or using an unsupported device with a high current rating.

Each power module contains a power supply with an internal fan for cooling. Two power modules (redundant configuration) use active current sharing to share the power load equally. If one power module fails or is removed, or if one of the ac power cords is accidentally removed, the other power module takes over the entire power load without interruption.

One Power Module/One Fault Troubleshooting Procedure

CAUTION! There should be no bus activity when these steps are performed. The storage system should be offline.

NOTE! Power cycle the storage system after performing each step in this procedure.

If the storage system contains one power module and a power supply fault occurs when installing storage modules, perform the following steps:

1. If any storage module in the four upper slots is set to the same SCSI ID number as a storage module in the four lower slots, change the SCSI ID to a unique number.
2. Remove all storage modules.
3. Install the storage modules one at a time until a power supply fault occurs.
4. Remove all storage modules except the last one installed.
5. If a power supply fault occurs again, replace the storage module.
6. If a power supply fault occurs after replacing the storage module, replace the power module.

Two Power Modules/One Fault Troubleshooting Procedure

CAUTION! There should be no bus activity when these steps are performed. The storage system should be offline.

If the storage system contains two power modules and one power supply fault occurs when installing storage modules, perform the following steps:

1. Check the power cord for the faulty power module.
2. Remove and re-install the faulty power module.
3. Replace the faulty power module.

Two Power Modules/Two Faults Troubleshooting Procedure

CAUTION! There should be no bus activity when these steps are performed. The storage system should be offline.

If the storage system contains two power modules and two fan modules and two power supply faults occur, follow these steps:

1. Cycle storage system power.
2. After power-on, the power module status lights will be amber.
 - If both fan module status lights do not turn green before they turn off, replace both fan modules.
 - If at least one fan status light turns green after power-on, either a power module has failed or an over-current condition exists. Follow the steps under "One Power Module/One Fault".

DDS Tape Module Troubleshooting Procedure

If a DDS tape module failure occurs, see Table 9.

Disk Module Troubleshooting Procedure

If a disk module failure occurs, check the following:

1. A solid green status light at any time other than during a self-test indicates a drive fault. A flashing or pulsing green status light indicates read/write activity.
2. Termination problems can prevent successful completion of a drive module self-test. Verify there are no termination problems on the SCSI bus (see "SCSI Bus Troubleshooting Procedure").
3. Solve the problem using the appropriate procedure. If the disk module needs to be replaced, see Figure 29. DF Disk Module Replacement Decision Flowchart".

Module Replacement Procedures

The following procedures describe how to replace the storage system modules.

NOTE! The term *hot pluggable*, refers to modules that can be replaced while the host and storage system are operating. Not all modules are hot pluggable, and some modules require the use of command line utilities before removal and after replacement. See Table 1 in Chapter 2 for HP system support of hot pluggable modules.

Fan Module Replacement Procedure

WARNING! You can only replace one fan module at a time. Do not remove a failed fan module from the storage system until the replacement fan module is ready to be installed. Both fan modules must be installed for proper air flow and cooling.

NOTE! You can replace a fan module while the host and the storage system are operating.

To replace a fan module:

1. Remove the fan module from the storage system (see Figure 24).
2. Install a new fan module into the storage system (see Figure 25).

Figure 24. Removing a Fan Module

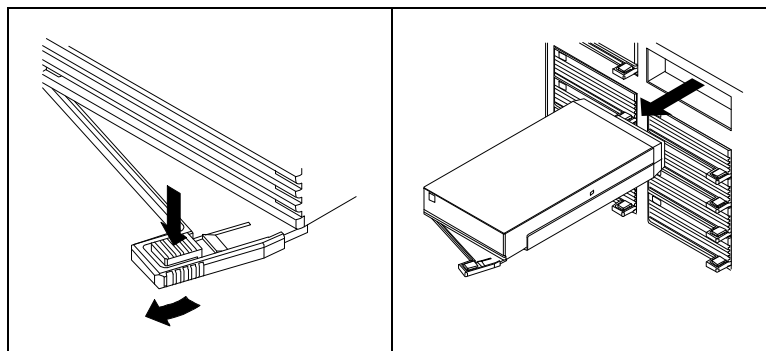
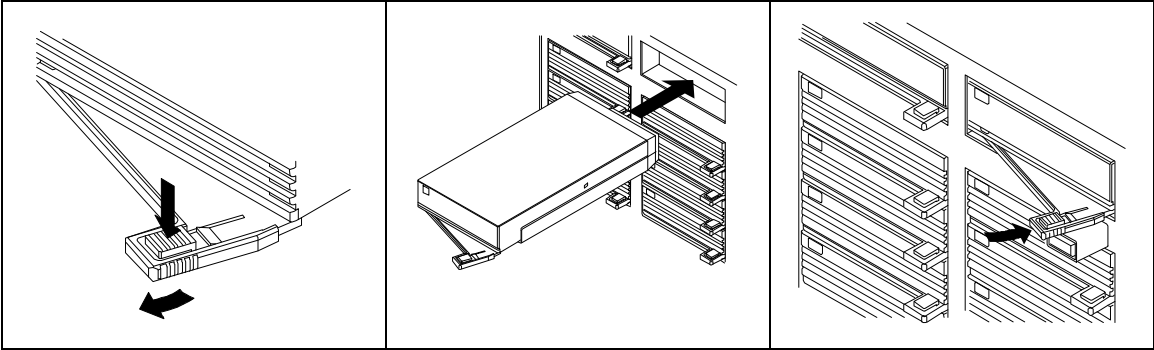


Figure 25. Installing a Fan Module



Power Module Replacement Procedure

CAUTION! The power module is hot pluggable only if a second power module is present and operating. If you remove the only power module in the storage system, the storage system and all modules will lose power.

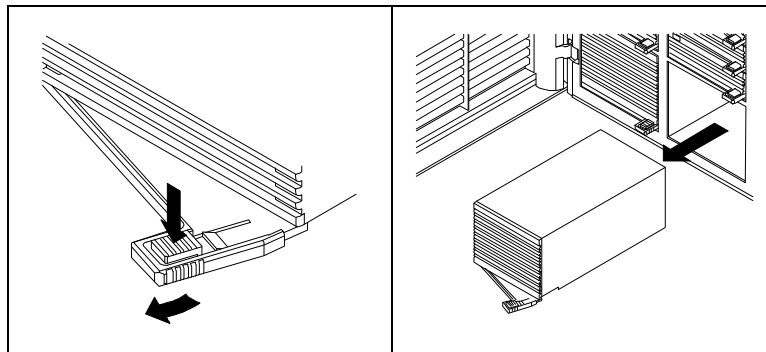
NOTE! If there are two power modules in the storage system, each will share the power load. If one power module fails or is removed, or if one of the ac power cords is removed, the other power module will take over the entire power load without interruption.

NOTE! You can replace a power module while the host and the storage system are operating.

To replace a power module:

1. Remove the power module from the storage system (see Figure 26).
2. Install the new power module into the storage system (see Figure 6 in Chapter 2).

Figure 26. Removing a Power Module



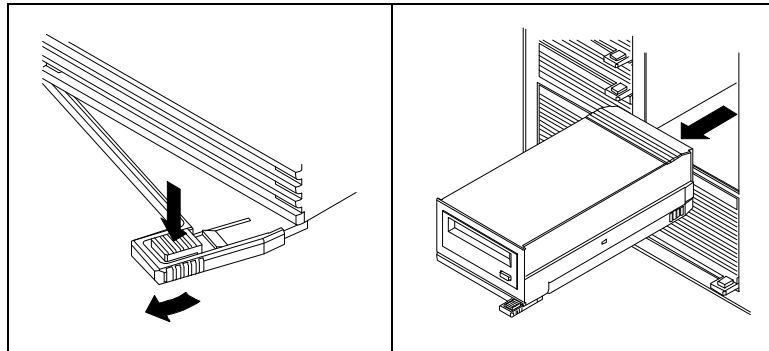
DDS Tape Module Replacement Procedure

CAUTION! DDS tape modules cannot be replaced while the host is running. You must shut down the host and power-off the storage system before you replace a tape module.

To replace a DDS tape module:

1. Shut down the host and power-off the storage system.
2. Remove the DDS tape module from the storage system (see Figure 27).
3. Install the new DDS tape module into the storage system (see Figure 9 in Chapter 2).
4. Perform host recovery procedures.

Figure 27. Removing a DDS Tape Module



Disk Module Replacement Procedures

CAUTION! Not all disk modules are hot pluggable. See Table 11 and the appropriate replacement procedure in this chapter for information on replacing a disk module.

NOTE! Replacement of a disk module is not the same as installing additional capacity to an operating storage system. To add capacity, see "Installing Additional Disk Modules".

Table 11. Host Support of Hot Pluggable Disk Modules

Disk Module	HP 3000 Series 900	HP 9000 Series 700, C-Series, J-Series	HP 9000 Series 800 Version 9.04, 10.01*
Single-Ended (SE)	No	No	No
F/W Differential (DF)	Yes	No	Yes

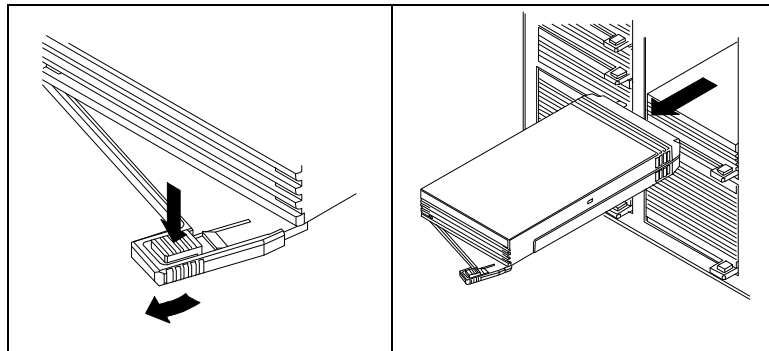
*The storage system does not support version 10.0 for HP-UX systems.

To replace a disk module:

- Determine the proper disk module replacement procedure to use, based on:
 - the type of disk module being replaced (SE or DF)
 - the type of host system and its configuration
- If the disk module is single-ended (SE), follow the steps in one of the following procedures:
 - SE Disk Module Replacement Procedure (HP 3000 Series 900)
 - SE Disk Module Replacement Procedure (HP 9000 Series 700, C-Series, J-Series)
 - SE Disk Module Replacement Procedure (HP 9000 Series 800)
- If the disk module is differential (DF), see Figure 29 then follow the steps in one of the following procedures:
 - DF Disk Module Replacement/Recovery Procedure (HP 3000 Series 900)
 - DF Disk Module Replacement Procedure (HP 9000 Series 700, C-Series, J-Series)
 - DF Disk Module Replacement Procedure (HP 9000 Series 800, No Strict Mirroring)
 - DF Disk Module Replacement/Recovery Procedure for Attached Physical Volumes (HP 9000 Series 800 with Strict Mirroring)

- DF Disk Module Replacement/Recovery Procedure for Unattached Physical Volumes (HP 9000 Series 800 with Strict Mirroring)
4. Remove the disk module (see Figure 28).
 5. Install a new disk module into the storage system (see Figure 8 in Chapter 2).

Figure 28. Removing a Disk Module



SE Disk Module Replacement Procedure (HP 3000 Series 900)

CAUTION! The new disk module must be of the same capacity and model as the module being replaced.

1. Shut down the host then power-off the storage system.
2. Remove the disk module from the storage system.
3. Install a new disk module with the same model and capacity as the failed disk module.
4. Power-on your computer, then power-on the storage system. If your boot device is the storage system, *you may need to reboot your computer*

SE Disk Module Replacement Procedure (HP 9000 Series 700, C-Series, J-Series)

1. Shut down the host then power-off the storage system.
2. Remove the disk module from the storage system.
3. Install a new disk module with the same model and capacity as the failed disk module.
4. Power-on the storage system and reboot the host.
5. Perform an `ioscan` to ensure that the host recognizes the new disk module.

SE Disk Module Replacement Procedure (HP 9000 Series 800)

1. Shut down the host. The storage system can remain operating while you replace the disk module.
2. Remove the disk module from the storage system.
3. Install a new disk module.
4. Power-on the storage system and reboot the host.
5. Perform an `ioscan` to ensure that the host recognizes the new disk module.

Figure 29. DF Disk Module Replacement Decision Flowchart

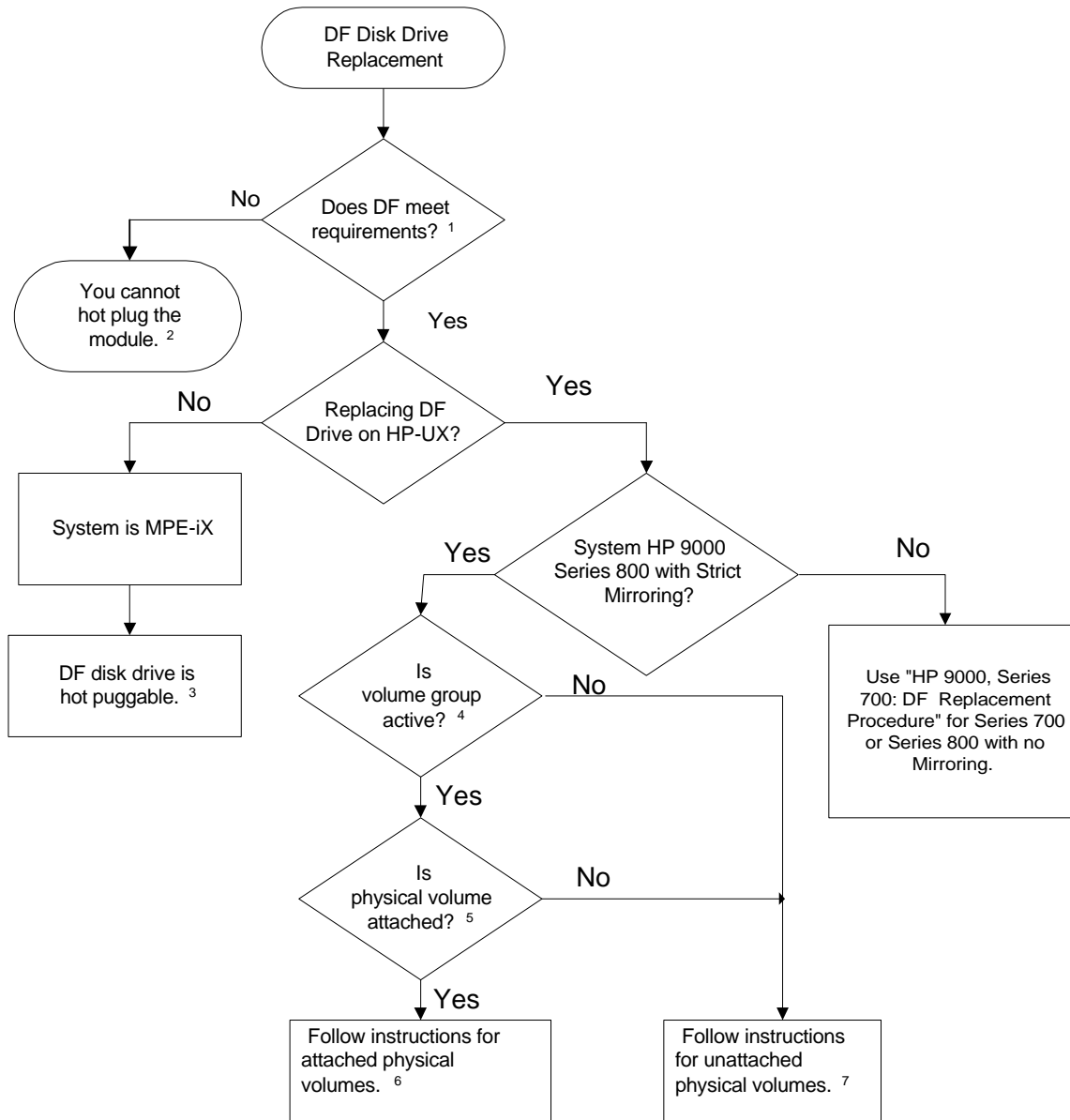


Figure 29 Footnotes:

1. See “DF Disk Module Replacement Requirements” in this chapter.
2. Contact your HP service representative for software assistance.
3. See “DF Disk Module Replacement/Recovery Procedure (HP 3000 Series 900)”.
4. If you don't know, see “DF Disk Module - Is the Volume Group or Physical Volume Group Active? (HP 9000 Series 800 with Strict Mirroring)”.
5. If you don't know, see “DF Disk Module - Is the Physical Volume Attached? (HP 9000 Series 800 with Strict Mirroring)”.
6. See “DF Disk Module Replacement/Recovery Procedure for Attached Physical Volumes (HP 9000 Series 800 with Strict Mirroring)”.
7. See “DF Disk Module Replacement/Recovery Procedure for Unattached Physical Volumes (HP 9000 Series 800 with Strict Mirroring)”.

DF Disk Module Replacement Requirements

To replace a disk module while the host is operating, all of the following conditions must be met:

- All patches must be loaded by an HP service representative or customer engineer (CE).
- All of the extents of the replaced disk that are in use must belong to mirrored logical volumes that were created with the `strict (-s)` option.
- You must have a current volume group configuration backup file. In version 10.x, the backup is created by default each time an LVM command changes the LVM configuration. The default backup file path name is: `/etc/lvmconf/base_vg_name.conf`. In version 9.x, the backup is a manual process.
- The replacement disk module must be of the same or greater capacity as the module being replaced.

NOTE! HP uses different manufacturers for disk modules having the same product number. The manual hot plug procedure will not update the disk module internal information to that of the replaced disk. A replacement disk module must have the same capacity and block size as the defective disk module because it has the same product number. The only string that can be different is the one specifying the vendor name. This will not affect the behavior of the LVM. If you want to update the manufacturer's name, the disk's volume group must be deactivated and reactivated.

If the conditions listed above cannot be met, contact your HP service representative for help.

If the conditions above are met, you can replace the DF disk module while the host is operating. To know which replacement and recovery procedure to use, you must:

1. Determine if the volume group is active. See “DF Disk Module - Is the Volume Group or Physical Volume Group Active? (HP 9000 Series 800 with Strict Mirroring)”.
 - If the volume group *is active*, determine if the physical volume is attached. See “DF Disk Module - Is the Physical Volume Attached? (HP 9000 Series 800 with Strict Mirroring)”.
 - If the volume group *is not active*, follow the procedure under “DF Disk Module Replacement/Recovery Procedure for Unattached Physical Volumes (HP 9000 Series 800 with Strict Mirroring)”.
2. Determine if the physical volume (replaced disk module) is attached.
 - If the physical volume (replaced disk module) *is attached*, follow the procedure under “DF Disk Module Replacement/Recovery Procedure for Attached Physical Volumes (HP 9000 Series 800 with Strict Mirroring)”.
 - If the physical volume *is not attached*, follow the procedure under “DF Disk Module Replacement/Recovery Procedure for Unattached Physical Volumes (HP 9000 Series 800 with Strict Mirroring)”.

Example of a Disk Module Failure

Use the example in Table 12 of a disk module failure to see the types of messages the host may display while using LVM utility commands. The DF replacement/recovery procedures base their example messages on the hardware addresses or device files shown below.

Volume group `/dev/vg00` contains three discs, with the logical volume configuration shown below:

Table 12. Example Volume Group with Three Disks

lvol 1	lvol 3	lvol 4
lvol 2	lvol 4	lvol 5
lvol 3	lvol 5	

Hardware Address: 52.6.0 52.5.0 52.4.0
 Device File (/dev/dsk/): c2t6d0 c1t5d0 c2t4d0

NOTE! In HP-UX 9.04, the device file `/dev/dsk/` naming convention is `cXdXsX`. (Versions 10.01 are different.)

DF Disk Module Replacement/Recovery Procedure (HP 3000 Series 900)

Hot pluggable disk modules are only supported on the HP 3000, Series 900 MPE-iX Version 5.0 with Express 3. If the host does not meet this specification, follow the steps in “HP 3000, Series 900: SE Disk Module Replacement Procedure”.

Before you replace the disk module, ensure that the host meets the following criteria. If you are unsure, see Table 11. If the host or replacement disk module do not meet the following requirements, contact your HP service representative. You can replace the disk module while the host and the storage system are operating.

NOTE! The new disk module must have the same product ID as the disk module being replaced. This will ensure that the new disk module has the same capacity.

1. If the host acknowledged the disabled logical drive, the host may display the following message:

```
/ACKNOWLEDGE MIRRORED PARTNER DISABLED FOR LDEV #3 (Y/N)?
```

This is only an advisory message. Replying to it only stops the message from repeating.
2. Remove the disk module from the storage system.
3. Install a new disk module with the same model and capacity as the failed disk module.
4. Run VOLUTIL, the mirrored volume utility program:

```
REPLACEMIRRVOL sname:vname ldev
```
5. The system will automatically recognize and start the repair of the mirrored pair of disks.

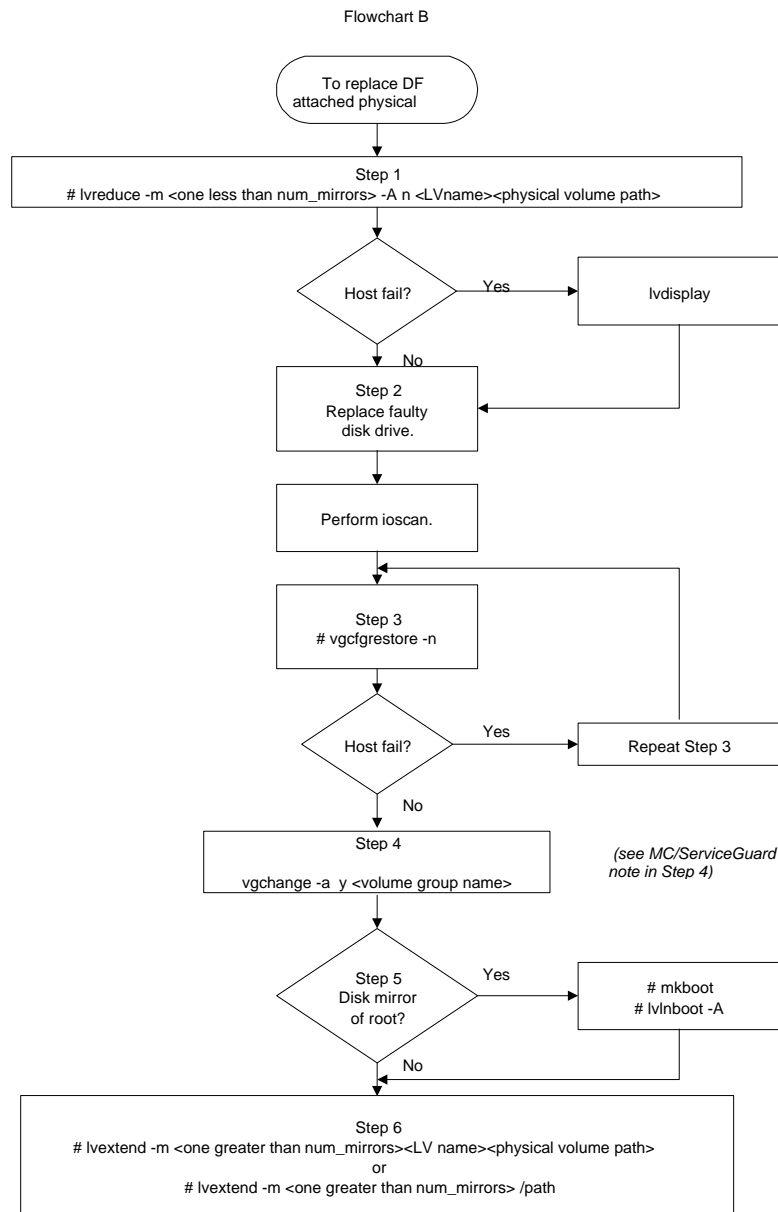
DF Disk Module Replacement Procedure (HP 9000 Series 700, C-Series, J-Series)

1. Shut down the host then power-off the storage system.
2. Remove the disk module from the storage system.
3. Install a new disk module.
4. Power-on the storage system and reboot the host.
5. Perform an `ioscan` to ensure that the host recognizes the new disk module.

DF Disk Module Replacement Procedure (HP 9000 Series 800, No Strict Mirroring)

1. Shut down the host. The storage system can remain operating while you replace the disk module.
2. Remove the disk module from the storage system.
3. Install a new disk module.
4. Reboot the host.
5. Perform an `ioscan` to ensure that the host recognizes the replaced disk module.

Figure 30. DF Disk Module Replacement/Recovery Flowchart for Attached Physical Volumes



DF Disk Module Replacement/Recovery Procedure for Attached Physical Volumes (HP 9000 Series 800 with Strict Mirroring)

Before you begin, review the requirements under “DF Disk Module Replacement Requirements” and ensure they are met.

Use the following commands to reduce any logical volumes that have mirror copies on the faulty disk module so they no longer mirror onto that disk module. If the host fails during a process, the recovery process is listed at the end of each step.

NOTE! This procedure will use the `lvreduce` command to remove mirrors whose extents are on the defective disk. Once the disk has been replaced, use the `lvextend` command to re-create the mirrors' extents on the new disk.

NOTE! Mirrors which span several disks may not have their extents placed on the disks as they were before. For cases where the original mirror layout needs to be preserved, the operator should consider deactivating the volume group with the `vgchange` command and following the steps in "DF Disk Module Replacement/Recovery Procedure for Unattached Physical Volumes (HP 9000 Series 800 with Strict Mirroring)".

Step 1

The `-A n` option is effective only in HP-UX release 10.01 and later and is not required for HP-UX release 9.04.

For one-way mirroring:

```
# lvreduce -m <one less than num_mirror> -A n <LV name> <physical volume path>
```

or, for two-way mirroring:

```
# lvreduce -m <one less than num_mirror> -A n <LV name> <physical volume path>
```

If you follow the example under “Example of a Disk Module Failure”, the host will display:

```
# lvreduce -m <one less than num_mirror> -A n /dev/vg00/lvol4 /dev/dsk/c2t4d0
```

```
# lvreduce -m <one less than num_mirror> -A n /dev/vg00/lvol5 /dev/dsk/c2t4d0
```

If the host fails during Step 1

If the host failed during an `lvreduce` command, you should execute an `lvdisplay` command to determine if the command succeeded. If the command did not succeed, the command should be executed again.

You should perform any other `lvreduce` commands that had not been executed before the system failure, then proceed.

NOTE! An important side effect of the `lvreduce` commands is that the LVM configuration backup file used by the `vgcfgrestore` command in step 1 is updated. If this hot plug procedure is being performed now on another host system and there was no need to execute any `lvreduce` commands, then the configuration file has not been updated. However, the LVM configuration is correct on the physical volumes, so the configuration file can be updated with the `vgcfbackup` command.

Step 2

- a. Replace the disk module if you have not done so already.
- b. Perform an `ioscan` on the new disk module to ensure that it is accessible and also, as a double check, that it is a proper replacement.

If you follow the example under “Example of a Disk Module Failure”, the host will display:

```
# ioscan /dev/dsk/c2t4d0
```

HP uses different manufacturers for disks having the same product number. The manual hot plug procedure will not update the disk module’s internal information to that of the replaced disk.

Replacement disks must have the same capacity and block size as the defective disk because they have the same product number. The only field that could be incorrect is the string specifying the vendor's name. This will not affect the behavior of the LVM. If you want to update the manufacturer's name, the disk's volume group must be deactivated and reactivated.

Step 3

Use the following commands to restore the LVM configuration/headers to the replaced disk modules from your backup of the LVM configuration:

```
# vgcfgrestore -n <volume group name> <physical volume path>
```

For example, the host will display:

```
# vgcfgrestore -n /dev/vg00 /dev/rdisk/c2t4d0
```

If the host fails during Step 3

Repeat step 3 to ensure all the configuration data is written to the new disk.

NOTE! An important side effect of the `vgchange` commands is that the LVM configuration backup file used by the `vgcfgbackup` command in step 3 is updated. If this hot plug procedure is being performed now on another host system and there was no need to execute `lvreduce` commands, then the configuration file has not been updated. However, the LVM `vgcfgbackup` command.

Step 4

he replaced disk module to the active volume group with the `vgchange` command:

```
# vgchange -a y <volume group name>
```

```
# vgchange -a y /dev/vg00
```

Note for MC/ServiceGuard If the disk array is used in an MC/ServiceGuard cluster volume group, use the `vgchange -a y /dev/vgcluster` command.

VG Status

Available
Available, exclusive
Available, shared, server

Command

`vgchange -a y`
`vgchange -a`
Not sure what to do with SLVM
Not sure what to do with SLVM

VG Status from the `vgdisplay`:

**available may*

Step 5

6. If the disk is the mirror of a root disk:

a. Run the `mkboot` command on the replaced disk.

If you use the example from “Example of a Disk Module Failure”, the host will display:

```
# mkboot /dev/rdisk/c2t4d0
```

Run the `vgchange -a y` command to `-link` the replaced disk into the Boot Data Reserved Area of all

```
# lvlnboot -R
```

5

```
mkboot and -R
```

commands are repeatable with no harm.

Step 6

Use the `lvextend` command to transfer the mirrors back on to the replaced disk. This will take some time because it copies all of the data from the original copy of the data to the mirrored extents. The logical volumes are still accessible to users' applications during this command for two-way mirroring:

```
# lvextend -m <one greater than num_mirror> <LV name> physical volume path
```

or for three-way mirroring:

```
# lvextend -m <one greater than num_mirrors> <LV name> physical volume path
```

If you follow the example under “Example of a Disk Module Failure”, the host will display:

```
# lvextend -m <one greater than num_mirrors> /dev/vg00/lvol4 /dev/dsk/c2t4d0
```

```
# lvextend -m <one greater than num_mirrors> /dev/vg00/lvol5 /dev/dsk/c2t4d0
```

At this point, your system should be fully functioning.

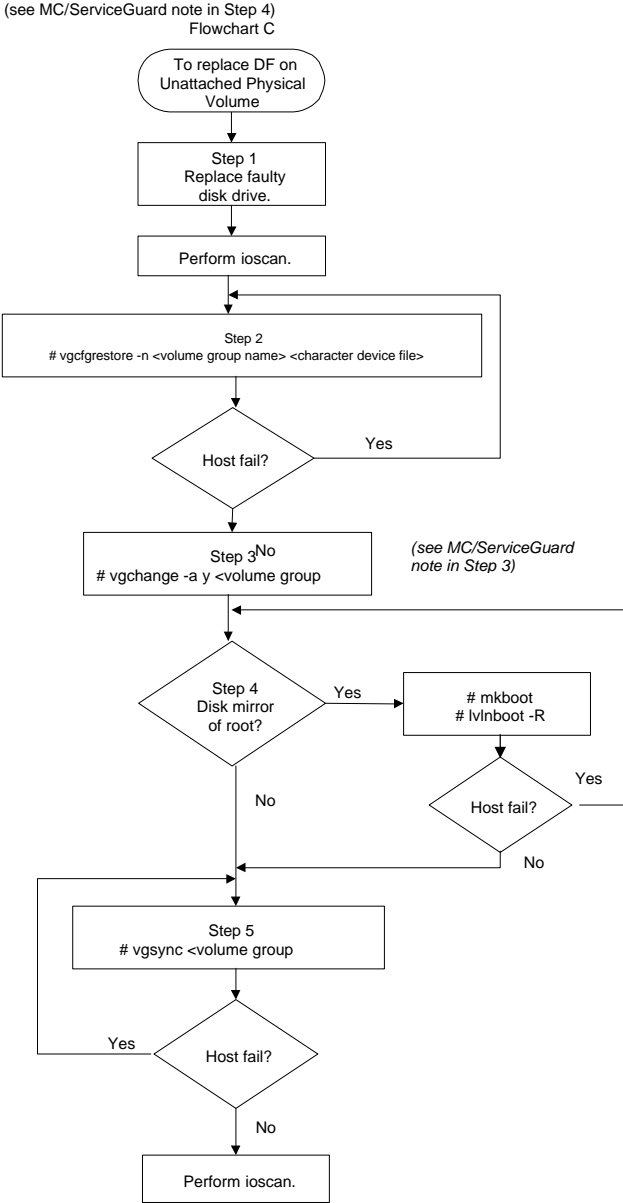
If the host fails during Step 6

Execute an `lvdisplay` command to determine if the command was successfully executed. If the command did not successfully execute, re-issue the command.

You should perform any other `lvextend` commands that had not been executed before the system failure.

Figure 31

Replacement Flowchart for Unattached Physical Volumes



DF Disk Module Replacement/Recovery Procedure for Unattached Physical Volumes (HP 9000 Series 800 with Strict Mirroring)

Before you begin, review and ensure the requirements described in the “DF Disk Module Replacement Requirements” are met. Use this procedure if the volume group is not active or if the physical volume is unattached.

Step 1

- a. Replace the disk module if you have not done so already.
- b. Perform `ioscan` on the replaced disk module to ensure that it is accessible and to check that it is a proper replacement.

If you follow the example under “Example of a Disk Module Failure”, the host will display:

```
# ioscan /dev/dsk/c2t4d0
```

Step 2

Restore the LVM configuration/headers to the replaced disk from your backup of the LVM configuration:

```
# vgcfgrestore -n <volume group name> character device file
```

For example, the host will display:

```
# vgcfgrestore -n /dev/vg00 /dev/rdisk/c2t4d0
```

If the host fails during Step 2

If the host fails during this step, repeat this step to ensure all of the configuration data is written to the new disk.

Step 3

Attach the new disk module to the active volume group with the `vgchange` command:

```
# vgchange -a y <volume group name>
```

For example, the host will display: # `vgchange -a y /dev/vg00`

Note for MC/ServiceGuard - If the disk array is used in an MC/ServiceGuard cluster volume group, the appropriate activation mode should be used. For example, `vgchange -a e /dev/vgcluster`

The appropriate activation mode can be determined by the value of the **VG Status** from the `vgdisplay`:

<u>VG Status*</u>	<u>Command</u>
Available	<code>vgchange -a y</code>
Available, exclusive	<code>vgchange -a e</code>
Available, shared, server	Not sure what to do with SLVM
Available, shared, client	Not sure what to do with SLVM

*available may have a state specified after it (e.g. available/state)

Step 4

If the disk is not the mirror of a root disk, skip this step.

Run the mkboot command. For the above example

```
# mkboot /dev/rdisk/c2t4d0
```

- b. `lvinboot -` command to re-
Area of all the Physical Volumes in the Volume Group:
`-R`

If the host fails during Step 4

when the host failed. The `mkboot` `lvinboot -` commands
are repeatable with no harm.

Step 5

`-synchronize` the mirrors of the replaced disk module. This will take some time because it copies all the
d extents. The logical volumes are still accessible to
users' applications during this command:

```
# vgsync <VG name>
```

```
# vgsync /dev/vg00
```

If the host fails during Step 5

`-issue` the `command`.



DF Disk Module - Is the Volume Group or Physical Volume Group Active? (HP 9000 Series 800 with Strict Mirroring)

Use this procedure to determine if the volume group and physical volume group is active:

1. At the host console type:

```
# vgdisplay <VG name>
```

If you followed the example under “Example of a Disk Module Failure”, the host will display:

```
# vgdisplay /dev/vg00
```

If the volume group is not active, the host will display:

```
# vgdisplay: volume group not active
```

```
# vgdisplay: cannot display volume group <VG name>
```

2. If the disk was defective when `vgchange` was executed, the following messages will be displayed:

```
VGDISPLAY:WARNING: COULDN'T QUERY PHYSICAL VOLUME "/DEV/DSK/c2t4d0"
```

```
THE SPECIFIED PATH DOES NOT CORRESPOND TO PHYSICAL VOLUME  
ATTACHED TO THE VOLUME GROUP
```

```
VGDISPLAY: WARNING: COULDN'T QUERY ALL OF THE PHYSICAL VOLUMES
```

- If the message above displays, the physical volume is not active. Refer to “DF Disk Module Replacement/Recovery Procedure for Unattached Physical Volumes (HP 9000 Series 800 with Strict Mirroring)”.
- If the message above does not display, the physical volume is active. Refer to “DF Disk Module -: Is the Physical Volume Attached? (HP 9000 Series 800 with Strict Mirroring)”.

- Is the Physical Volume Attached? (HP 9000 Series 800 with Strict

Use this procedure to det

The example messages shown here are based on “Example of a Disk Module Failure”.

Use the `phy` command to activate the volume group if you have not done so already.

The phy

```
VGCHANGE: WARNING: COULDN'T ATTACH TO THE VOLUME GROUP  
PHYSICAL VOLUME "/DEV/DSK/c2t4d0"
```

```
IS NOT CONFIGURED INTO THE KERNEL.
```

- for Unattached Physical Volumes (HP 9000, Series 800 with Strict Mirroring)”.

If the physical volume is attached, continue to “DF Disk Procedure for Attached Physical Volumes (HP 9000, Series 800 with Strict Mirroring)”.

The following diagnostic tools are available for isolating storage system hardware failures:

- `sd` - local device self-
- `sd` - Online system-

Self Test Diagnostics

`sd` -test diagnostic firmware. The self test executes automatically at power-up. `sd` -test can also be initiated externally, using `sd` -level diagnostic utilities. This enables the operator to execute a self test, without power-cycling the self-

addition, any self-

Sense command. Whenever a self-

to the host (see “Request Sense Information” on the following page).

automatically returned

Online Diagnostics

Most HP systems include online diagnostic utilities for use with SCSI mass storage devices. The following online diagnostics may be available on your system. Refer to your system documentation for information on using online diagnostics.

- *Sherlock Online Diagnostics for SCSI*: Used to diagnose all devices.
- *SCSIDISK2*: Used to diagnose disk devices.
- *SCSIDDS*: Used to diagnose DDS tape devices.

Disk Module Request Sense Information

This section describes the data returned for a disk module when a Request Sense command is invoked.

Table 13. Disk Module Request Sense Data Format

	Bit							
Byte	7	6	5	4	3	2	1	0
0	Valid	Error Code						
1	Segment Number							
2	FM	EOM	ILI	0	Sense Key			
3-6	Information Bytes (MSB=3; LSB=6)							
7	Additional Sense Length							
8-11	Command-Specific Information							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	FRU Code							
15	SKSV	Sense Key Specific						
16-17	Sense Key Specific							
18-n	Product Unique Sense Data							

Table 13 Returned Sense Data Fields:

Valid: one if byte 0-6 are valid, zero if not valid.

Error Code: 70h is a current error; Error Code 71h is a deferred error.

Segment Number: Always zeros.

File Mark: Always zero for a disk drive.

EOM: End Of Medium indicator. Always zero for a disk drive.

Incorrect Length Indicator:

of the data on the medium.

Indicates the general error category. These are listed in Table 14. The code in byte 12 provides additional explanation of

Information Bytes:

associated with the Sense Key. Unless otherwise specified, the Information Bytes contain the address of the current

Additional Length:

additional bytes. If the Allocation Length of the Command Descriptor Block is too small to transfer all of the

Additional Sense Code and Additional Sense Code Qualifier:

Sense Key is valid. Error code definitions are in Table 15. If the condition is not reportable by the disk drive, the

0000)".

Defined for Field Maintenance personnel only.

SKSV (Sense Key Specific Valid) bits and Sense Key Specific bytes:

The Additional Sense Code field may contain command-specific data, or vendor-specific data that further defines the nature of the CHECK CONDITION status.

The Sense Key Specific field is defined by this specification when the value of the SKSV bit is one. The definition of this field is determined by the value of the Sense Key field. This field is reserved for sense keys not described in

. If the Sense Key field is set to ILLEGAL REQUEST (5h) and the SKSV bit is set to 1, the Sense Key Specific field is defined as shown in Table 11. These fields point to illegal parameters in command descriptor blocks for in the DATA OUT phase.



Table 14. Disk Module Field Pointer Bytes

	Bit							
Byte	7	6	5	4	3	2	1	0
15	SKSV	C/D	Rsvd	Rsvd	BPV	Bit Pointer		
16-17	Field Pointer (MSB=16; LSB=17)							

A command data C/D bit of one indicates that the illegal parameter is in the command descriptor block. A C/D bit of zero indicates that the illegal parameter is in the data parameters sent by the initiator during the DATA OUT phase.

A BPV (Bit Pointer Valid) bit of zero indicates that the value in the bit pointer field is not valid. A BPV bit of one indicates that the Bit Pointer field specifies the bit of the byte designated by the field pointer that is in error. When a multiple-bit fields in error, the Bit Pointer field will point to the most significant bit of the field.

The Field Pointer field indicates the byte of the command descriptor block or of the parameter data that was in error. Bytes are numbered starting from zero, as shown in the tables describing the commands and parameters. When a multiple-byte field is in error, the pointer will point to the most significant byte of the field.

If a sense key is RECOVERED ERROR (1h), HARDWARE ERROR (4h), or MEDIUM ERROR (3h), and if the SKSV bit is one, the Sense Key Specific field is defined as shown in Table 12. These fields identify the actual number of retries used in attempting to recover from the error condition.

Table 15. Disk Module Actual Retry Count Bytes

	Bit							
Byte	7	6	5	4	3	2	1	0
15	SKSV	Reserved						
16-17	Actual Retry Count (MSB=16; LSB=17)							

The Actual Retry Count field returns implementation-specific information on the actual number of retries used in attempting to recover an error or exception condition. Not all drives implement reporting actual retry counts in bytes 15, 16, and 17. See specific drive Product Manual Volume 1.

If the Sense Key is NOT READY and the SKSV bit is one, the Sense Key Specific field will be defined as shown in Table 13. These fields are only defined for the FORMAT UNIT command with the Immed bit set to one.

16. Disk Module Format Progress Indication Bytes

	Bit							
Byte	7	6	5	4	3	2	1	0
15	SKSV	Reserved						
16-17	Progress Indication (MSB=16; LSB=17)							

The Progress Indication field is a percent complete indication in which the returned value is the numerator that has 655326 (10000h) as its denominator. The progress indication will be based upon the total format operation including any certification or initialization operations. Support of format progress indication is provided in each drive Product Manual Volume 1.

Product Unique Sense Data: Not used.

Table 14 lists the Sense Keys in the Extended Sense Data Format used by the drive.

Table 15 lists the Extended Sense Additional Sense codes and Additional Sense Qualifier codes.

17. Disk Module Sense Keys

Code	
1h	drive. This would be the case for a successful command or when the ILI bit is one. RECOVERED ERROR recovery action performed by the disk drive. When multiple recovered errors occur, the last
1a	may be required to correct this condition.
3h	MEDIUM ERROR . Indicates the command terminated with a nonrecoverable error probably caused by a flaw in the medium or an error in the recorded data.
4h	HARDWARE ERROR . Indicates the disk drive detected a nonrecoverable hardware failure - rface parity error,
	additional parameters supplied as data for some commands (Format Unit, Mode Select, etc.). If k drive detects an invalid parameter in the command descriptor block, it will terminate
	additional parameters supplied as data, the disk drive may have already a
6h	UNIT ATTENTION . Indicates the disk drive may have been reset or power cycled.
7h	DATA PROTECT . Indicates that a command that reads or writes to the medium on a block that is protected from this operation. The read or write operation is not performed.
9h	FIRMWARE ERROR . Vendor specific Sense Key.
Bh	ABORTED COMMAND . Indicates the disk drive aborted the command. The initiator may be ecover by trying the command again.
Ch	EQUAL . Indicates a SEARCH DATA command has satisfied an equal comparison.
Dh	VOLUME OVERFLOW . Indicates a buffered peripheral device has reached the end of t been written to the medium.
Eh	MISCOMPARE . Indicates that the source data did not match the data read from the medium.

Table 18. Disk Module Additional Sense Code/Qualifier Codes

Byte 12-13	Description
00 00h	No Additional Sense information
01 00h	No index/sector signal
02 00h	No seek complete
03 00h	Peripheral device write fault
04 00h	LUN not ready; cause not reportable
04 01h	LUN not ready; becoming ready
04 02h	LUN not ready; initializing command required
04 03h	LUN not ready; manual intervention required
04 04h	LUN not ready; format in progress
08 00h	LUN communication failure
08 01h	LUN communication time-out
08 02h	LUN communication parity error
09 00h	Track following error
09 04h	Head select fault
0A 00h	Error log overflow
0C 00h	Write error
0C 01h	Write error recovered with auto-reallocation
0C 02h	Write error; auto-reallocation failed
10 00h	ID CRC or ECC error
11 00h	Unrecovered read error
11 01h	Read retries exhausted
11 02h	Error too long to correct
11 04h	Unrecovered read error; auto reallocation failed
12 00h	Address mark not found for ID field
12 01h	Recovered data without ECC using previous sector ID
12 02h	Recovered data with ECC using previous sector ID
14 00h	Sector not found
14 01h	Record not found
15 00h	Random positioning error
15 01h	Mechanical positioning error
15 02h	Positioning error detected by read of medium
16 00h	Data synchronization mark error
17 00h	Recovered data with no error correction applied
17 01h	Recovered data using retries

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Byte -13	Description
17 02	Recovered data using positive offset
17 03	Recovered data using negative offset
17 05	Recovered data using previous sector ID
17 06	Recovered data without ECC; data auto-reallocated
18 00	Recovered data with ECC
18 01	Recovered data with ECC and retries applied
18 02	Recovered data with ECC and/or retries; data auto-reallocated
19 00	Defect list error
19 01	Defect list not available
19 02	Defect list error in primary list
19 03	Defect list error in grown list
1A 00	Parameter list length error
1B 00	Synchronous data transfer error
1C 00	Defect list not found
1C 01	Primary defect list not found
1C 02	Grown defect list not found
1D 00	Miscompare during verify operation
20 00	Invalid command operation code
21 00	Logical block address out of range
24 00	Invalid field in CDB
25 00	LUN not supported
26 00	Invalid field in parameter list
26 01	Parameter not supported
26 02	Parameter value invalid
26 03	Invalid field parameter; threshold parameter
26 98	Invalid field parameter; checksum
26 99	Invalid field parameter; firmware tag
27 00	Write-protected
28 00	Not ready-to-ready transition; medium may have changed
29 00	Power-on, Reset, or bus device reset occurred
29 01	Power-on Reset occurred
2A 00	Parameters changed
2A 01	Mode parameters changed
2A 02	Log parameters changed
2F 00	Tagged commands cleared by another initiator

Byte -13	Description
31 00	Medium format corrupted
31 01	Format failed
32 00	No defect spare location available
37 00	Parameter rounded
3D 00	Invalid bits in identify message
3E 00	LUN has not yet self-configured
3F 00	Target operating conditions have changed
3F 01	Microcode changed
3F 02	Changed operating definition
40 01	DRAM parity error
42 00	Power-on or self-test failure
43 00	Message error
44 00	Internal target failure
45 00	Select/reselection failure
47 00	SCSI parity error
48 00	Initiator detected error message received
49 00	Invalid message error
4C 00	LUN failed self-configuration
4E 00	Overlapped commands attempted
5B 00	Log exception
5B 01	Threshold condition met
5B 02	Log counter at maximum
5B 03	Log list codes exhausted
5C 00	RPL status change
5C 01	Spindles synchronized
5C 02	Spindles not synchronized
65 00	Voltage fault
80 00	General firmware error qualifier

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This section describes the data returned for a DDS tape module when a Request Sense command is

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	Bit							
Byte	7	6	5	4	3	2	1	0
0	Valid	Error Code (70h or 71h)						
1	Segment Number							
2	Mark	EOM	ILI	Rsvd (0)	Sense Key			
3 6	Information Bytes (MSB=3; LSB=6)							
7	Additional Sense Length (0Eh)							
8 11	Command Specif							
-								
-								

Table 19 Returned Sense Data Fields:

Valid: 1 indicates that the information bytes contain valid information as defined in the SCSI specification.

Error Code: 70h indicates that the error is *current*, that is, it is associated with the current CONDITION status has been reported. 71h indicates that the error is *deferred*. A deferred error occurs when there is an error in a

CONDITION status was reported is therefore unlikely to be the cause of the deferred error. It simply gives the drive the ECK CONDITION status for an error that already exists.

Segment Number:

(Default value is 1) The Mark bit is set to 1 when the logical position is at a filemark or setmark. See the Sense Code and Qualifier fields will indicate which sort of mark it is.

MODE SELECT Device Configuration Parameters page is set.

EOM: (Default value is 1) The EOM bit indicates the tape is at a BOP or EOP/M. Three different Sense keys may be

- region preceding EOP with an additional sense code of 01h. This sense key is reported when the tape encounters BOP, or after commands such as LOAD and REWIND. EOP/M is reported when a WRITE or REWIND command fails on a tape partition.

(Default value is 0) The EOP/M bit is set to 1 when the tape is at an EOP/M. This bit is set by the EOP/M and VERIFY commands can cause this bit to be set.

Sense Key:

The Information Bytes field is on the sense data following the failure of either a READ, WRITE, WRITE FILEMARKS, or SPACE command. The field can take a value from 00h to 0Fh and that failed for the

0Eh specifies the number of additional sense bytes to follow and is always set to 0Eh.

Command Specific Information Bytes: The number of additional sense bytes to follow is

These two bytes provide additional information about the cause of the error and the position when the REQUEST SENSE is unsolicited. See “Additional Sense Information” for more details.

This will be set to a value to indicate a specific part that has failed. It may be one of the following

- 0: Controller PCA failure
- 1: Drive mechanism failure
- 2: Drive mechanism failure
- 3: Change mechanism or external power supply

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SKSV: 0 indicates the Sense Key Specific Bytes (bytes 15 through 17) are invalid. The C/D, BPV, and Bit Pointer fields will be zero. The top byte of the Field Pointer will be zero, and the bottom byte will contain a product-specific error code.

1 indicates the Sense Key Specific Bytes are valid. This will only happen when the bytes assume the role of Field Pointer Bytes as defined by ANSI. This occurs when an Illegal Field check detects an error in a command descriptor block or a Parameter List check detects an error in a command parameter list.

C/D: Command Data is only valid if the SKSV flag is set. 0 indicates the Field Pointer information applies to the parameter list for the command. 1 indicates the Field Pointer information applies to command descriptor block.

BPV: 0 indicates the Bit Pointer field is invalid. 1 indicates the Bit Pointer field is valid. If the SKSV bit is set then the BPV bit must be set also.

Bit Pointer: Identifies the bit position of the field in error, whether it is a command descriptor or a command parameter list field. Only valid when the SKSV flag is set.

Field Pointer/Drive Error Code: If SKSV is set, this field identifies in which byte of the command descriptor or parameter list an error was detected. Note that the drive scans from byte 0 bit 7 of a command or parameter list through to byte n bit 0. The field and bit pointers are set to point to the most significant bit of the field that is in error. If SKSV is not set, the top byte of this field will be zero. The bottom byte contains the drive error code associated with the failure of the previous command, or zero in the case of no failure and no appropriate error code.

CLN: 0 indicates the drive is OK. 1 indicates the drive requires cleaning.

Table 20. DDS Tape Module Sense Keys

Code	Description
0h	NO SENSE. There is no real problem. the sense information is probably indicating some condition such as encountering a filemark.
1h	RECOVERED ERROR. An error has occurred from which the drive has recovered.
2h	NOT READY. The drive is not in a state to be able to execute the request.
3h	MEDIUM ERROR. The command failed, possibly because of a problem with the tape or an error in the recorded data.
4h	HARDWARE ERROR. The command failed, possibly because of a problem with the drive hardware. The FRU in the sense data should indicate which part of the hardware is faulty.
5h	ILLEGAL REQUEST. The last command sent to the drive or the data associated with the command violated conditions imposed by the drive on its acceptance.
6h	UNIT ATTENTION. Indicates some condition of which the host needs to be made aware.
7h	DATA PROTECT. A write command was attempted on a write-protected block.
8h	BLANK CHECK. The drive encountered a blank tape or EOD while reading.
Bh	ABORTED COMMAND. The drive has stopped trying to act on a command, usually through some problem on the SCSI bus.
Dh	VOLUME OVERFLOW. Physical EOT reached, unable to fit remaining information on a tape.

Table 21. DDS Tape Module Additional Sense Codes

Code	Description
00 00h	No additional sense information
00 01h	Filemark detected
00 02h	EOP/M detected
00 03h	Setmark detected
00 04h	BOP/M detected
00 05h	EOD detected
04 00h	LUN not ready, cause not reportable
04 01h	LUN becoming ready
04 02h	LUN not ready, initializing command required
09 00h	Track following error
0C 00h	Write error
11 00h	Unrecovered read error
14 03h	EOD not found
15 01h	Mechanical positioning error
17 00h	Recovered data with no error correction applied
17 01h	Recovered data with retries
18 00h	Recovered data with error correction applied
1A 00h	Parameter list length error
20 00h	Invalid command operation code
24 00h	Invalid field in command descriptor block
25 00h	LUN not supported
26 00h	Invalid field in parameter list
27 00h	Write-protected
28 00h	Not ready-to-ready transition
29 00h	Power-on, reset, or bus device reset occurred
2A 01h	Mode parameters changed
30 00h	Incompatible medium
30 01h	Cannot read media, unknown format
30 02h	Cannot read media, incompatible format
30 03h	Cleaning cartridge installed
31 00h	Medium format corrupted
33 00h	Tape length error
37 00h	Parameter rounded
3A 00h	Medium not present

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Code	Description
3B 00h	Sequential positioning error
3D 00h	Invalid bits in Identify message
3E 00h	LUN has not yet self-configured
3F 01h	Microcode download
40 XXh	Diagnostic failure on component XX
43 00h	Message error
44 00h	Internal target failure
45 00h	Select or reselect failure
47 00h	SCSI parity error
48 00h	Initiator detected error message received
49 00h	Invalid message error
4A 00h	Command phase error
4B 00h	Data phase error
4E 00h	Overlapped commands attempted
50 00h	Write append error
51 00h	Erase failure
52 00h	Cartridge fault
53 00h	Media load or eject failed.
53 02h	Medium removal prevented
5D 00h	Failure prediction threshold exceeded
5D FFh	Failure prediction threshold exceeded (false)
70 nnh	Decompression exception short algorithm ID of <i>nnh</i>
82 83h	Bad microcode detected

Table 22. DDS Tape Module Drive Error Codes

Code	Description
06h	Capstan motor stalled.
07h	During calibration, servo failed to converge to a value within the correct range.
08h	Drum is stationary when it should be rotating.
09h	Drum phase lock lost during a write. The drive failed to maintain drum phase relative to tape, so tracks are starting too early or too late.
0Dh	During a mode movement, 20s elapsed without reaching target position, or 6.4s elapsed without any change in rotary encoder state.
15h	Servo did not see first command.
16h	Drum failed to stop rotating.
17h	Reels stuck while drive in process of threading tape.
18h	Supply reel stuck during capstan or reel-driven tape motion.
19h	Servo ROM checksum failure.
1Ah	Too many reel FG pulses detected from supply reel during capstan or reel-driven tape motion.
1Bh	Take-up reel stuck during capstan or reel-driven tape motion.
1Ch	Too many reel FG pulses detected from take-up reel during capstan or reel-driven tape motion.
1Dh	Attempt to execute download routine failed because download version does not correspond to version of servo firmware.
1Eh	Communication protocol error indicates servo is “busy” when it should not be.
1Fh	Servo cannot respond because it is hung.
20h	Filemark encountered during a read, write, or spacing operation.
21h	Setmark encountered during a read, write, or spacing operation.
22h	Record of unexpected length was read.
23h	Format error in the group just read. MEDIUM ERROR.
24h	Buffer firmware does not know the logical tape position. MEDIUM ERROR.
25h	Parity error on reading data from the buffer. HARDWARE ERROR.
26h	Mismatch in number of bytes transferred to and from SCSI, due to firmware or hardware failure. HARDWARE ERROR.
27h	Illegal machine state detected. HARDWARE ERROR.
28h	Illegal buffer command received. HARDWARE ERROR.
29h	Illegal parameters sent with a valid buffer command. HARDWARE ERROR.
2Ah	Space or Locate failed; position specified is in middle of a compressed entity.
2Bh	Write Setmarks failed because it would cause the number of setmarks in the current partition to exceed 65535. No error is logged to EEPROM. ILLEGAL REQUEST.

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Code	Description
40h	Drive found data compressed using an algorithm other than DCLZ. MEDIUM ERROR.
41h	DC read transfer shorter than indicated in its header. MEDIUM ERROR.
42h	Parity error while processing compressed data. HARDWARE ERROR.
47h	Invalid DC command sequence received. HARDWARE ERROR.
48h	Decompression error reported when no decompression should occur. HARDWARE ERROR.
49h	Decompression error reported while DC ASIC waited for input. HARDWARE ERROR.
4Ah	Decompression error reported while DC ASIC waited for output. HARDWARE ERROR.
4Bh	Decompression error reported when DC ASIC status is active. HARDWARE ERROR.
4Ch	Decompression error reported when DC ASIC status register indicates a Reset is being performed. HARDWARE ERROR.
4Dh	Decompression error reported when DC ASIC status register indicates bad word length. HARDWARE ERROR.
4Eh	Decompression error reported when DC ASIC status register indicates unknown code word. HARDWARE ERROR.
4Fh	Decompression error reported when DC ASIC status register indicates parity error. HARDWARE ERROR.
52h	DC task detected entity with algorithm ID of zero (not an access point), but dictionary status was invalid (not 8 bytes). MEDIUM ERROR.
53h	Entity header invalid. MEDIUM ERROR.
54h	Defect in DC task firmware. Drive will only respond to a Log Sense to allow access to Trace logs. HARDWARE ERROR.
80h	Unexpected command received during a Write. HARDWARE ERROR.
81h	Failure to get a write command.
82h	Write command afoul; possible firmware defect. HARDWARE ERROR.
83h	Reported problems during a Write; possible firmware defect. HARDWARE ERROR.
84h	RAW retry limit exceeded for a group. MEDIUM ERROR.
85h	RAW retry limit exceeded while writing a frame. MEDIUM ERROR.
86h	No communication message sent by servo processor over internal bus within the time-out period. HARDWARE ERROR.
87h	Bad Read command received. HARDWARE ERROR.
88h	Failure to get a Read command.
89h	Read command queue afoul; possible firmware defect. HARDWARE ERROR.

Code	Description
8Bh	Hardware parity error detected when reading from DRAMs. HARDWARE ERROR.
8Ch	C3 row calculation failed.
8Dh	Streamfail occurred during error mapping; drive cannot cope.
8Eh	Too many frames with bad sub-data. MEDIUM ERROR.
8Fh	Too many guessed logical frame Ids. Tape position may be lost. MEDIUM ERROR.
90h	Group being read was found to be incomplete. MEDIUM ERROR.
91h	Bad positive-azimuth track found when reading 22-frame group. MEDIUM ERROR.
92h	Bad negative-azimuth track found when reading 22-frame group. MEDIUM ERROR.
93h	Conflict between tracks found when reading 22-frame group. MEDIUM ERROR.
94h	Time-out exceeded during hardware CS ECC syndrome check while reading HARDWARE ERROR.
95h	Mismatch with a checksum stored in a positive-azimuth track during C3 error correction while reading. MEDIUM ERROR.
96h	Mismatch with a checksum stored in a negative-azimuth track during C3 error correction while reading. MEDIUM ERROR.
97h	C3 error correction failed during a Read. MEDIUM ERROR.
98h	C3 ECC shows no error, yet a frame is considered to contain invalid data. MEDIUM ERROR.
99h	C3 error-correction calculations failed. MEDIUM ERROR.
9Ah	C3 error-correction failure. MEDIUM ERROR.
9Bh	Firmware failed to perform all processing during a “message window” time period. HARDWARE ERROR.
9Ch	Mismatch between checksum calculated while reading, and that stored in a positive track. MEDIUM ERROR.
9Dh	Mismatch between checksum calculated while reading, and that stored in a negative track. MEDIUM ERROR.
9Eh	Too many bad sub-data areas to allow checksum cross-checks. MEDIUM ERROR.
A0h	Buffer controller ASIC test failed. HARDWARE ERROR.
A2h	Communication test between servo processor and main 68000 processor failed. HARDWARE ERROR.
A3h	Illegal parameters specified for AFC search. ILLEGAL REQUEST.
A4h	Time-out waiting for BOM or EOM flag. HARDWARE ERROR.
A5h	Unexpected BOM or EOM encountered. HARDWARE ERROR.
A8h	Failure in data loopback test between buffer controller and DAT formatting ASIC. Flags or data were not set correctly. HARDWARE ERROR.

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Code	Description
A9h	Failure in data loopback test between buffer controller and DAT formatting ASIC. Data header was not set correctly. HARDWARE ERROR.
AAh	Failure in data loopback test between buffer controller and DAT formatting ASIC. Checksum register was not as expected. HARDWARE ERROR.
ABh	Drum motor took too long to reach speed. HARDWARE ERROR.
ACH	Capstan motor took too long to reach speed. HARDWARE ERROR.
ADh	Supply-reel motor took too long to reach speed. HARDWARE ERROR.
Aeh	Take-up reel motor took too long to reach speed. HARDWARE ERROR.
B1h	Status report from servo processor to main processor not valid. HARDWARE ERROR.
B3h	Illegal diagnostic requested. ABORTED COMMAND.
B4h	Illegal loopcount value specified. ABORTED COMMAND.
B5h	Diagnostic needs a tape; no tape detected. ABORTED COMMAND.
B6h	Tape in drive; can only perform diagnostic when no tape present. ABORTED COMMAND.
B7h	Diagnostic not supported by drive. ABORTED COMMAND.
B8h	Reel failed to turn during reel-motor calibration.
B9h	Reel failed to stop during reel-motor calibration.
BAh	Failure to change state within time-out period. HARDWARE ERROR.
BBh	Drive failed to achieve ATF lock during Drum PG autocalibration.
BCh	Having achieved ATF lock during Drum PG autocalibration, drive could not find a delay that would cause it to unlock again.
BDh	Results of drum autocalibration unacceptable; tolerance window not the right size.
BEh	Servo firmware revision incompatible with controller firmware revision.
C0h	Group found which does not comply with DDS format. MEDIUM ERROR.
C1h	DOS format violation in EOD frames.
C2h	Reference or system area DDS format violation.
C3h	No sub-data available for the group. MEDIUM ERROR.
C4h	EOD found when trying to find correct position to append data. MEDIUM ERROR.
C5h	Unreadable sub-data encountered when track-following. MEDIUM ERROR.
C6h	Tape position possibly beyond EOD. MEDIUM ERROR.
C7h	Drive action did not occur within time-out period. HARDWARE ERROR.
C8h	EOM and BOM reported simultaneously. MEDIUM ERROR.
C9h	Tape speed wrong while writing. HARDWARE ERROR.
CAh	EOD encountered; not necessarily an error condition. BLANK CHECK reported, with Additional Sense of 0005h (EOD detected).
CBh	BOM encountered; not necessarily an error condition.
CCh	Drive reached EOM. MEDIUM ERROR.

Code	Description
CDh	Target position missed; position controller went past desired position without achieving objective. MEDIUM ERROR.
CEh	Failure to achieve ATF locking within time-out period. MEDIUM ERROR.
CFh	Failure to reach the target point on tape. MEDIUM ERROR.
D0h	Unexpected physical BOM encountered.
D1h	Failure to position. HARDWARE ERROR.
D2h	Servo command time-out. HARDWARE ERROR.
D3h	Drum took too long to reach speed. HARDWARE ERROR.
D4h	Failure to process one servo event before servo processor sent next event. HARDWARE ERROR.
D5h	Too long between successive servo message events. HARDWARE ERROR.
D6h	Unexpected position counter.
D7h	Calculated supply-reel diameter is suspect. HARDWARE ERROR.
D8h	Tape not available for use. HARDWARE ERROR.
D9h	Tape is threaded; command received which requires no tape to be threaded. HARDWARE ERROR.
DAh	No cartridge in drive; cartridge is expected. HARDWARE ERROR.
DBh	Cartridge present; no cartridge expected. HARDWARE ERROR.
DCh	Time-out when finding Absolute Frame Count of append point. MEDIUM ERROR.
DDh	Initialization error. HARDWARE ERROR.
DEh	Buffer controller detected underflow. HARDWARE ERROR.
DFh	Buffer controller detected overflow. HARDWARE ERROR.
E0h	Buffer controller detected parity error. HARDWARE ERROR.
E1h	Overflow in servo message to main 68000 processor. HARDWARE ERROR.
E2h	System log on tape is unreadable. MEDIUM ERROR.
E3h	Tape either blank or completely unreadable. BLANK CHECK.
E4h	Tape not in valid DDS format. MEDIUM ERROR, with Additional Sense of 3002h (cannot read media, incompatible format).
E5h	Parity error in reading track checksums out of buffer RAM. HARDWARE ERROR.
E6h	Failure in position controller's internal state machine. HARDWARE ERROR.
E7h	Unable to find target position on tape. MEDIUM ERROR.
EEh	Failed to measure tracking calculation; not enough samples to calibrate time-tracking properly.
F0h	Device command rejected because a previous command failed. HARDWARE ERROR.
F1h	Invalid command sequence. HARDWARE ERROR.
F2h	Invalid tape length.
F3h	Unsupported tape inserted. MEDIUM ERROR.

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Code	Description
F4h	Cleaning sequence occurred. Only logged in EEPROM for firmware earlier than version V10.
F5h	Invalid command opcode received from buffer. HARDWARE ERROR.
F6h	Invalid device parameter received. HARDWARE ERROR.
F7h	Defect in device firmware. HARDWARE ERROR.
F8h	Invalid tape format. HARDWARE ERROR.
F9h	No tape present; tape expected. HARDWARE ERROR.

Chapter 5. Service

This chapter provides instructions for replacing storage system assemblies and parts. This chapter also includes exploded views of deskside and rackmount storage systems, and part numbers for replaceable parts.

WARNING! The procedures in this chapter should only be performed by a qualified service representative. If you are not a qualified service representative, performing these procedures may result in personal injury or loss of data.

CAUTION! Check with system administrator before powering down the system.

Tools Required

- T10 Torx® driver
- T15 Torx® driver
- T25 Torx® driver
- Large flat-bladed screwdriver
- Small flat-bladed screwdriver (< 4 inches long, 0.25 inch wide)
- 3/8-inch nut driver
- deep socket
- nut driver
- needle-nose pliers

Door Assembly

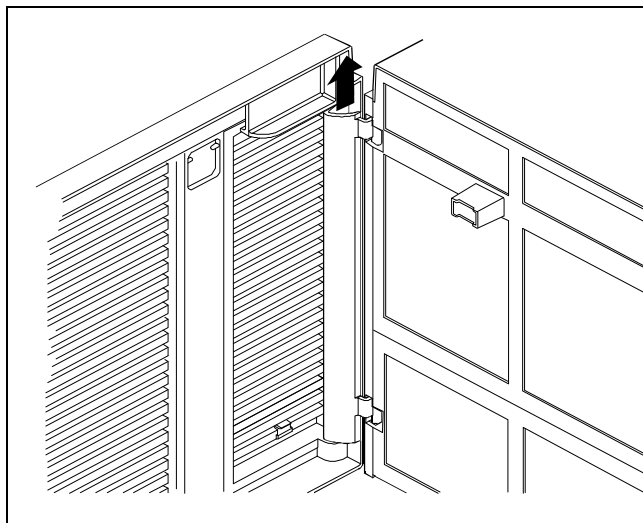
Deskside Door

To replace the deskside door (Figure 32):

1. Unlock the security lock.
2. Open the door to 90 degrees from the closed position.
3. Move the hinged side toward the left and rear.
4. Remove the door by lifting it up and out toward the front.
5. Replace the door by lowering the hinges onto the enclosure hinge bracket.

NOTE! The replacement door includes a switch cover, security lock, two light pipes, and a latch. Keys are not included with the replacement door.

Figure 32. Replacing the Deskside Door

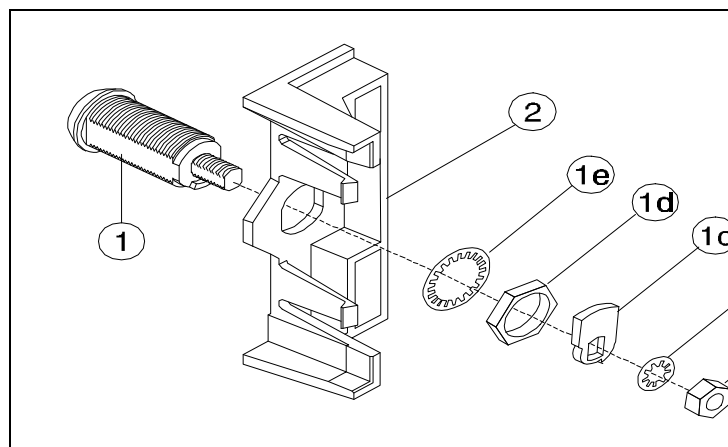


Deskside Security Lock and Latch

To replace the deskside security lock and latch (Figure 33):

1. Using a 3/8 inch nut driver, remove the #10 nut (1a), lock washer (1b), and pawl (1c).
2. Use a 19 mm deep socket to remove the M12 nut (1d).
3. Remove the lock washer (1e).
4. Remove the latch (2) and security lock (1).
5. Install the security lock parts in reverse order, ensuring the key slot is pointing up and the pawl is positioned to allow the lock to turn outward to lock.

Figure 33. Replacing the Deskside Security Lock



1 - Security Lock
1a - #10 Nut
1b - #10 Lock Washer
1c - Pawl

1d - M12 Nut
1e - M12 Lock Washer
2 - Door Latch

Deskside Switch Cover

To replace the deskside switch cover:

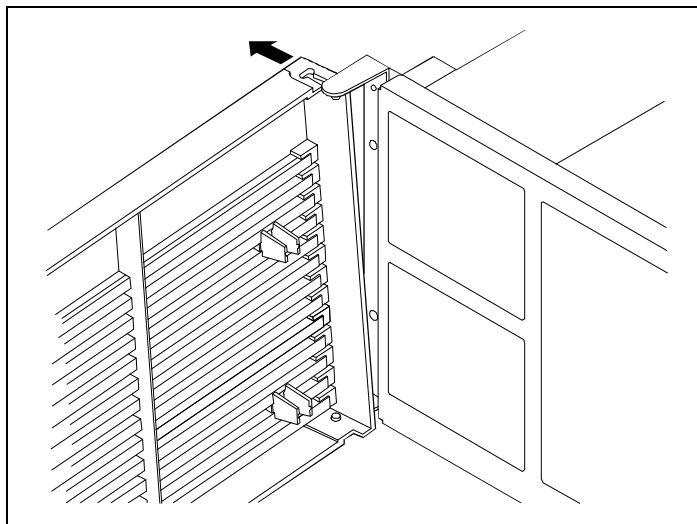
1. Press the switch cover outward from behind the door.
2. Snap the switch cover in place from the front of the door.

Rackmount Door

To replace the rackmount door (Figure 34):

1. Open the door to a position 90 degrees from the closed position.
2. Center the top hinge pin in the door's top hinge pin slot.
3. Push the top of the door top outward, so the hinge pin exits through the hinge pin slot.
4. Pull the door up and free it from the bottom hinge pin.
5. Replace the door by lowering the door's bottom hinge pin hole onto the bottom hinge pin.
6. Push the top hinge pin slot into the top hinge pin until it snaps into place.

Figure 34. Replacing the Rackmount Door



Rackmount Switch Cover

To replace the rackmount switch cover:

1. Press the switch cover outward from behind the door.
2. Snap the switch cover in place from the front of the door.

Rackmount Door Handle

To replace the rackmount door handle:

1. Squeeze the securing tab at the top of the handle.
2. Press the handle outward from behind the door.
3. Replace the door handle by snapping it in place.

Rackmount Door Snap

To replace the rackmount door snap:

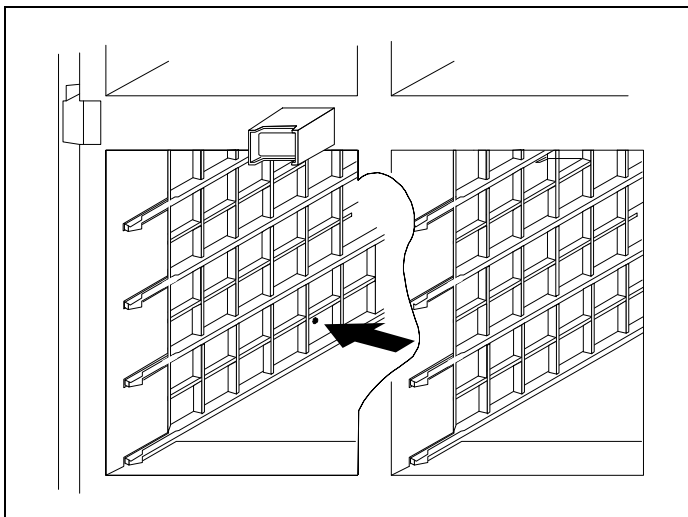
1. Align the door snap with the alignment pins on the right mounting flange.
2. Secure the door snap with a T15 screw.

Deskside Side Panel

To replace a deskside side panel (Figure 35):

1. Remove the modules from the two lower bay slots.
2. Locate the removal access hole inside the panel.
3. Holding the outside of the side panel and pressing slightly upward, insert a small screwdriver into the removal access hole in the direction of the arrow, pressing the panel outward.
4. Move the side panel upward to release it from the hook slots at the top and bottom of the enclosure.
5. Replace the side panel by positioning the hooks into the slots and pushing the panel downward.

Figure 35. Locating the Side Panel Removal Access Hole



Deskside Pedestal Base

CAUTION! Before removing the pedestal bases, disconnect cables to prevent stressing the cables and connectors.

To remove a deskside pedestal base (Figure 45):

1. Lay the enclosure on its top.
2. Push the pedestal base (12) toward the center to unlatch it, then lift the outer edge.
3. To replace a pedestal base, insert the inner tabs then snap the outside edge in place.

Backplane Assembly

Deskside Backplane Assembly

CAUTION! The following procedures require that you turn off the storage enclosure and make it inaccessible. Check with the system administrator before proceeding.

To replace the deskside backplane assembly (Figure 45):

1. Disconnect the ac power cords and SCSI interface cables.
2. Remove all modules from the bays.
3. Remove two captive screws (17) from the rear panel (5).
4. Tilt the top of the rear panel outward and remove it.
5. Remove nine M4/T15 screws (14) from the backplane assembly (13).
6. Remove the four outer M3 nuts (15) from the ac power adapters.
7. Remove the backplane assembly.
8. Reassemble the backplane assembly in reverse order. Ensure that the flat washers (16) are still on the ac power adapter studs, before replacing the backplane assembly. Align the power switch push rod (19) with the power switch on the backplane assembly and check for proper operation.

Rackmount Backplane Assembly

CAUTION! The following procedures require that you turn off the storage enclosure and make it inaccessible. Check with the system administrator before proceeding.

To replace the rackmount backplane assembly (Figure 46):

1. Disconnect the AC Power cords and SCSI interface cables.
2. Remove all modules from the bays.
3. Remove eight standoffs (23) from four SCSI connectors with a flat-bladed screwdriver.
4. Remove eleven M4/T15 screws (14).
5. Remove the backplane assembly (24).
6. Reassemble the backplane assembly in reverse order, ensuring that it is seated properly. Align the power switch push rod (19) with the power switch on the backplane assembly and check for proper operation.

SCSI Bus Reset Switch

CAUTION! Changing the default factory settings on the SCSI bus reset switch may cause operating system conflicts for the host computer. The switch is covered with a label that states “Factory Set Only”.

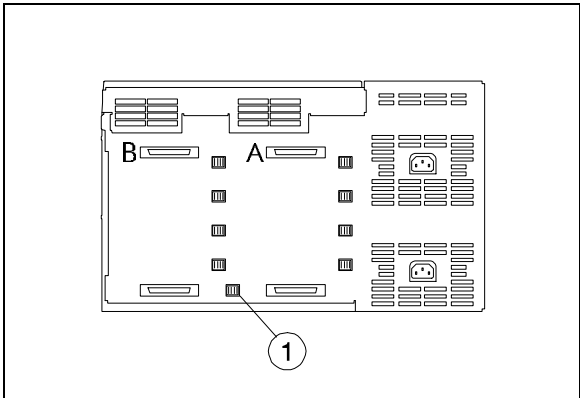
NOTE! A SCSI reset is a high priority interrupt. The SCSI bus reset option is used when the host controller or software requires a SCSI reset to be sent as notification of device removal or power shutdown.

The default setting for the SCSI bus reset switch is all switch segments enabled. The switch is enabled when the host controller or software requires a SCSI reset to be sent as notification of disk removal or power shutdown.

The SCSI bus reset switch is visible on the rackmount rear panel (see Figure 36, item 1). To locate the switch on the deskmount rear panel, remove the two T15 screws (see Figure 37, item 2), then remove the rear panel (see Figure 37, item 3) to expose the switch (see Figure 37, item 1). Figure 38 shows the switch segments on the SCSI bus reset switch and Table 23 shows the switch functions.

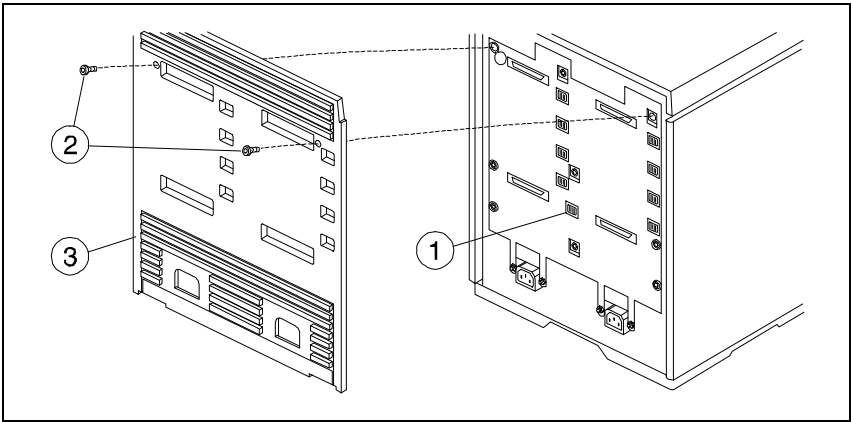
NOTE! Even when bus A and bus B are connected to form one bus, the SCSI bus reset switches function independently.

Figure 36. Rackmount SCSI Bus Reset Switch



1 - Rackmount SCSI Bus Reset Switch

Figure 37. Deskside SCSI Bus Reset Switch



1 - Deskside Rear Panel
2 - T15 Screws (2)

3 - Deskside SCSI Bus Reset Switch

Figure 38. SCSI Bus Reset Switch Default Settings

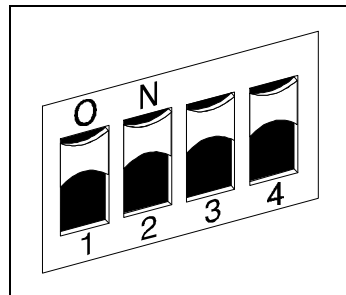


Table 23. SCSI Bus Reset Switch Functions

	Switch 1: Bus B Power Detect	Switch 2: Bus B Module Detect	Switch 3: Bus A Power Detect	Switch 4: Bus A Module Detect
Switch Enabled (Up, Default):	SCSI bus B is <i>reset</i> if one of these events occurs: <ul style="list-style-type: none"> • The power switch is cycled. • Both power cords are unplugged. • The input voltage limits are exceeded on both power supplies. • Both power supplies shut down. 	SCSI bus B is <i>reset</i> if a storage module is inserted or removed.	SCSI bus A is <i>reset</i> if one of these events occurs: <ul style="list-style-type: none"> • The power switch is cycled. • Both power cords are unplugged. • The input voltage limits are exceeded on both power supplies. • Both power supplies shut down. 	SCSI bus A is <i>reset</i> if a storage module is inserted or removed.
Switch Disabled (Down):	SCSI bus B is <i>not reset</i> if one of the above events occurs.	SCSI bus B is <i>not reset</i> if a storage module is inserted or removed.	SCSI bus A is <i>not reset</i> if one of the above events occurs.	SCSI bus A is <i>not reset</i> if a storage module is inserted or removed.

Power Button and Push Rod

To replace the power button and push rod in either storage system (Figure 45 or Figure 46):

1. Remove the backplane assembly.
2. Pull out the power button (21) with pliers and remove it.
3. Remove the spring (20).
4. Slide the push rod (19) out of the rear of the chassis.
5. Reassemble the parts in the reverse order, holding the push rod while snapping the button onto the rod.

NOTE! (1) The rear of the push rod is angled upward to fit the switch on the backplane assembly. (2) The spring fits between the enclosure and the power button. (3) The vertical mark on the button should point upward.

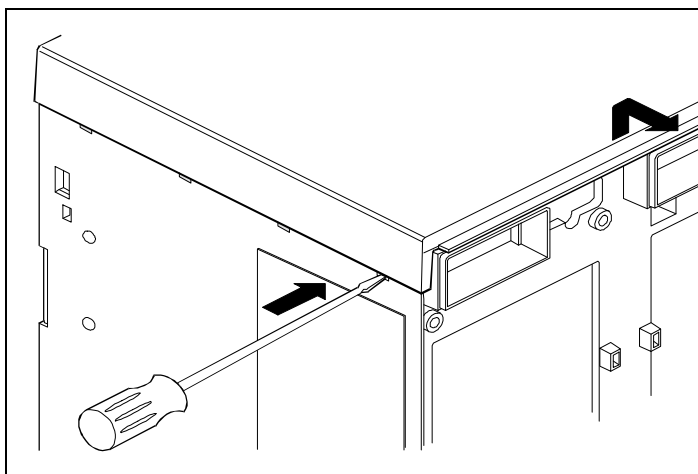
6. Check for proper operation.

Top Cover

To replace the top cover on either storage system (Figure 39):

1. Turn off the storage system and disconnect power and SCSI cables.
2. Remove one of the following parts:
 - Deskside: the rear cover (see Figure 45, item 2).
 - Rackmount: the backplane assembly (see Figure 46, item 24).
3. Insert a flat-bladed screwdriver into the slot shown in Figure 39. Twist the screwdriver to open the latch and lift the rear of the top cover. The other latches should then release.
4. Hold the released side of the top cover up and repeat step 3 to release the other side.
5. Pull the top cover up and toward the rear to remove it.
6. To replace the top cover, push the front edge of the top cover onto the enclosure, then push the top cover downward until all latches are secured.
7. Replace the rear cover (deskside) or backplane assembly (rackmount), SCSI cables and power cords.
8. Check for proper operation.

Figure 39. Replacing the Top Cover



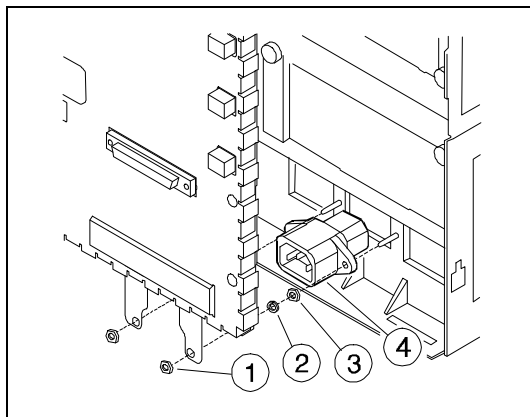
AC Power Adapter

Deskside AC Power Adapter

To replace the deskside ac power adapter (Figure 40):

1. Remove the power module and the rear cover.
2. Remove the two M3/T10 nuts (1) from the backplane tabs.
3. Remove the backplane assembly.
4. Remove the two flat washers (item 2) and the two nuts (item 3).
5. Remove the ac power adapter (item 4).
6. Replace in reverse order, ensuring the flat washers are in front of the backplane tabs.

Figure 40. Replacing the Deskside AC Power Adapter



- | | |
|---------------------|----------------------|
| 1 - M3/T10 Nut (2) | 3 - M3/T10 Nut (2) |
| 2 - Flat Washer (2) | 4 - AC Power Adapter |

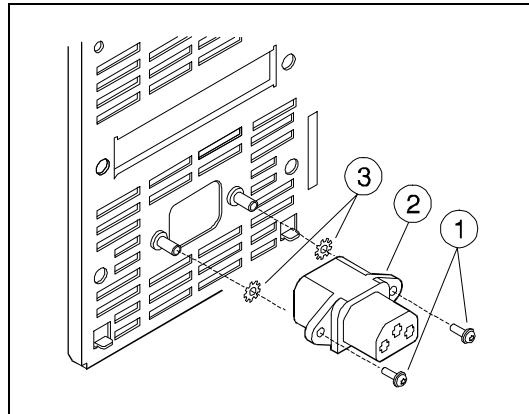
Rackmount AC Power Adapter

To replace the rackmount ac power adapter (Figure 41):

1. Remove the power module.
2. Remove two T10 screws (item 1)
3. Remove two star washers (item 3).
4. Remove the ac power adapter (item 2).
5. Replace the ac power adapter in reverse order, ensuring the lock washers are located between the ac power adapter and the rear of the chassis.

NOTE! Put the screws and washers on the power adapter, then fasten the entire assembly at once.

Figure 41. Replacing the Rackmount AC Power Adapter



- 1 - M3/T10 Screw (2) 3 - Star Washer (2)
2 - AC Power Adapter

Module Cam Lever

To replace the module cam lever:

1. Squeeze the pivot tabs with pliers (see Figure 42) and lift the cam lever off of the pivot.
2. Position the locking bracket (Figure 43, item 2) over the track notch (Figure 43, item 3) and lift it out of the track.
3. To replace the cam lever, insert the locking bracket into the notch, then snap the cam lever onto the pivot (Figure 44).

Figure 42. Removing Module Cam Lever from Pivot

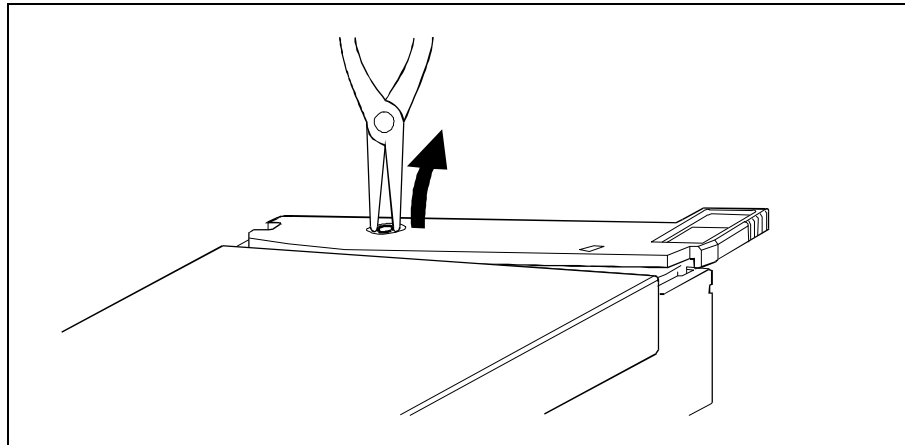


Figure 43. Removing Module Cam Lever from Track

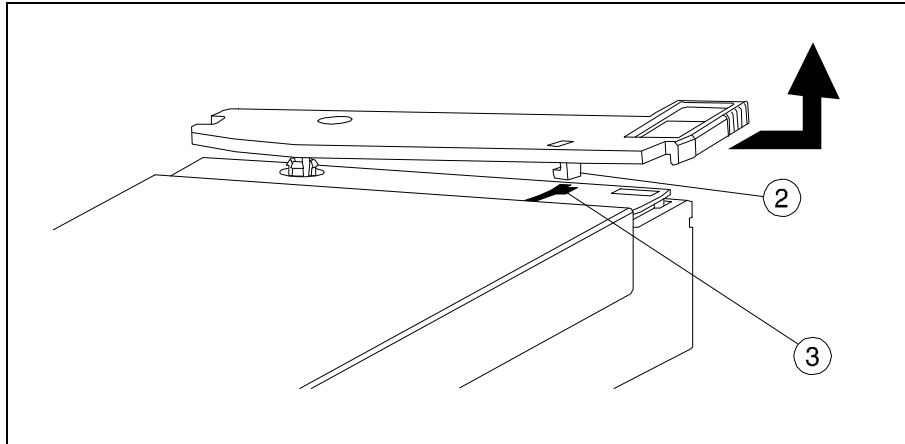
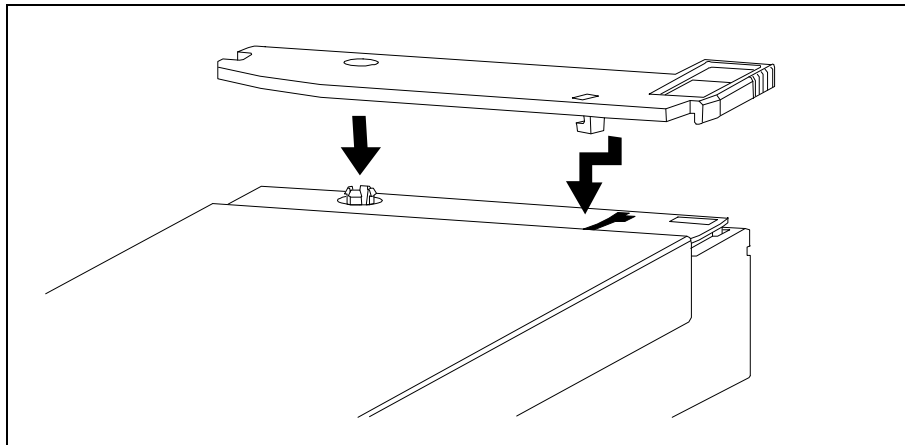
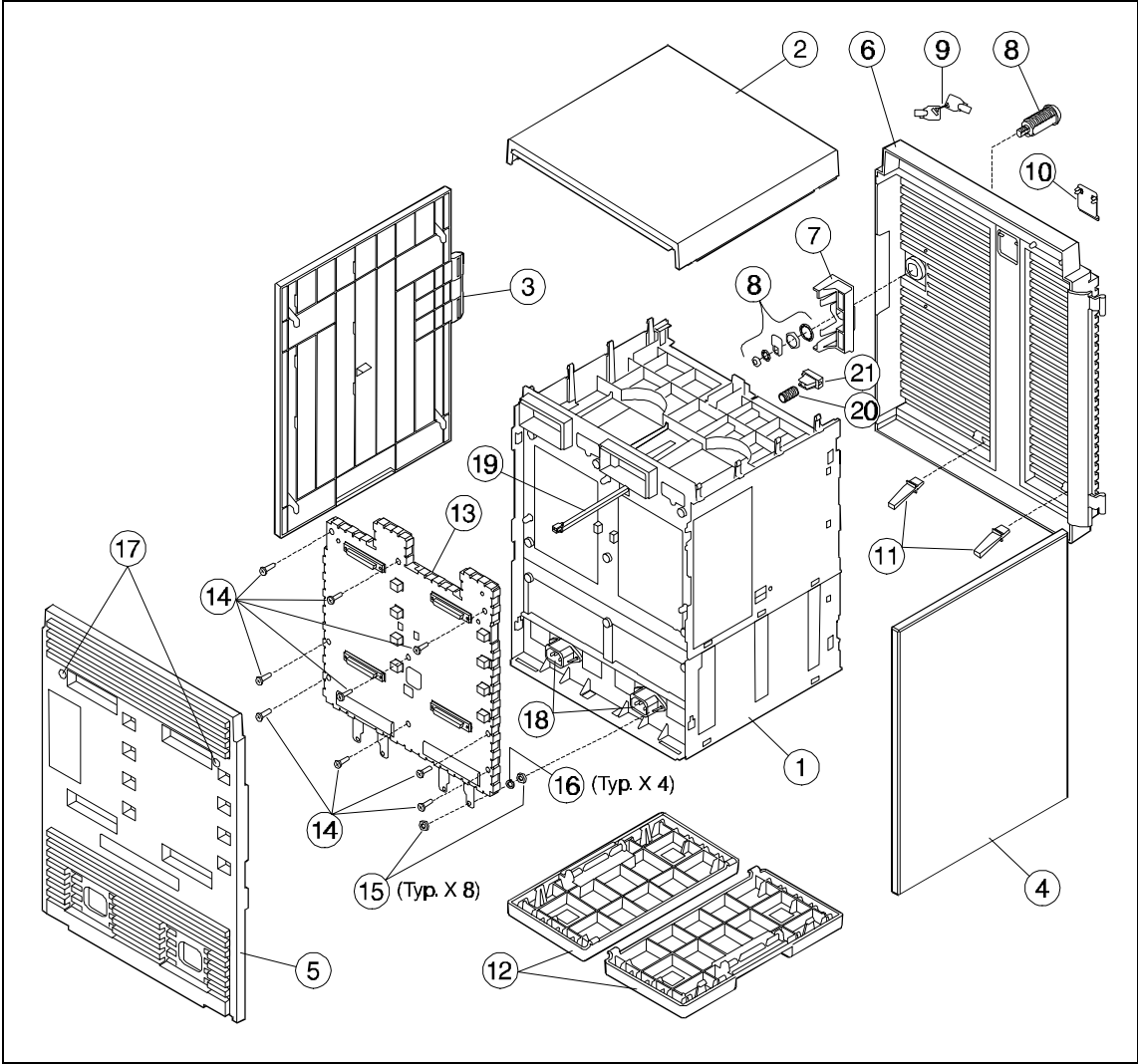


Figure 44. Replacing Module Cam Lever



Enclosure Replaceable Parts

Figure 45. Deskside Enclosure Replaceable Parts



Service

Figure 46. Rackmount Enclosure Replaceable Parts

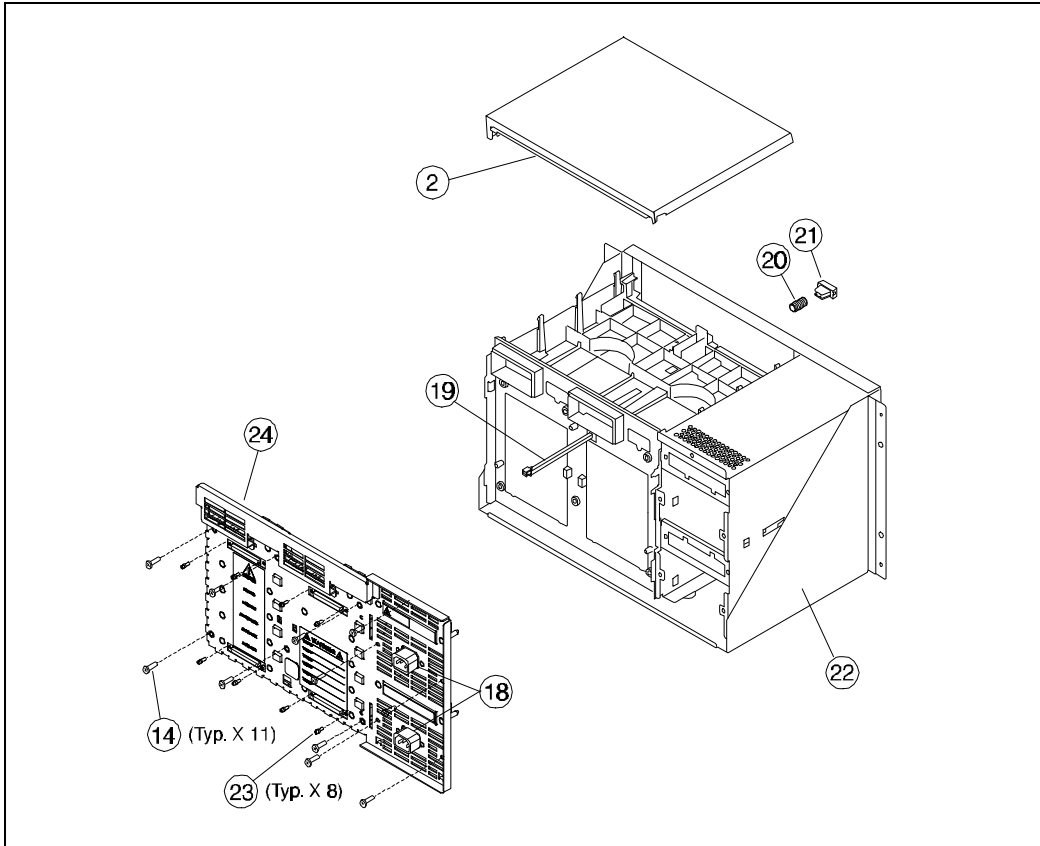


Figure 47. Rackmount Kit Replaceable Parts

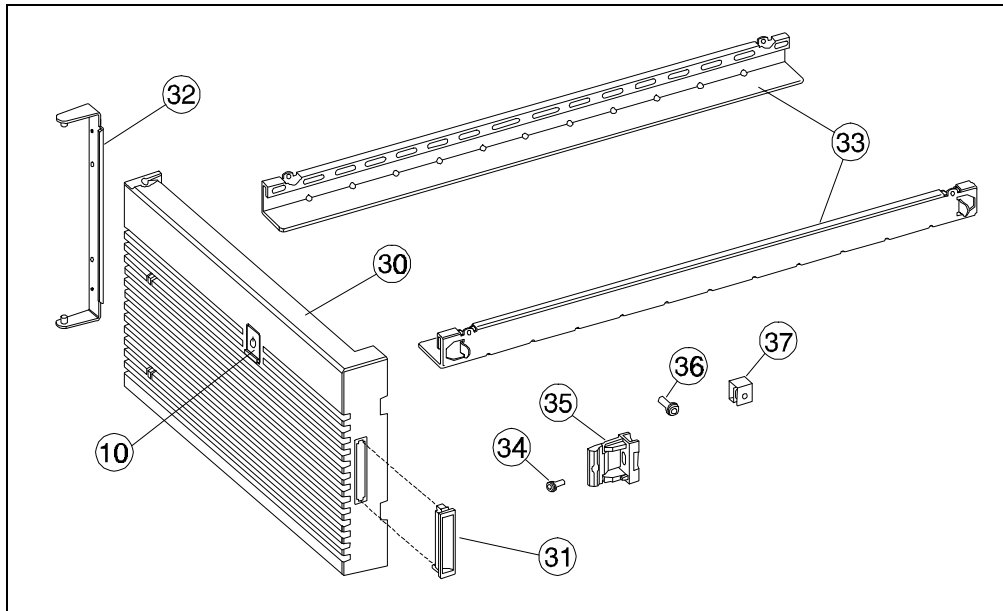
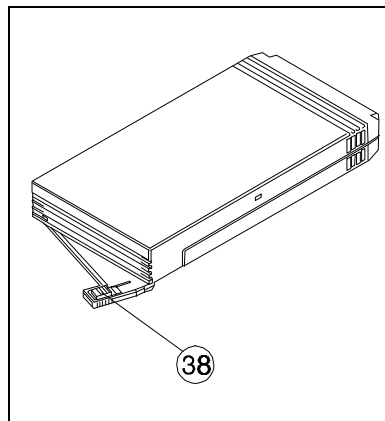


Figure 48. Module Replaceable Parts



Service
Enclosure Replaceable Parts

Table 24. A3311A Enclosure Parts List

Figure No.	Item No.	HP Part No.	Description	Qty.
45	1	<i>Not Available</i>	A3311A Deskside Enclosure	1
45	2	C3573-40053	Top Cover	1
45	3	C3573-40066	Right Panel	1
45	4	C3573-40065	Left Panel	1
45	5	<i>Not Available</i>	Rear Panel	1
45	6	A3311-00007	Door Assembly, incl. items 7, 8, 10, and 11	1
45	7	C3595-40050	Front Door Latch	1
45	8	5181-7789	Security Lock	1
45	9	5181-7790	Security Key, set of 2	1
45	10	C3595-40031	Power Switch Cover	1
45	11	<i>Not Available</i>	Front Door Light Pipe	1
45	12	C3573-40070	Pedestal Base	2
45	13	A3311-69002	Backplane Assembly	1
45	14	0515-2270	Screw, backplane, T15, M4 x 16mm	9
45	15	0535-0028	Nut, backplane, T10, M3 x 5.5mm, with captive ext. washer	8
45	16	3050-1131	Washer, M3, external	4
45	17	5181-7791	Screw, rear panel, T15, M4 x 10mm	2
45	18	5181-7779	AC Power Adapter	2
45	19	C3595-40009	Power Push Rod	1
45	20	<i>Not Available</i>	Compression Spring	1
45	21	C3595-40010	Power Push Button	1
N/A	N/A	C3573-60068	Shipping Package, A3311A	1

Table 25. A3312A/12AZ Enclosure Parts List

Figure No.	Item No.	HP Part No.	Description	Qty.
46	22	<i>Not Available</i>	A3312A Field Rackmount Enclosure	1
46	22	<i>Not Available</i>	A3312AZ Factory Rackmount Enclosure	1
46	2	C3573-40053	Top Cover	1
46	18	5181-7779	AC Power Adapter	2
46	19	C3595-40009	Power Push Rod	1
46	20	<i>Not Available</i>	Compression Spring	1
46	21	C3595-40010	Power Push Button	1
46	23	5181-7796	Standoff	8
46	24	A3312-69002	Backplane Assembly	1
46	14	0515-2270	Screw, backplane, T15, M4 x 16mm	11
46	25-29	<i>Not Available</i>	<i>Not Available</i>	—
47	30	A3312-00004	Front Door Assembly (Parch. White), incl. items 10 and 31	1
47	30	A3312-00104	Front Door Assembly (Qtz. Gray), incl. items 10 and 31	1
47	31	C2786-40003	Door Handle	1
47	10	C3595-40031	Power Switch Cover	1
47	32	C3573-00057	Hinge Bracket	1
47	33	C2786-00002	Rail	2
47	34	0515-1357	Screw, latch, T15, M4 x 10mm	1
47	35	C2786-40002	Door Snap	1
47	36	0515-2992	Screw, rail, T25, 6-32 x 0.625	8
47	37	0590-2318	Nut, captive, rail, 6-32	8
N/A	N/A	C3573-60040	Shipping Package, A3312A	1

Service
Enclosure Replaceable Parts

Table 26. Enclosure Accessories Parts List

Figure No.	Item No.	HP Part No.	Description	Qty.
N/A	N/A	A1658-62016	SCSI Terminator, single-ended narrow, active (A3328A)	(1)
N/A	N/A	A1658-62024	SCSI Terminator, wide differential, passive (C2905A)	(1)
N/A	N/A	8120-1351	*Power Cord, UK, BS 1363/A	(1)
N/A	N/A	8120-1369	*Power Cord, Austral., AS 3112	(1)
N/A	N/A	8120-1689	Power Cord, Cont. Europe, GMBH/CEE7	(1)
N/A	N/A	8120-1751	Power Cord, N. Am., NEMA	(1)
N/A	N/A	8120-3996	*Power Cord, N. Am., NEMA 6-15P	(1)
N/A	N/A	8120-2104	Power Cord, Switz., SEVTYP12	(1)
N/A	N/A	8120-2956	Power Cord, Denmark, MDPP/CEE	(1)
N/A	N/A	8120-4211	*Power Cord, S. Africa, IEC 83-B1	(1)
N/A	N/A	8120-4753	*Power Cord, Japan, JIS C 8303	(1)
*Female connectors are type IEC 320-1 C13				

Table 27. Exchange Parts List

Exchange Part Number	Description*
A3517-69003	2 GB SE LP 7200 Disk Module
A3318-69003	2 GB DF LP 7200 Disk Module
A3322-69001	4 GB SE DDS2 HH Tape Module
A3646-69002	4.3 GB DF LP 7200 Disk Module
A3647-69002	4.3 GB DF LP 7200 Disk Module
A3319-69001	4.3 GB SE HH Disk Module
A3320-69002	4.3 DF DF HH Disk Module
A5238-69001	9.1 GB DF LP 7200 Disk Module
A5285-69001	9.1 GB DF LP 7200 Disk Module
A3649-69002	9.1 GB DF HH 7200 Disk Module
A5286-69001	18.2 GB DF LP 7200 Disk Module
A5239-69001	18.2 GB DF HH 7200 Disk Module
A3640-69001	12 GB SE HH DDS-3 Tape Module
A3538-69002	Power Module
N/A	Fan Module
C3595-40007**	Module Cam Handle***
A3311-69001	Deskside Backplane
A3312-69001	Rackmount Backplane
*SE=Single-Ended Wide; DF=Wide Differential; HH=Half-Height (1.6"); LP=Low Profile (1"); 7200=7200 rpm spindle speed **HP Part No. ***Figure 48, item 38	

Table 28. Cables

HP Product Number	Equiv Option	Description	Special App Notes
A1658-62018	001	0.9 meter 68PHD-68PHD M/M	Single Bus
A1658-62018	801	0.9 meter 68PHD-68PHD M/M	
A1658-62020	802	2.5 meter 68PHD-68PHD M/M	
A1658-62021	803	5 meter 68PHD-68PHD M/M	
A1658-62022	804	10 meter 68PHD-68PHD M/M	
A3639-63011	806	1 meter 68PHD-68PHD LP/LP	N/A4800A/FWD
A3639-63012	807	2.5 meter 68PHD-68PHD LP/LP	N/A4800A/FWD
A3639-63013	808	5 meter 68PHD-68PHD LP/LP	N/A4800A/FWD
A3639-63014	809	10 meter 68PHD-68PHD LP/LP	N/A4800A/FWD
5183-2651	811	1 meter VHDCI-68PHD	N/A5149A,A5150A,A5159A/SE*, FWD,LVD**
5183-2653	812	2.5 meter VHDCI-68PHD	N/A5149A,A5150A,A5159A/SE*, FWD,LVD**
5183-2654	813	5 meter VHDCI-68PHD	N/A5149A,A5150A,A5159A/SE*, FWD,LVD**
5183-2655	814	10 meter VHDCI-68PHD	N/A5149A,A5150A,A5159A/SE*, FWD,LVD**
A3639-63015	841	2 meter V VHDCI-VHDCI/68PHD	N(HA)/A5159A-A5159/FWD
A3639-63016	842	2 meter V VHDCI-VHDCI (ILT) / 68PHD	N(HA)/A5159A-A5159/FWD
A3639-63017	843	2 meter V 68PHD-VHDCI / 68PHD	N(HA)/A5159A-Legacy/FWD
A3639-63018	844	2 meter V 68PHD-VHDCI (ILT) / 6PHD	N(HA)/A5159A-Legacy/FWD
A3639-63019	B25	4 meter V VHDCI-VHDCI / 68PHD	N(HA)/A5159A-A5159/FWD
A3639-63020	B26	4 meter VHDCI-VHDCI (ILT) / 68PHD	N(HA)/A5159A-A5159/FWD
A3639-63021	B27	4 meter 68PHD-VHDCI / 68PHD	N(HA)/A5159A-Legacy/FWD
A3639-63022	B28	4 meter 68PHD-VHDCI (ILT) / 68PHD	N(HA)/A5159A-Legacy/FWD
5063-1214	821	1 meter 50PLD-68PHD M/M	
5063-1269	822	2 meter 50PLD-68PHD M/M	

Table 28. Cables

HP Product Number	Equiv Option	Description	Special App Notes
5063-5323	823	1 meter 50PLD-68PHD F/M	
5181-7705	825	1 meter 50PLD-68PHD M/M	
C2962A	826	1.5 meter 50PHD-68PHD M/M	
5181-7707	827	2 meter 50PHD-68PHD M/M	
5181-8686	840	2 meter 68PHD M/M	
A4801-63002	851	10 meter 68PHD-68PHD (ILT) M/M	
A4801-63012	871	2/5 meter V 68PHD (ILT) M	
A4801-63010	873	2/3 meter V 68PHD (ILT) M	
A4801-63004	875	5 meter 68PHD (ILT) – 68PHD M/M	
<p>* Except 10 meter cable ** 40 MHz speeds only Description 68PHD = 68 Pin High Density 50PLD = 50 Pin Low Density LP/LP = Low Profile to Low Profile M/M = Male to Male F/M = Female to Male VHDCI = Very High Density Cable Interconnect (Standard) ILT = Inline Terminator Special Application Notes: <i>Servers</i> N = N-Class N (HA) = N-Class in High Availability Configuration V = V-Class <i>HBA's</i> A4800A = single port FWD A5149A = single port SE or LVD, auto negotiating A5150A = dual port SE or LVD, auto negotiating A5159A = dual port FWD <i>Interfaces</i> SE = Single-Ended FWD = Fast / Wide Differential LVD = Low Voltage Differential</p>			

Table 29 Supported Cabinets

HP Product Number	Description
A1833A	1.1 meter EIA cabinet for MPE systems (Legacy Cabinets)
A1834A	1.6 meter EIA cabinet for MPE systems (Legacy Cabinets)
A1896A	1.1 meter EIA cabinet for HP-UX systems (Legacy Cabinets)
A1897A	1.6 meter EIA cabinet for HP-UX systems (Legacy Cabinets)
A4901A	1.6 meter EIA cabinet for HP-UX systems (A4900 Series Cabinets)
A4902A	1.96 meter EIA cabinet for HP-UX systems (A4900 Series Cabinets)
A5135A	1.6 meter EIA cabinet for MPE systems (A4900 Series Cabinets)
A5136A	1.96 meter EIA cabinet for MPE systems (A4900 Series Cabinets)

Appendix A. A3312A Rackmount Installation

This appendix shows how to install the A3312A into a 1.1-meter, 1.6-meter, or 2.0-meter EIA cabinet.

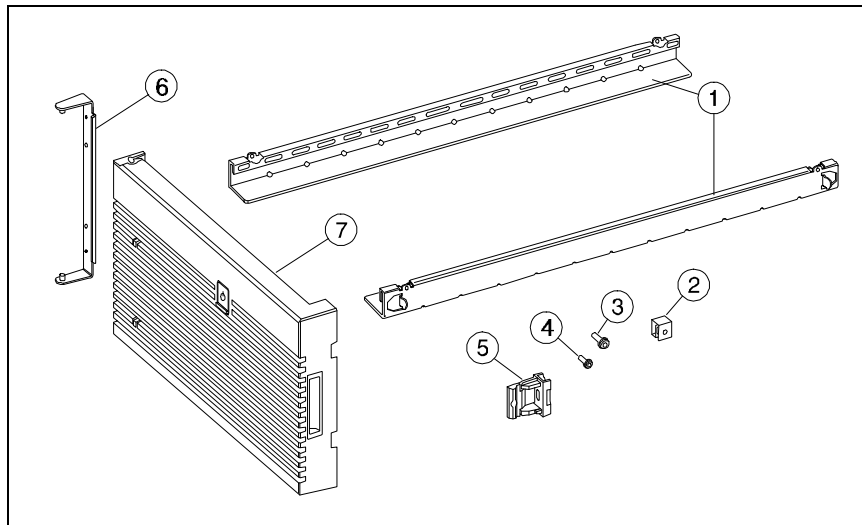
WARNING! The A3312A weighs 41kg (90 lb) fully loaded. To avoid personal injury, remove all modules before installation into the EIA cabinet. The empty weight is less than 15 kg (27 lb). Also, install A3312A storage systems first into the lower bays of the EIA cabinet.

CAUTION! The A3312A should be installed into an EIA cabinet only by your HP service representative.

To install the A3312A into an EIA cabinet:

1. Check the contents of the rackmount kit (see Figure 49). The number in parenthesis next to each item is the quantity of the item included in the kit.

Figure 49. A3312A Rackmount Kit

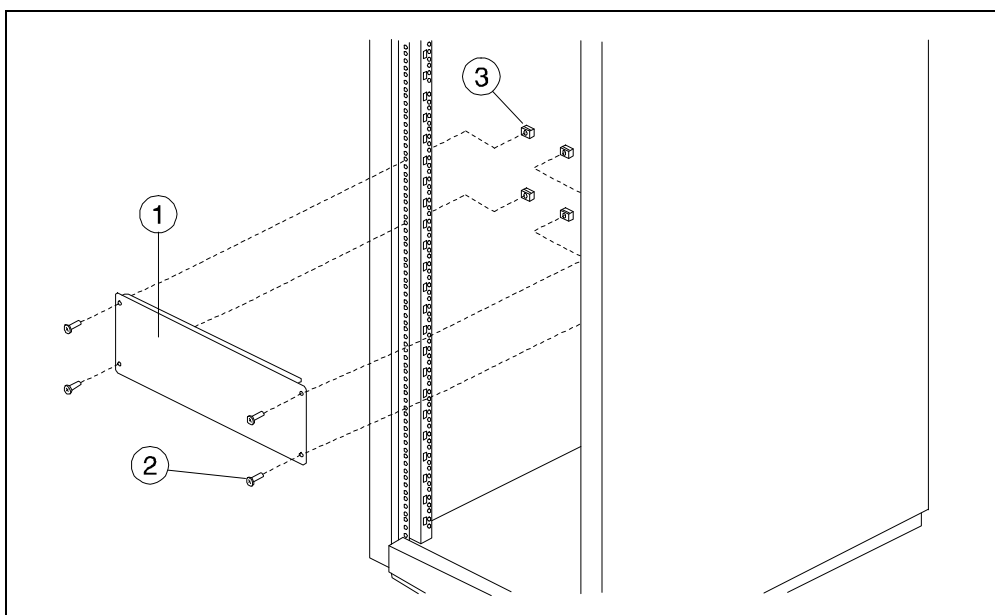


- | | |
|-----------------------|-----------------------|
| 1 - Support Rails (2) | 5 - Door Snap (1) |
| 2 - Clip Nut (8) | 6 - Hinge Bracket (1) |
| 3 - T25 Screw (8) | 7 - Door (1) |
| 4 - T15 Screw (1) | |

Appendix A. A3312A Rackmount Installation

- Remove the front and rear shipping panels, (Figure 50, item 1), eight T25 screws (2), and eight clip nuts (3) from the cabinet.

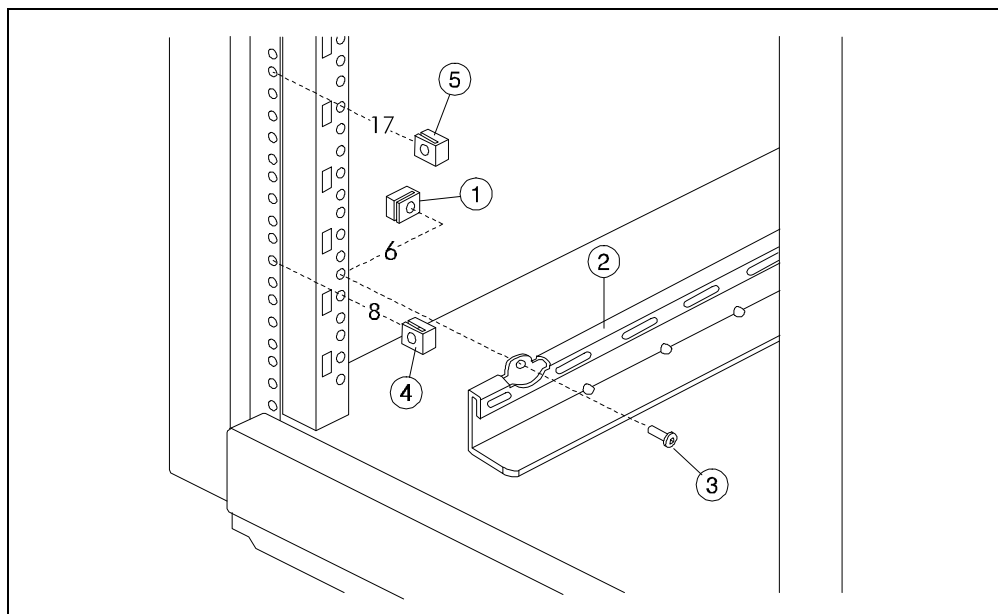
Figure 50. Removing Shipping Panels



Appendix A. A3312A Rackmount Installation

3. Install one clip nut (Figure 51, item 1) on each of the four rail standards on hole number 6, counting from the bottom of the cabinet. Secure the rails (2) with four T25 screws (3). See Table 30 for the rail standard holes to use when installing multiple storage systems.
4. Install two clip nuts on the right and left front ear standards: one clip nut (Figure 51, item 4) on hole number 8 and one clip nut (5) on hole number 17. See Table 30 for the ear standard holes to use when installing multiple storage systems.

Figure 51. Installing Clip Nuts and Rails



Rackmounting

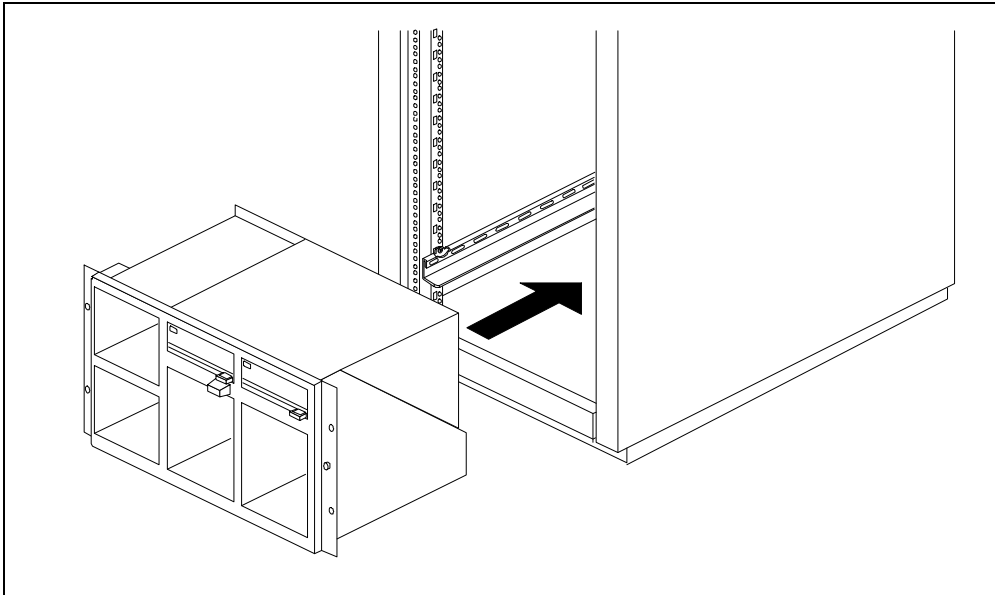
Table 30. Storage System Spacing in a 1.6-m EIA Cabinet

Storage System Number	Rail Standard Holes	Ear Standard Holes
5	62	64, 73
4	48	50, 59
3	34	36, 45
2	20	22, 31
1	6	8, 17

Appendix A. A3312A Rackmount Installation

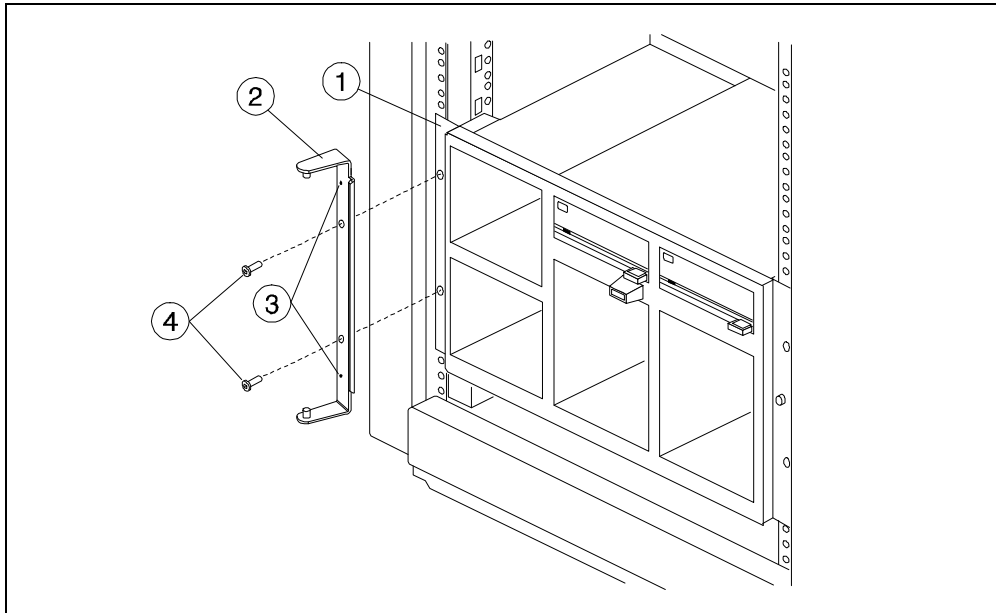
5. Slide the A3312A into the EIA cabinet (Figure 52).

Figure 52. Sliding the A3312A into EIA Cabinet



6. Install the hinge bracket (Figure 53, item 2) on the left mounting ear (1) using the alignment pins (3) as a guide. Secure the left mounting ear and hinge bracket with two T25 screws (4) through the hinge bracket and left mounting ear.

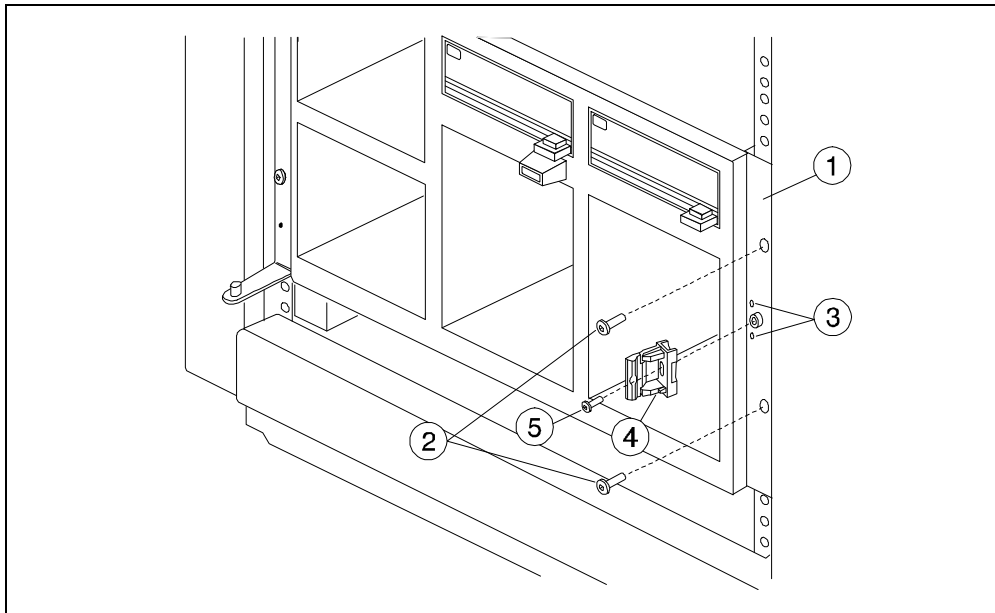
Figure 53. Installing Hinge Bracket and Securing Left Ear



Appendix A. A3312A Rackmount Installation

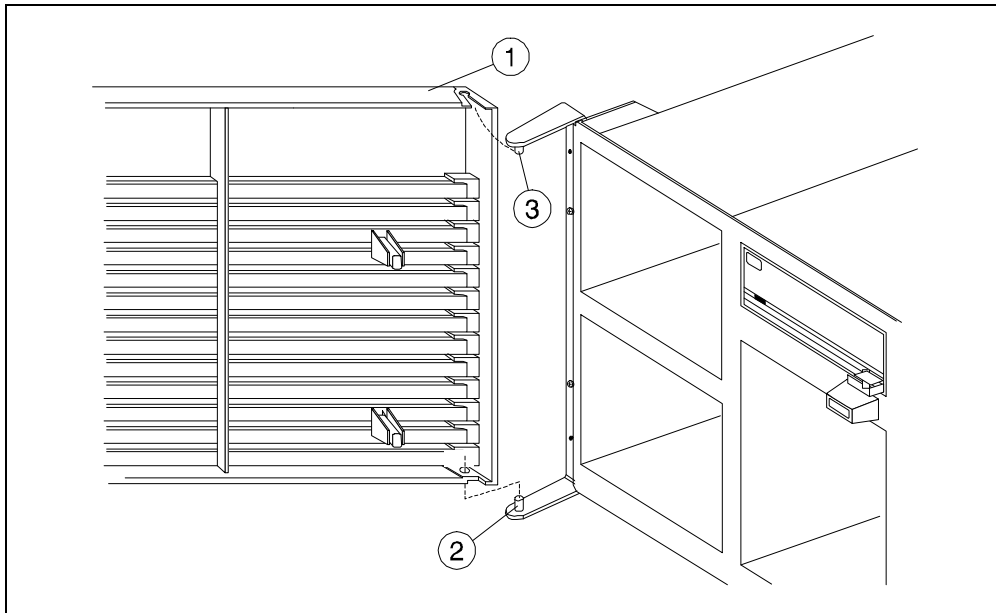
7. Install two T25 screws (Figure 54, item 2) through the right mounting ear (1).
8. Install the door snap (Figure 54, item 4) on the right mounting ear, using the alignment holes (3) as a guide. Secure the door snap with one T15 screw (5).

Figure 54. Securing Right Ear and Installing Door Snap



9. Install the door (Figure 55, item 1). Drop the lower corner mounting hole onto the lower hinge bracket pin (2) then swing the upper corner mounting slot into the upper hinge bracket pin (3). Gently press on the front upper left corner of the door and snap the upper corner into the hinge bracket pin.

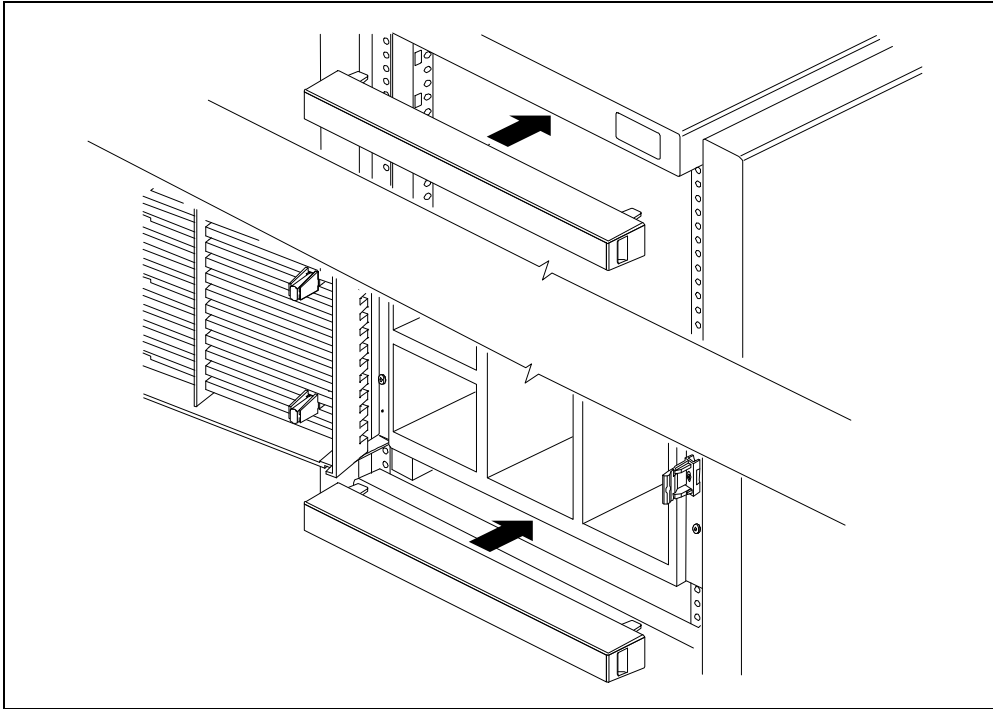
Figure 55. Installing the Door



Appendix A. A3312A Rackmount Installation

10. Repeat steps 1 through 9 to install additional A3312A storage systems.
11. Install one filler panel in the bottom EIA slot and one in the top EIA slot (Figure 56).

Figure 56. Installing EIA Filler Panels

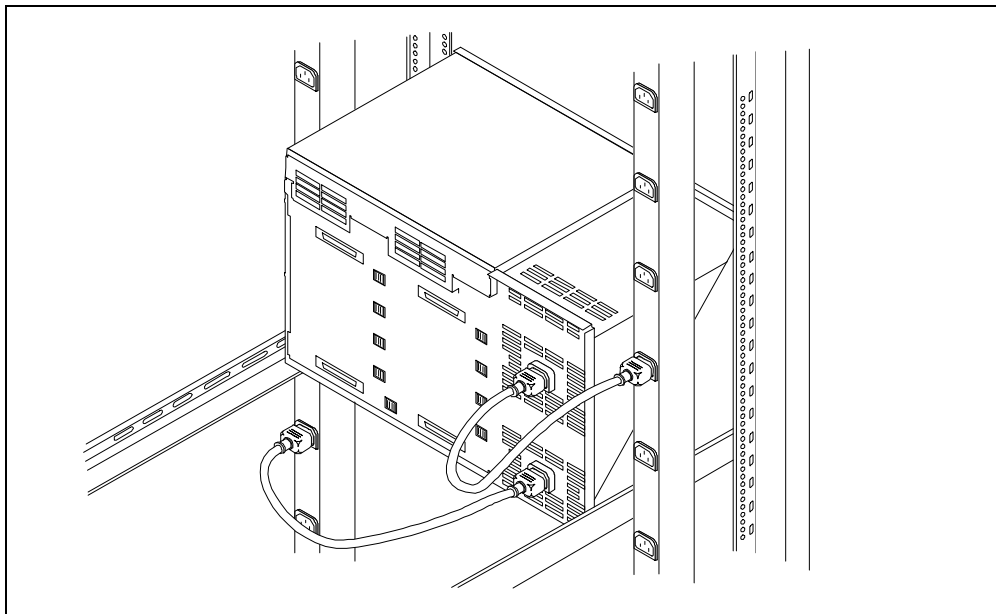


12. Complete the steps under “Installation Overview” in Chapter 2.
13. Connect the storage system power cords to the EIA cabinet power distribution units (PDUs) (see Figure 57).

CAUTION! To avoid exceeding the current rating of the PDU, the maximum number of storage systems that can be connected to one PDU is seven (with one power module each) or eight (with two power modules each).

NOTE! If the storage system contains two power modules, you can connect each power module into a separate PDU for greater redundancy.

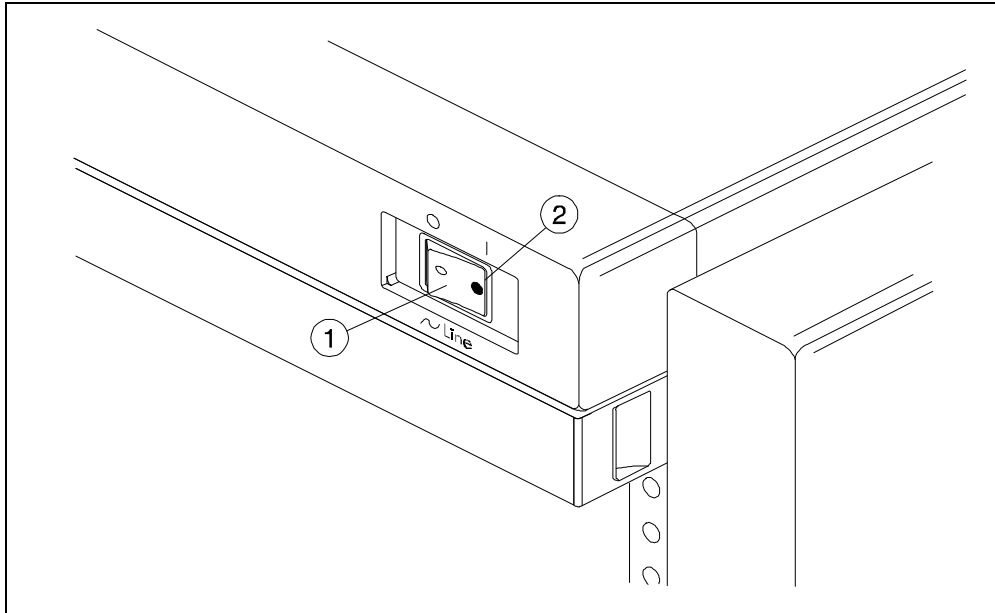
Figure 57. Connecting Power Cords to PDUs



Appendix A. A3312A Rackmount Installation

14. To power-on the EIA cabinet, press the cabinet power switch (Figure 58, item 1) to the power-on “1” position. The cabinet power light (2) should be green.

Figure 58. Powering-On the EIA Cabinet



Appendix A. A3312A Rackmount Installation

Rackmounting

Appendix B. Product Specifications

This appendix contains storage system enclosure and module specifications.

Table 31. Enclosure Specifications

Weight:	
Deskside Net, Min. Config. ¹ :	14 kg (31 lb)
Deskside Net, Max. Config. ² :	25 kg (55 lb)
Deskside Shipping, Min. Config. ¹ :	18 kg (40 lb)
Deskside Shipping, Max. Config. ² :	30 kg (66 lb)
Rackmount Net, Min. Config. ¹ :	16 kg (35 lb)
Rackmount Net, Max. Config. ² :	28 kg (62 lb)
Rackmount Shipping, Min. Config. ¹ :	22 kg (49 lb)
Rackmount Shipping, Max. Config. ² :	34 kg (75 lb)
Dimensions:	
Deskside Enclosure:	415 mm H x 310 mm W x 320 mm D (16.34 in x 12.2 in x 12.6 in)
Rackmount Enclosure:	263 mm H x 425 mm W x 265 mm D (10.35 in x 16.73 in x 10.43 in)
Deskside Packaging:	673 mm H x 406 mm W x 432 mm D (26.5 in x 15.98 in x 17.01 in)
Rackmount Packaging:	584 mm H x 508 mm W x 610 mm D (23 in x 20 in x 24.02 in)
Line Input Requirements:	
Input Power ³ :	400 W (120 Vac @ 3.3 A; 230 Vac @ 1.7 A)
Nominal Voltages:	100/120/127 Vac, 8 A max; 200/230 Vac, 4 A max
Inclusive Voltage Range:	88-140 Vac; 180-269 Vac
Nominal Frequencies:	60 Hz (120 Vac), 50 Hz (230 Vac)
Inclusive Frequency Range:	47.5 to 66 Hz
Fast Rise:	1 kV, 1 μsec duration, 1 pulse/cycle for 10 min
Surge Transient:	1 kV, 50 μsec duration, 1 pulse/cycle every 10 sec
Ringing Wave:	3 kV, 100 kHz
Brownout:	88/180 to 0 Vac over 30 min
Brownout Recovery:	0 to 88/180 Vac over 30 min
Transparent Line Surge:	293 Vac for 500 msec
Recoverable Line Surge:	298 Vac for 500 msec
Line Voltage Sag:	80.5 Vac for 500 msec
Line Dropout:	≤ 20 msec
Notes:	
1. Minimum Configuration is 2 fan modules, 1 power module, no disk modules	
2. Maximum Configuration is 2 fan modules, 2 power modules, eight 1-inch disk modules	
3. Worst case during spin-up; Maximum Configuration	

Appendix B. Product Specifications

Electromagnetic:	
Radiated:	5 V/m, 14 kHz to 1000 Mhz
Conducted:	3 Vrms, 30 kHz to 50 kHz; 1 Vrms, 50 kHz to 400 MHz
Magnetic:	47.5 Hz to 198 Hz @ 4 Gauss external field
Electrostatic Discharge:	1-10 kV operating; 1-25 kV nonoperating
Magnetic Interference, Nonop:	< 5.25 mGauss @ 4.6 m; < 2 mGauss @ 0.7 ft
Magnetic Interference, Operating:	< 5 mGauss p-p @ product surface
Magnetic Susceptibility:	47.5 Hz to 198 Hz @ 4 Gauss external field
Radiated Susceptibility:	3 V/m external field, 14 kHz to 1000 MHz
Conducted Susceptibility:	3 Vrms, 30 kHz to 50 kHz; 1 Vrms, 50 kHz to 400 MHz
ESD, Operating:	0 to 15 kV, air discharge
ESD, Nonop:	15 kV to 25 kV, air discharge
Heat Dissipation:	
Min. Config. ¹ :	66 W (225 Btu/hr; 57 kcals/hr)
Max. Config. ² :	177 W (603 Btu/hr; 152 kcals/hr)
Airflow Space:	102 mm (4.02 in) min. front and rear
Temperature:	
Operating (Disk/DDS Tape):	5° to 40° C (41° to 104° F)
Operating Gradient (Disk):	20° C/hr (68° F/hr) max
Operating Gradient (DDS Tape):	10° C/hr (50° F/hr) max
Nonop (Disk/DDS Tape):	-40° to 65° C (-40° to 149° F)
Nonop (DDS Tape Media):	-40° to 45° C (-40° to 113° F)
Nonop Gradient (Disk/DDS Tape):	20° C/hr (68° F/hr) max
Humidity:	
Maximum Wetbulb Temperature:	26° C (79° F)
Operating Gradient:	10% RH/hr
Operating (Disk Module):	8 to 80% RH (noncondensing)
Operating (DDS Tape Module w/Media):	20 to 80% RH (noncondensing)
Nonop (Disk Module):	5 to 90% RH (noncondensing)
Nonop (DDS Tape Module w/Media):	20 to 80% RH (noncondensing)
Altitude:	
Operating:	0 to 3,048 m (0 to 10,000 ft.)
Nonop:	3,048 to 4,572 m (10,000 to 15,000 ft.)
Shock:	
Operating ³ :	0.635 cm (0.25 in) tilt drop
Notes:	
1. Minimum Configuration is 2 fan modules, 1 power module, no disk modules	
2. Maximum Configuration is 2 fan modules, 2 power modules, eight 1-inch disk modules	
3. No damage; no data loss	

Appendix B. Product Specifications

Vibration:	
Operating Random:	≈ 0.21 g rms from 5 to 500 Hz (PSD of 0.0001 g ² /Hz from 5 to 350 Hz, 0 dB/octave, -6 dB/octave from 350 to 500 Hz; PSD of 0.00005 g ² /Hz at 500 Hz)
Nonop Random:	≈ 2.09 g rms from 5 to 500 Hz (PSD of 0.015 g ² /Hz from 5 to 100 Hz, 0 dB/octave, -6 dB/octave from 100 to 370 Hz; PSD of 0.008 g ² /Hz from 137 to 350 Hz, 0 dB/octave, -6 dB/octave from 359 to 500 Hz; PSD of 0.0039 g ² /Hz at 500 Hz, 0 dB/octave)
Nonop Swept Sine:	0.5 g (0-p) from 5 to 500 Hz
Acoustic Emissions:	< 5.9 bels

Table 32. Module Specifications

Fan Module:	
Weight:	0.45 kg (0.99 lb)
Dimensions:	39.5 mm H x 120 mm W x 240 mm D (1.56 in x 4.72 in x 9.45 in)
Type:	Radial blower
Power Module:	
Weight:	2.7 kg (5.95 lb)
Dimensions:	100 mm H x 120 mm W x 230 mm D (3.94 in x 4.72 in x 9.06 in)
Type:	N+1, active power factor correcting/current sharing, with int. axial fan
1-Inch Disk Module:	
Weight:	1.1 kg (2.43 lb)
Dimensions:	36.5 mm H x 120 mm W x 240 mm D (1.44 in x 4.72 in x 9.45 in)
Type:	2 GB, 4.3 GB SE/WD or 9.1 GB WD, SCSI-2, 7200 rpm
1.6-Inch Disk Module:	
Weight:	1.6 kg (3.53 lb)
Dimensions:	74 mm H x 120 mm W x 240 mm D (2.91 in x 4.72 in x 9.45 in)
Type:	18.2 GB WD, SCSI-2, 7200 rpm
1.6-Inch DDS Tape Module:	
Weight:	1.6 kg (3.53 lb)
Dimensions:	74 mm H x 120 mm W x 240 mm D (2.91 in x 4.72 in x 9.45 in)
Type:	4 GB (DDS-2, 1:1 DC) or 12 GB (DDS-3, 1:1 DC), SEN, SCSI-2

Appendix B. Product Specifications

Appendix C. Regulatory Statements

This appendix contains the product regulatory and safety statements and the declaration of conformity.

FCC Statement (USA Only)

The Federal Communications Commission (in 47 CFR 15.105) has specified that the following notice be brought to the attention of the users of this product.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. The end user of this product should be aware that any changes or modifications made to this equipment without the approval of Hewlett-Packard could result in the product not meeting the Class A limits, in which case the FCC could void the user's authority to operate the equipment.

IEC Statement (Worldwide)

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

VCCI Statement (Japan Only)

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

This equipment is in the Class A category information technology equipment based on the rules of Voluntary Control Council For Interference by Information Technology Equipment (VCCI). When used in a residential area, radio interference may be caused. In this case, user may be required to take appropriate corrective actions.

Appendix C. Regulatory Statements

Class A Warning Statement (For Taiwan Only)

警告使用者：這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

Spécification ATI Classe A (France seulement)

DECLARATION D'INSTALLATION ET DE MISE EN EXPLOITATION d'un matériel de traitement de l'information (ATI), classé A en fonction des niveaux de perturbations radioélectriques émis, définis dans la norme européenne EN 55022 concernant la Compatibilité Electromagnétique.

Cher Client,

Conformément à la Réglementation Française en vigueur l'installation ou le transfert d'installation, et l'exploitation de cet appareil de classe A, doivent faire l'objet d'une déclaration (en deux exemplaires) simultanément auprès des services suivants:

- Comité de Coordination des Télécommunications 20, avenue de Ségur - 75700 PARIS
- Préfecture du département du lieu d'exploitation

Le formulaire à utiliser est disponible auprès des préfectures.

La déclaration doit être faite dans les 30 jours suivant la mise en exploitation.

Le non respect de cette obligation peut être sanctionné par les peines prévues au code des Postes et Télécommunications et celles indiquées dans la loi du 31 mai 1993 susvisée.

Arrêté du 27 Mars 1993, publié au J.O. du 28 Mars - ATI

Product Noise Declaration (Germany Only)

Acoustic Noise Emissions

LpA: 58 dB

At bystander position per ISO 7779.

All data are the results from type tests of the product configuration having the highest acoustic emissions: 8 disk modules. All other configurations have lower emission levels. Refer to the environmental specification section of the manual for details.

Geräuschemission

LpA: 58 dB

Am fiktiven Arbeitsplatz nach DIN 45635 T. 19.

Die Daten sind die Ergebnisse von Typprüfungen an Gerätekonfigurationen mit den höchsten Geräuschemissionen: 8 Plattenlaufwerke. Alle andere Konfigurationen haben geringere Geräuschpegel. Für weitere Angaben siehe unter Umgebungsbedingungen.

Appendix C. Regulatory Statements

EMC Compliance

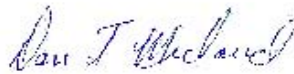
- FCC Class A
- Canadian EMC Class A
- VCCI Registered Class 1
- Meets EMC Directive 89/336/EFC
 - CISPR-22: 1993/EN 55022 (1994) Class A
 - EN 50082-1: 1992
 - IEC 10003-2: 1995/EN61000-3-2 (1995)

Safety Certification

- IEC 950: 1991+A1+A2+A3
- EN 60950: 1992+A1+A2+A3
- IEC 825-1: 1993/EN 60825-1: 1994 Class 1 (Laser/LED)
- CSA C22.2 No. 950-95
- UL 1950 3rd Edition

Appendix C. Regulatory Statements

DECLARATION OF CONFORMITY
according to ISO/IEC Guide 22 and EN 45014

Manufacturer Name:	Hewlett-Packard
Manufacturer Address:	Enterprise Storage Solutions Division P.O. Box 15 Boise, Idaho U.S.A 83707
declares, that the product	
Product Name:	HP High Availability Storage System
Product Number(s):	A331XA, A3312AZ, A332XA, A3538A, A364XA, A523XA X= 0-9
Product Options:	All options
conforms to the following Product Specifications:	
Safety:	IEC 950: 1991 +A1, A2, A3 / EN 60950 (1992) +A1, A2, A3 IEC 825-1:1993 / EN60825-1:1994 Class 1 (Laser/LED)
EMC:	CISPR 22:1993 / EN 55022 (1994) Class A EN 50082-1:1992 IEC 801-2: 1991 / prEN 55024-2 (1991): 3 kV CD, 8 kV AD IEC 801-3: 1984 / prEN 55024-3 (1991): 3 V/m IEC 801-4: 1988 / prEN 55024-4 (1992): 1kW power lines 0.5 kv Data Lines IEC 1000-3-2: 1995 / EN 61000-3-2 (1995) IEC 1000-3-3: 1995 / EN 61000-3-3 (1995)
Supplementary Information:	The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC. and carries the CE Mark accordingly. 1.) The product was tested with a Hewlett-Packard Netserver computer system.
	
BOISE, IDAHO U.S.A	01/30/98
Location	Date Signature / QA Manager
<small>European Contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department HQ-TRE, Herrenberger Straße 130, 71034 Böblingen (FAX: +49-7031-143143)</small>	

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