Cabinets

The HP C2786A Cabinet is used for mounting HP Series 6000 HP-FL Multiuser Disk Arrays. Up to five disk arrays can be mounted in this 1.6-meter high, 19-inch EIA cabinet. The cabinet includes a power distribution unit (PDU), a power cord, and two filler panels. Table 1-1 lists the options for the HP C2786A Cabinet.

Caution The HP C2786A Cabinet was tested to meet the necessary environmental and regulatory requirements for the housing of HP Series 6000 HP-FL Multiuser Disk Arrays. If a disk array is installed in a cabinet other than the HP C2786A Cabinet, the customer assumes responsibility for ensuring that the cabinet meets the necessary environmental and regulatory requirements.

Table 1-1. Cabinet Options

Option	Description
ABA	North American power cord, 208 V/220 V, 20 A, 1930 mm (76-inches), NEMA L6-20P plug.
ABB	European power cord, 220 V, 1930 mm (76 inches) long, VDE without plug.
1F9	Six filler panels to fill one unused disk array position in the HP C2786A Cabinet. This option should be ordered for each unused disk array position in the cabinet.

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Accessories

The following accessories must be ordered separately and are available from your local Hewlett-Packard Sales Office:

- HP C2786A Cabinet.
- HP 19572A PBus Cable, 2.0 m long, for connecting multiuser disk arrays in two adjacent HP C2786A cabinets.
- HP 19573A PBus Cable, 2.11 m long, for connecting multiuser disk arrays in an HP C2786A Cabinet to an HP Series 6000 Disk Storage System Model 670FL/1.34FL or to an HP 7936/37FL Disk Drive in an adjacent cabinet.
- HP C2791A Filler Panel Kit, contains six filler panels (same as cabinet option 1F9); six filler panels are used to fill each unused disk array position in the HP C2786A Cabinet.

Note

An HP-FL host adapter PCA is required to connect the computer system to a disk array in the cabinet. The HP-FL host adapter PCA must be ordered separately, and includes a 500-meter fiber optic cable and a PBus terminator. Refer to your system documentation for the part number of the HP-FL host adapter PCA.

Operating Specifications

The operating specifications and environmental requirements for disk arrays are included in *HP Series 6000 HP-FL Multiuser Disk Arrays User's Manual*, part no. C2250-90901.

Service Strategy

These products are designed to be repaired on site to the field replaceable assembly (FRA) level. The internal self-test and limited number of FRAs allow the product to be repaired and returned to service quickly.

Product Support Package

Table 1-2 lists the contents of the recommended Product Support Package.

Table 1-2. Product Support Package Contents

Part No.	Description
09740-90031	*Online Diagnostics Subsystem Manual, Volume II: Peripherals*
5960-0820	*Using the PBus Tester*
5061-3200	PBus Tester
9300-1155	Field Service Grounding Kit
8710-1426	TORX[1] Field Kit
07937-60192	PBus Connector Box
5061-3151	PBus Terminator
HFBR-3020	Fiber Optic Loopback Cable
	[1]*TORX is a product of the Camcar Division of Textron, Inc.*

Controls/Indicators/Connectors

Figure 1-1 shows the cabinet controls and indicators used to operate the disk array. The cabinet is shown fully loaded with five disk arrays.

Figure 1-2 shows the disk array controls, indicators, and connectors with the array access door open. To access the array display panel, you must open the array access door.

Figure 1-3 shows the disk array controls, indicators, and connectors with the cabinet rear door open and I/O panel removed. To access the rear of the disk array, you must open the cabinet rear door.

Note

The hard disk drive status light can be seen through the module vent slots in the upper left-hand corner of the module (refer to *5.25-inch Hard Disk Drive Service Manual*, part no. 5960-3881).

Table 1-3. Cabinet ~LINE Switch Functions

Switch Position	Functional Description
ON	Power is applied to all array power supplies in the cabinet.
OFF	Power is removed from all array power supplies in the cabinet.

Table 1-4. Array POWER/STANDBY Switch Functions

Switch Position	Functional Description
POWER	The output of the array power supply is enabled; power is applied to the disk array.
STANDBY	Power is applied to the input of the array power supply, but the output is disabled; no power is applied to the disk array.

Slot Configurations

The disk array contains five disk drive module slots (see Figure 1-4). A disk array must have a minimum of two disk drive modules installed. Three more modules can be added to increase storage capacity or optimize system performance. Slot 4 is reserved for a data protection module.

Table 1-5 shows the valid disk array slot configurations for each operating mode and the corresponding unit number for each disk drive module in a configuration.

Note

A label under the handle on the disk drive module provides space for recording the slot number and the unit number of the module.

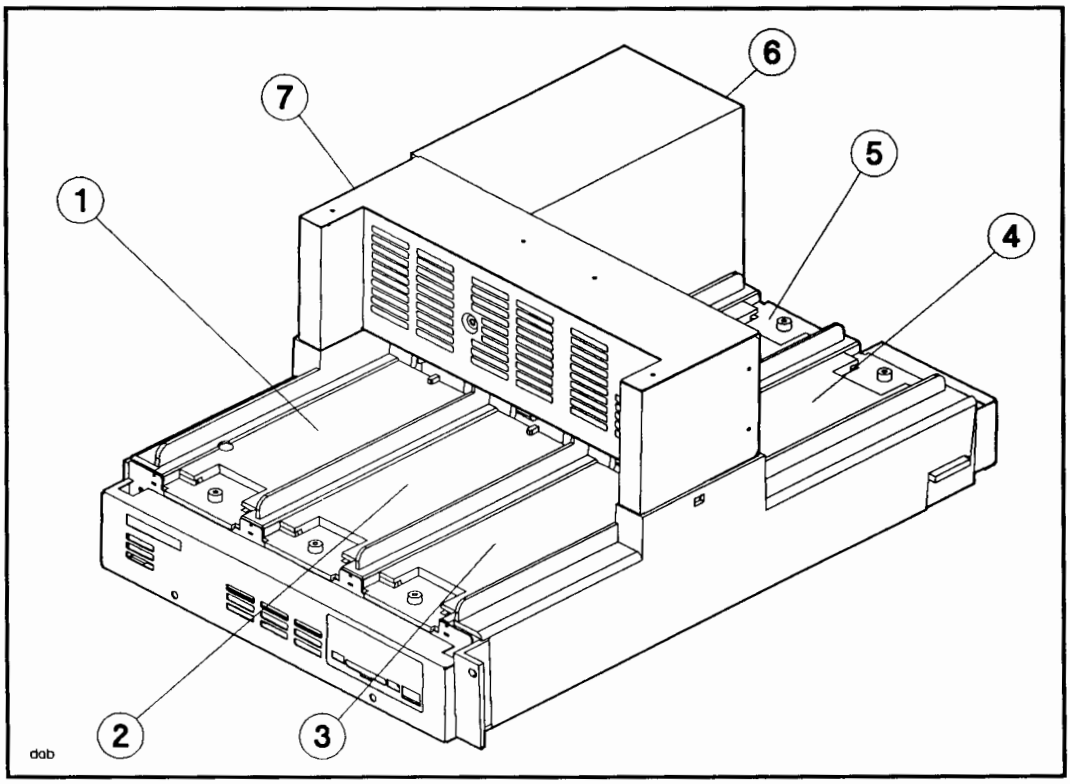

Figure 1-4. Disk Array Slots

1—Slot 0
2—Slot 1
3—Slot 2
4—Slot 3
5—Slot 4
6—Power Supply
7—Fan Assembly

Table 1-5. Disk Array Slot Configurations

Operating Mode	Capacity (Gbytes)	MODE Switches[1]	Slot[2] 0	Slot[2] 1	Slot[2] 2	Slot[2] 3	Slot[2] 4
Independent[3]	6.80	00	D/0	D/1	D/2	D/3	D/4
Mixed	2.72	11	D/0	D/0			
Mixed	2.72	11			D/1	D/1	
Mixed	5.44	11	D/0	D/0	D/1	D/1	
Striped	2.72	10	D/0	D/0			
Striped	5.44	10	D/0	D/0	D/0	D/0	
High Availability	2.72	10	D/0	D/0			P/0
High Availability	5.44	10	D/0	D/0	D/0	D/0	P/0

[1]0 = down position; 1 = up position

[2]D/n = data module/unit n; P/n = data protection module/unit n

[3]Only the maximum configuration is shown. Any number of disk drive modules can be located in any slots; the unit number of a module corresponds to its slot number.

Operating Modes

This section contains information about the following disk array operating modes:

- Independent Mode
- Striped Mode
- Mixed Mode
- High Availability Mode

Independent Mode

When a disk array operates in Independent Mode each disk drive functions as a single logical device (LDEV) or logical unit (LU) on the system. In Independent Mode, one disk drive can service one I/O request while the other disk drives service other I/O requests (see Figure 1-5). Thus, multiple I/O transactions can be performed concurrently on the same system bus. Independent Mode is best suited for applications that require high I/O concurrency such as data base applications.

Note No data protection is available with Independent Mode.

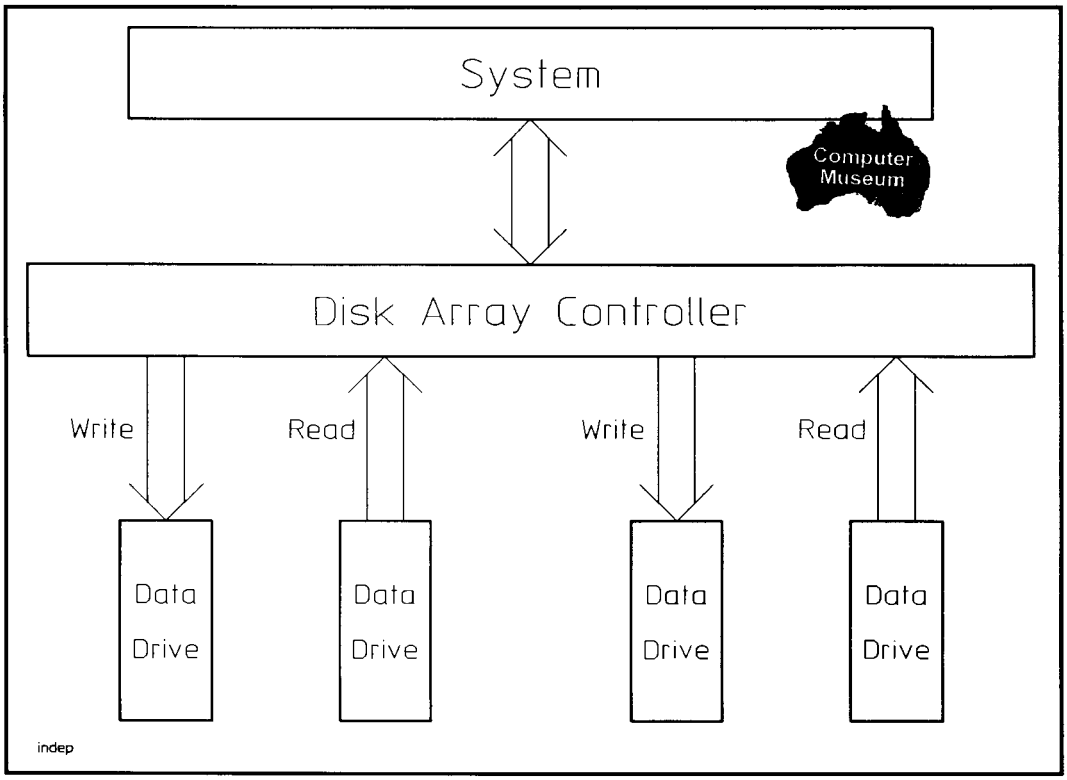

Figure 1-5. Independent Mode

Striped Mode

When a disk array operates in Striped Mode two or four synchronized disk drives are grouped together for high-speed, parallel data transfers. Each group functions as a single logical device (LDEV) or logical unit (LU) on the system. By using multiple disk drives to share the burden of data storage and retrieval, throughput is increased. Striped Mode increases the data transfer rate of the disk array by a factor of the number of disk drives in the disk array (two or four). During a write operation, data is distributed byte-by-byte across the disk drives (see Figure 1-6). During a read operation, data streams from the disk drives are merged by the array controller to recreate the original data block. Thus, Striped Mode can increase performance for applications that use large data transfers.

Note No data protection is available with Striped Mode.

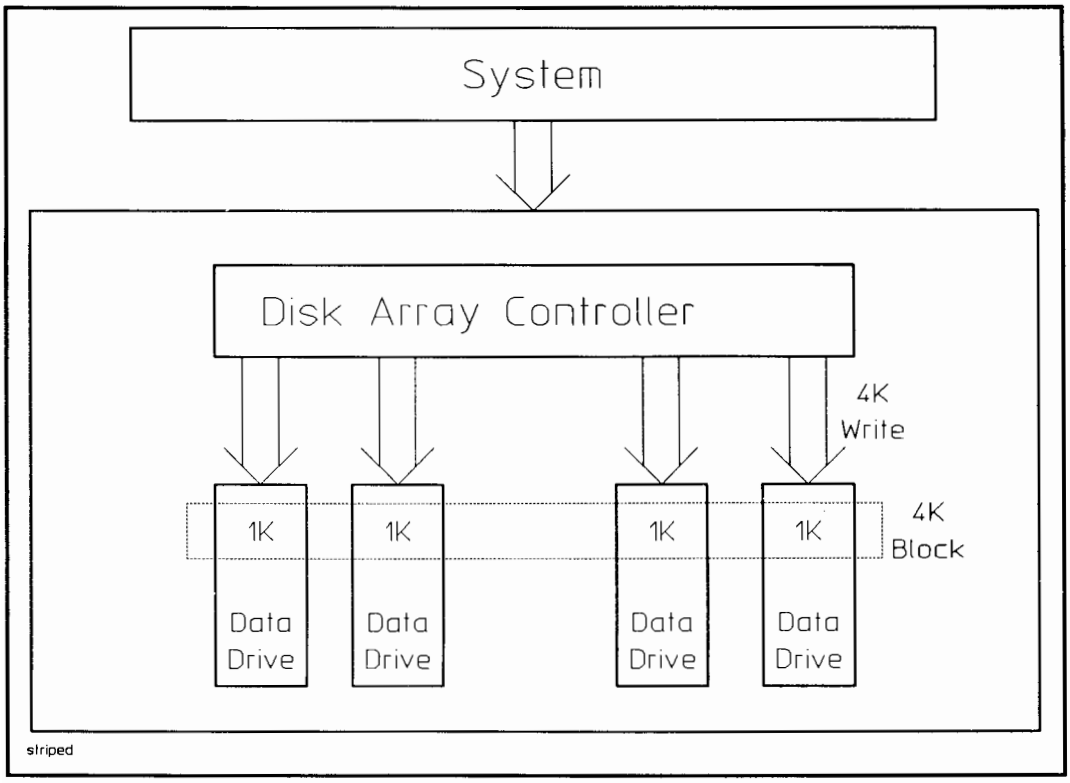

Figure 1-6. Striped Mode

Mixed Mode

Mixed Mode combines the I/O concurrency of Independent Mode and the high data transfer rates of Striped Mode. When a disk array operates in Mixed Mode, two groups of two synchronized disk drives each are combined (see Figure 1-7). Each group functions as a single logical device (LDEV) or logical unit (LU) on the system. As in Independent Mode, one group can service one I/O request while the other group services another I/O request. And, as in Striped Mode, data is distributed byte-by-byte across the disk drives within a group. This enables each group to achieve twice the data transfer rate of a single disk drive. Thus, Mixed Mode is well suited for applications that require both I/O concurrency and high data transfer rates.

Note No data protection is available with Mixed Mode.

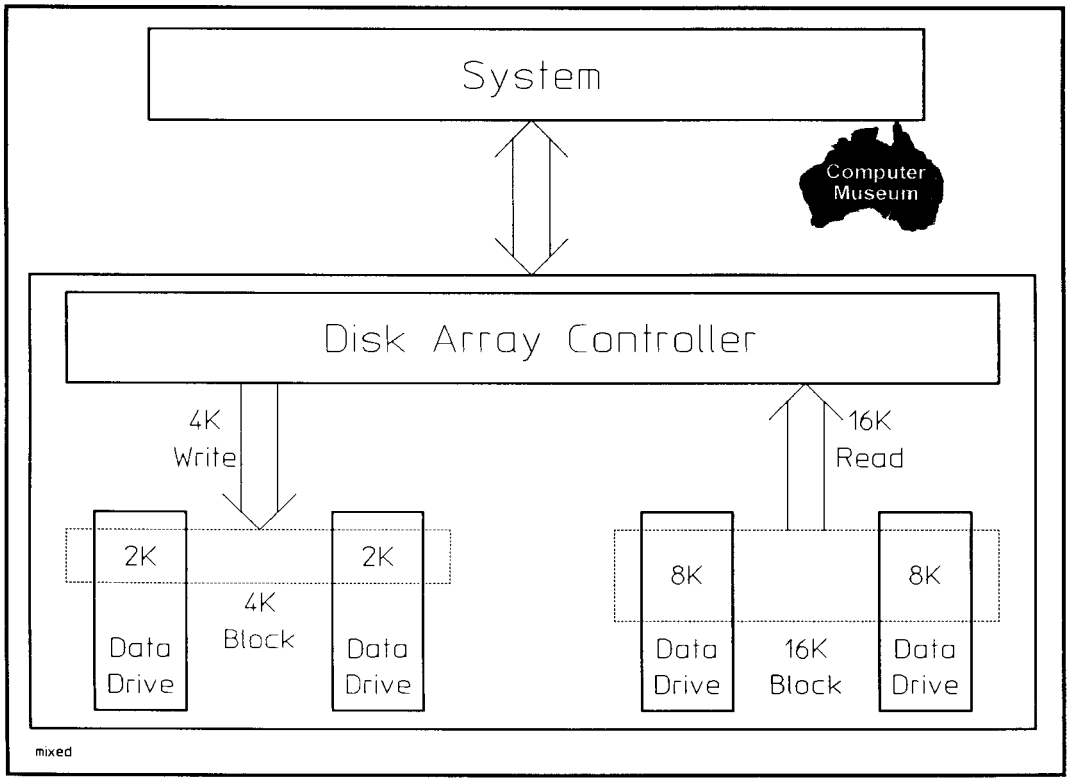

Figure 1-7. Mixed Mode

High Availability Mode

High Availability Mode adds data protection features to Striped Mode and improves system availability by allowing the system to keep running if a data drive fails. These data protection features cannot be added to Independent Mode and Mixed Mode. High Availability Mode is achieved by adding a data protection drive to a disk array currently operating in Striped Mode.

In High Availability Mode, the data protection drive stores an encoded form of the information stored in the data drives (see Figure 1-8). If a data error occurs in a data drive during an I/O operation the data protection drive is used to recover the data and complete the operation. If a drive fails during an I/O operation, the system continues to run in data recovery mode. The drive that failed can then be replaced while the disk array is online.

After the drive is replaced, a data rebuild operation is initiated by the user. During the data rebuild operation, the data protection drive works with system processes to recover the data. During this operation, the system may experience a slight degradation in performance. The amount of degradation in system performance is dependent on how busy the system is, because application I/Os are interleaved with rebuild I/Os.

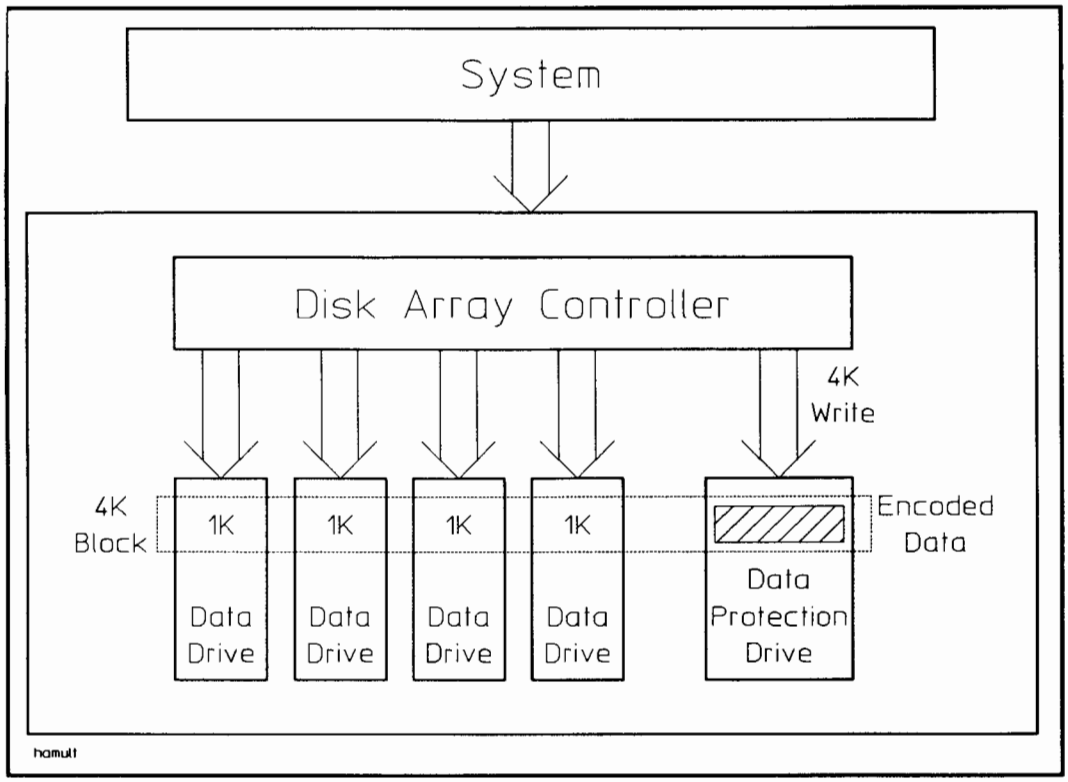

Figure 1-8. High Availability Mode

Summary of Operating Modes

Table 1-6 provides a summary of the disk array operating modes and the features or benefits of each mode:

Table 1-6. Summary of Disk Array Operating Modes

Operating Mode	Feature/ Benefit	Data Protection
Independent	High I/O concurrency.	NO
Striped	High data transfer rates.	NO
Mixed	High I/O concurrency balanced with high data transfer rates.	NO
High Availability	Protects data stored in Striped Mode. A faulty disk drive module can be replaced while the system is online.	YES

2

Site Planning and Requirements

This chapter provides information on site planning and environmental requirements of the disk array.

Site Planning

The site planning required for disk arrays is the same planning required for the host system.

Cabinet Location

The HP C2786A cabinet must be located in an air-conditioned room, with the rear of the cabinet at least one foot from the wall to ensure proper cooling of the disk arrays.

Static Electricity

If the disk array is located in a carpeted office environment, the use of anti-static mats and carpets is recommended. This will reduce static electricity problems and help ensure continued successful operation of the product.

Environmental Requirements

The environmental requirements for the storage array are included in *HP Series 6000 HP-FL Multiuser Disk Arrays User's Manual*, part no. C2250-90901. In general, the storage array requires the same operating environment as the host system, including the following requirements:

- Temperature between 0° C and 40° C (32° F and 104° F).
- Relative humidity between 8% and 80%.
- A stable environment, free from any sudden changes in temperature and humidity.
- Low levels of shock and vibration.
- A constant line voltage.

3

Installation

This chapter contains instructions for installing disk arrays into an HP 2786A Cabinet. Installation includes the following major tasks:

- Installation preparation.
- Installing cabinet hardware.
- Installing disk array bases.
- Configuring the system.

Installation Preparation

This section contains information about preparing to install disk arrays.

Learning Handling Precautions

To prevent damage to the disk array, observe the following precautions:

Warning

To ensure cabinet stability, the leveling feet on the cabinet must be lowered before installing the disk arrays. Also, do not transport the cabinet with disk arrays installed. Moving a fully loaded cabinet can cause it to tip over and personal injury may result.

Caution

- When installing a disk drive module into the disk array base, avoid sudden mechanical shocks. Sudden mechanical shock can damage a disk drive module.
- Disk drive modules and disk array bases are susceptible to damage from static electricity.

Removing the Cabinet Shipping Panels

To remove the cabinet shipping panels (see Figure 3-1):

1. Remove eight mounting screws.
2. Remove the shipping panels.
3. Remove eight clip nuts.

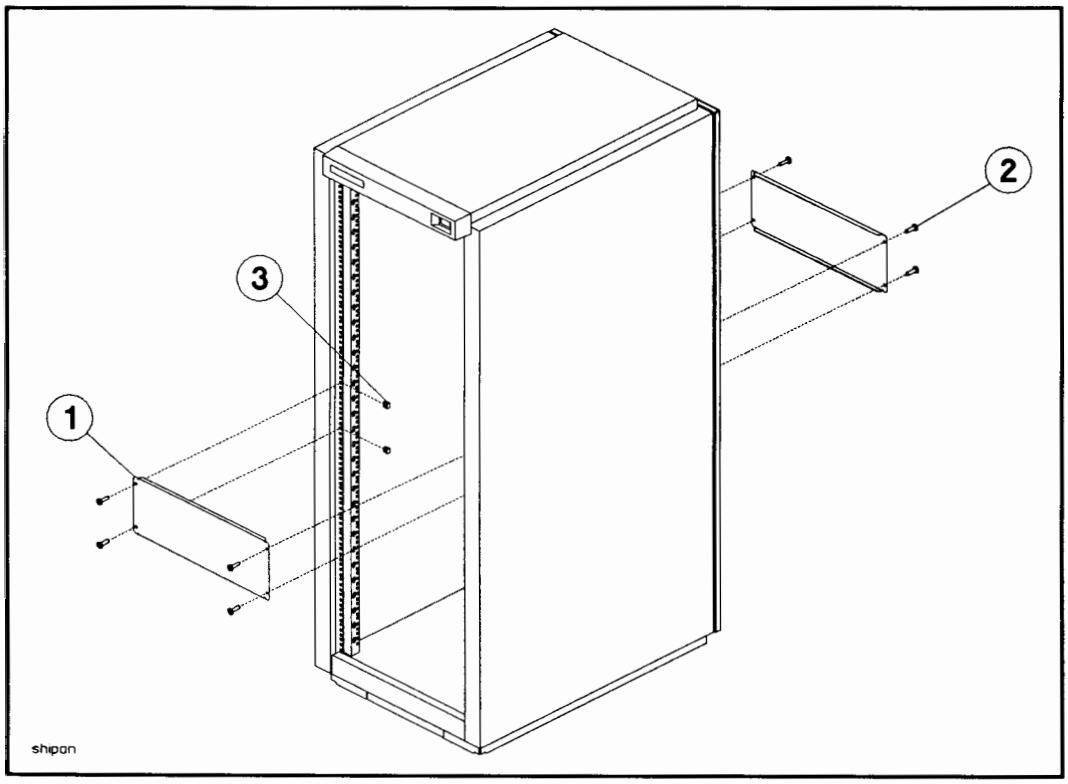

Figure 3-1. Removing Cabinet Shipping Panels

1. Shipping Panel (2)
2. Mounting Screw (8)
3. Clip Nut (8)

Unpacking a Disk Array Base

The disk array base is packaged with the power supply preinstalled. Before unpacking the disk array base, inspect the shipping cartons carefully for any signs of damage or mishandling that may have occurred during shipping. If you suspect that damage may have occurred during shipping, request that the carrier's agent be present when the disk array base is unpacked. The unpacking instructions are located on the top flap of the shipping carton.

After unpacking the disk array base, inspect it carefully for any signs of damage that may have occurred during shipping. If any damage is evident, contact your local Hewlett-Packard Sales Office and the carrier involved.

Note

Keep the packing material included in each shipping carton in case you need to repack the disk array base for shipment.

Identifying Parts

The following parts are supplied with each disk array:

- HP C2251A Disk Drive Modules (see item 1 in Figure 7-2) - two to five packaged separately
- HP C2250A Disk Array Base with preinstalled power supply (see item 8 in Figure 7-2) - packaged with the following:
  - Cabinet Assembly Kit, part no. C2250-60021 (see Figure 7-4 for kit contents)
  - Power Cord, part no. 5062-9416
  - PBus Cable, part no. 5061-3199
  - *HP Series 6000 HP-FL Multiuser Disk Arrays User's Manual*, part no. C2250-90901
  - *HP C2251A Disk Drive Module Installation Manual*, part no. C2250-90903
  - HP-UX Support Tape Kit, part no. C2250-60027, includes the following:

    0.5-inch Tape Reel, part no. C2250-80039
    DSS Cartridge, part no. C2250-80040
    HP-UX System Administration Note, part no. C2250-90002
  - MPE Support Tape Kit, part no. C2250-60028, includes the following:

    0.5-inch Tape Reel, part no. C2250-80041
    MPE Application Note, part no. C2250-90003

Recording Serial Numbers

Record the disk array serial number and the disk drive module serial number under "Serial Numbers" in chapter 3 of *HP Series 6000 HP-FL Multiuser Disk Arrays User's Manual*, part no. C2250-90901. See Figure 3-2 for the location of the disk array serial number. See Figure 3-3 for location of the disk drive module serial number.

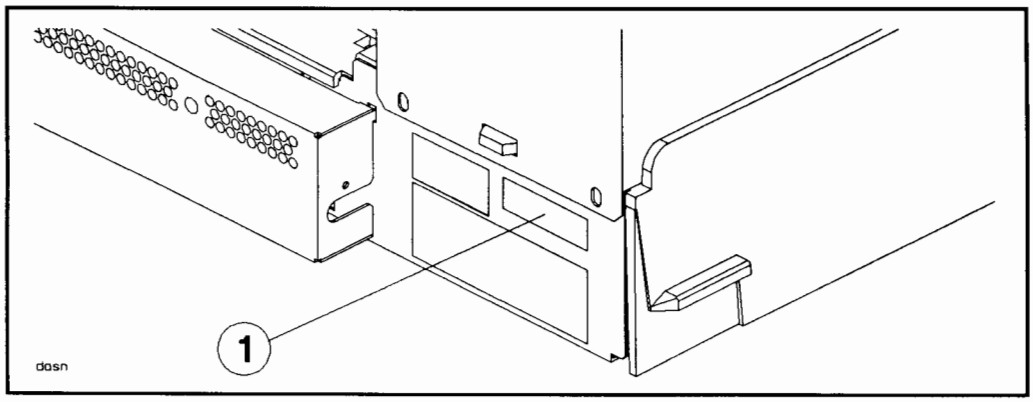

Figure 3-2. Locating the Disk Array Serial Number

1. Serial Number Label

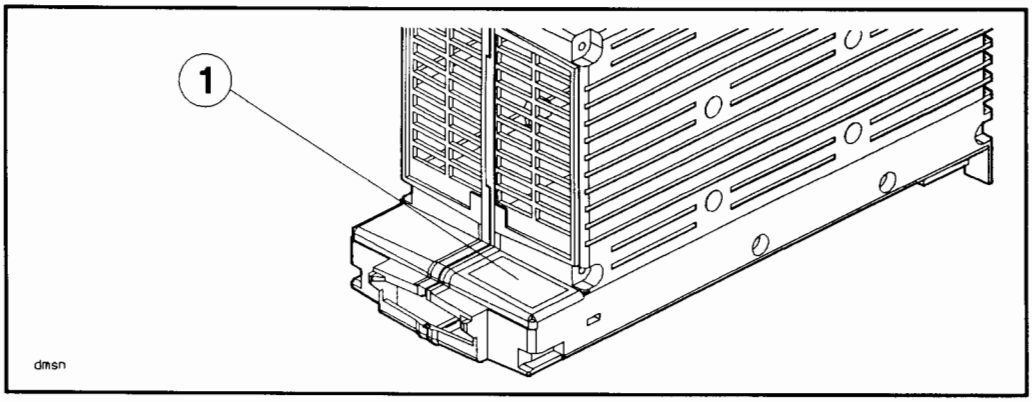

Figure 3-3. Locating the Disk Drive Module Serial Number

1. Serial Number Label

Installing Cabinet Hardware

This section contains the steps for installing hardware into the HP C2786A Cabinet.

Note Cabinet mounting hole numbers are counted from the bottom of the cabinet to the top.

Installing Mounting Rails

To Install mounting rails (see Figure 3-4):

1. Install two clip nuts over the holes indicated in Figure 3-4. (Use the same hole spacing to install multiple sets of mounting rails.)
2. Install the hooks at the ends of the mounting rail into the front and rear slots.
3. Tighten two T25 mounting screws through the mounting rail and clip nuts.
4. Repeat steps 1 through 3 for the mounting rail on the opposite side of the cabinet.

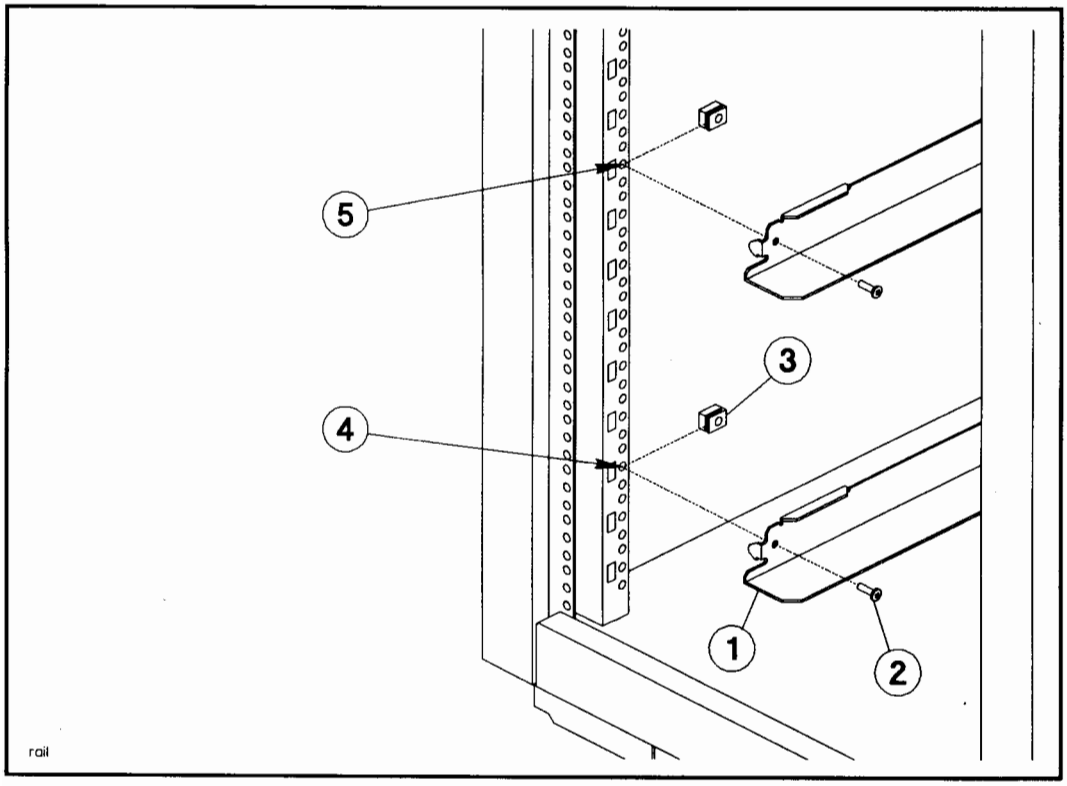

Figure 3-4. Installing Mounting Rails

1. Mounting Rail (2)
2. T25 Mounting Screw (4)
3. Clip Nut (4)
4. Hole No. 8
5. Hole No. 26

Installing an Array Access Door

To install an array access door (refer to Figure 3-5):

1. Insert two hinge studs into the holes indicated in Figure 3-5. (Use the same hole spacing for multiple access doors.)
2. Seat the two hinge locating bosses in the holes.
3. Tighten two M6 nuts onto the hinge studs with the 10 mm wrench supplied.

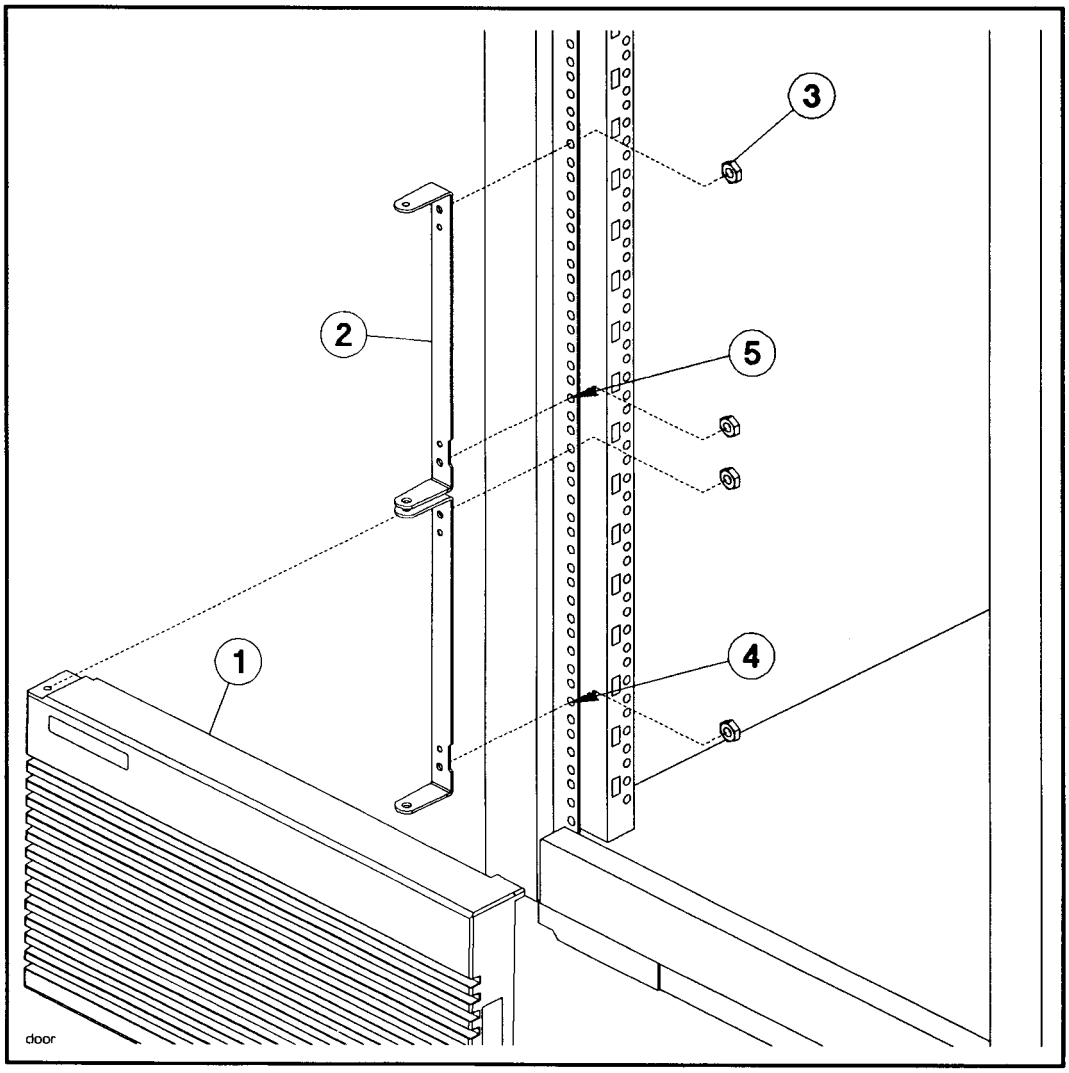

Figure 3-5. Installing an Array Access Door

1. Array Access Door
2. Hinge
3. M6 Nut (2)
4. Hole No. 8
5. Hole No. 26

Installing a Latch Plate

To install a latch plate (see Figure 3-6):

1. Insert the two latch plate mounting studs into the holes indicated in Figure 3-6. (Use the same hole spacing for multiple access doors.)
2. Tighten two M6 nuts onto the latch plate studs with the 10 mm wrench supplied.

Connecting the Cabinet Power Cord

Connect the cabinet power cord to a 220 Vac power receptacle.

Warning

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

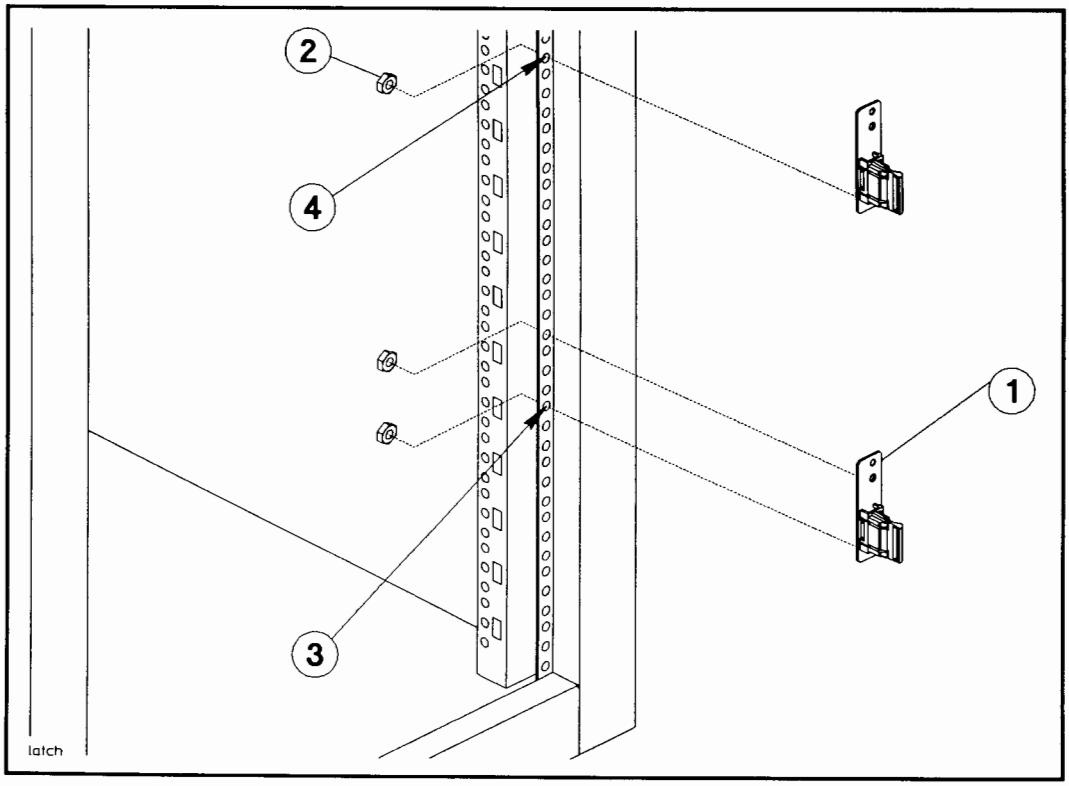

Figure 3-6. Installing a Latch Plate

1. Latch Plate
2. M6 Nut (2)
3. Hole No. 15
4. Hole No. 34

Installing Disk Arrays

This section includes the steps for installing the following disk array assemblies: the disk array base, disk drive modules, disk arrays, and cabling. Instructions for configuring and testing the disk array are also included.

Installing a Disk Array Base

To install a disk array base into the cabinet (see Figure 3-7):

Warning

Do not install the first disk array base in the top position of the cabinet. The cabinet may tip over and personal injury may result. When installing multiple bases, install the first base in the bottom position of the cabinet, then install successive bases from the bottom positon to the top position.

1. Open the array access door.
2. Slide the disk array base into the front of the cabinet on the array mounting rails until the mounting ear stops against the cabinet frame.
3. Install two clip nuts onto the holes opposite the two mounting ear holes. (Use the same hole spacing to install multiple array bases.)
4. Secure the disk array base with two T25 screws through the mounting ear.

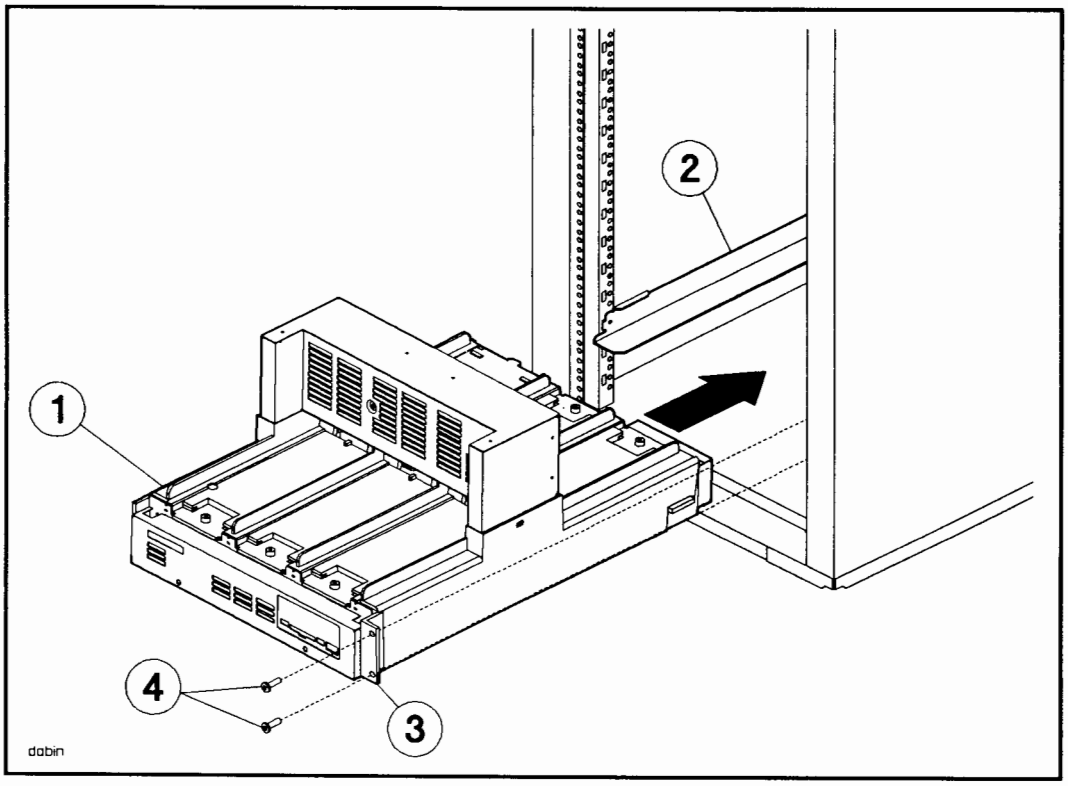

Figure 3-7. Installing a Disk Array Base

1. Disk Array Base
2. Mounting Rail
3. Mounting Ear
4. T25 Mounting Screws (2)

Installing Disk Drive Modules

To install a disk drive module into a disk array base (see Figure 3-8):

1. Move the disk drive module securing latch all the way to the left.
2. Grasp the disk drive module handle and slide it into a slot in the disk array base.
3. Lock the disk drive module securing latch all the way to the right.

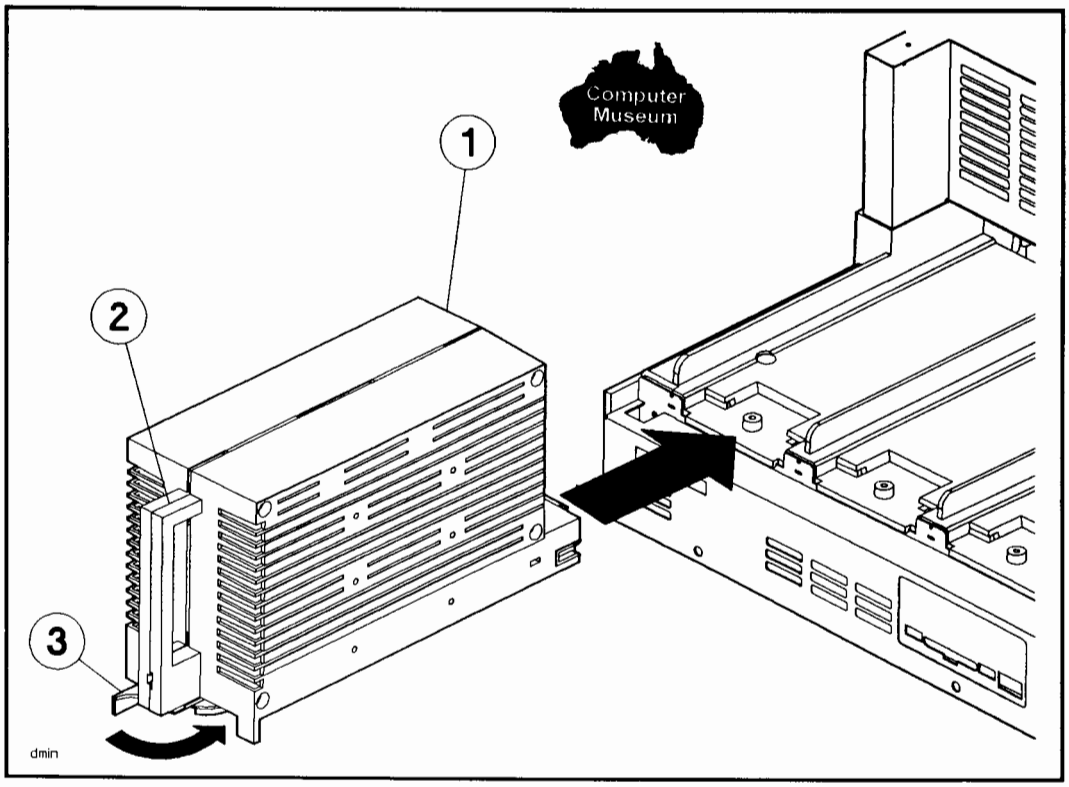

Figure 3-8. Installing a Disk Drive Module

1. Disk Drive Module
2. Handle
3. Securing Latch

Installing Filler Panels

If the cabinet has not been fully loaded with five disk array bases, install filler panels to cover the empty spaces in the cabinet. Six filler panels are required to fill the space for one array access door. If only one disk array is installed, 24 filler panels are required to fill the empty space above the disk array. Also, 2 filler panels are required to fill the space below the disk array.

To install a filler panel (see Figure 3-9):

1. Hold the filler panel up to the front of the cabinet between two of the stamped lines in the cabinet vertical rails.
2. Press on the filler panel until the clips snap into place.

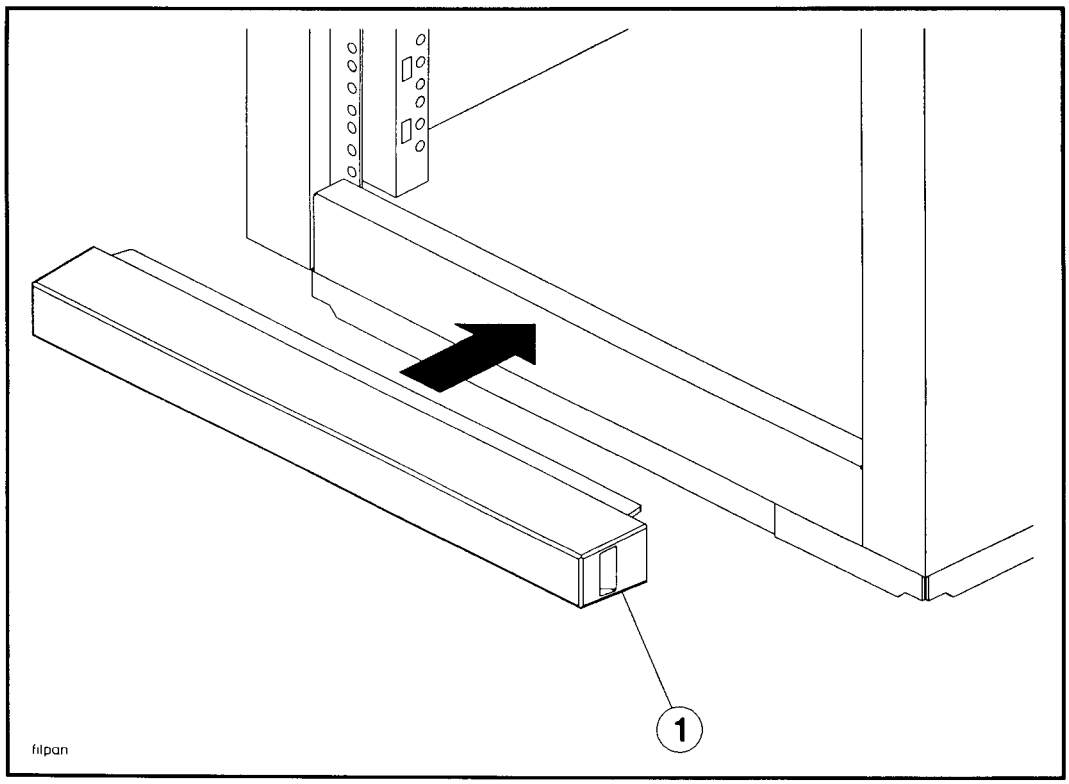

Figure 3-9. Installing a Filler Panel

1. Filler Panel

Connecting a Disk Array Power Cord

To connect a disk array power cord (see Figure 3-10):

1. Connect one end of the power cord to the power connector on the rear of the disk array power supply.
2. Connect the other end of the power cord to one of the ac power receptacles on the power strip.

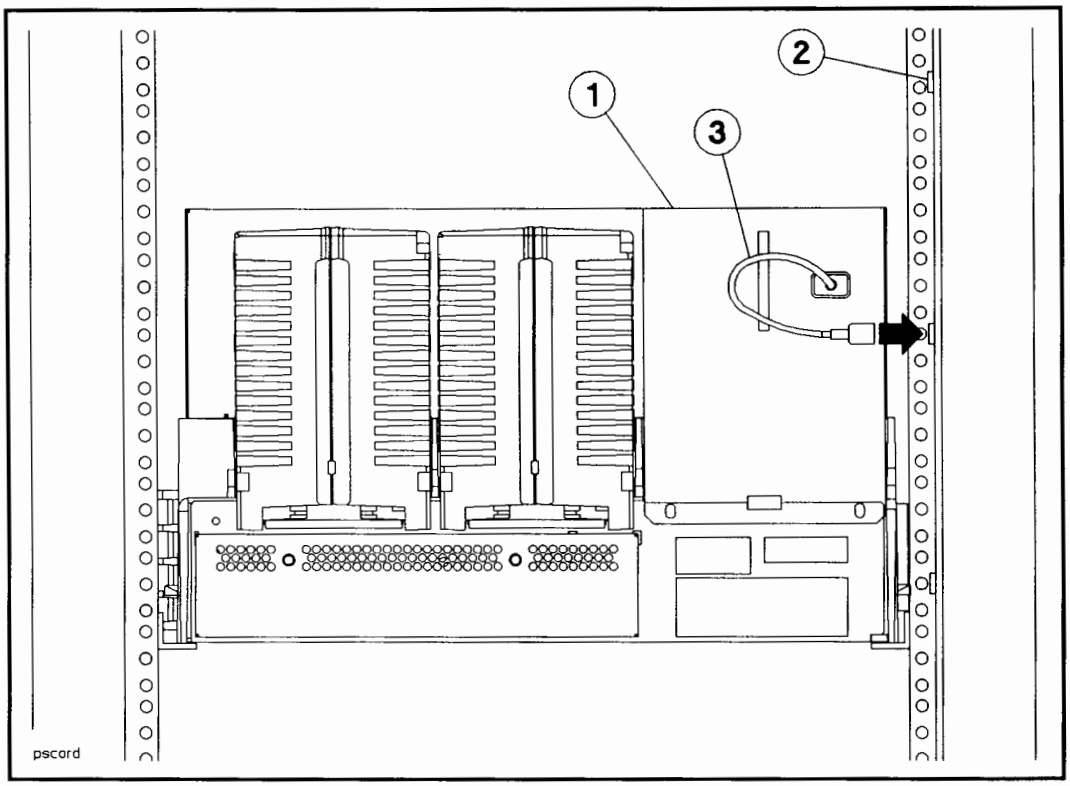

Figure 3-10. Connecting a Disk Array Power Cord

1. Power Supply
2. Power Strip
3. Power Cord

Removing an I/O Panel

Caution

Make sure your ESD strap is connected to the cabinet frame and the cabinet power cord is connected to a power receptacle to provide proper ESD ground. Damage to the disk array may result if proper ESD ground is not provided.

To remove an I/O panel (see Figure 3-11):

1. Remove the two I/O panel mounting screws.
2. Lift the I/O panel up and away from the disk array base.

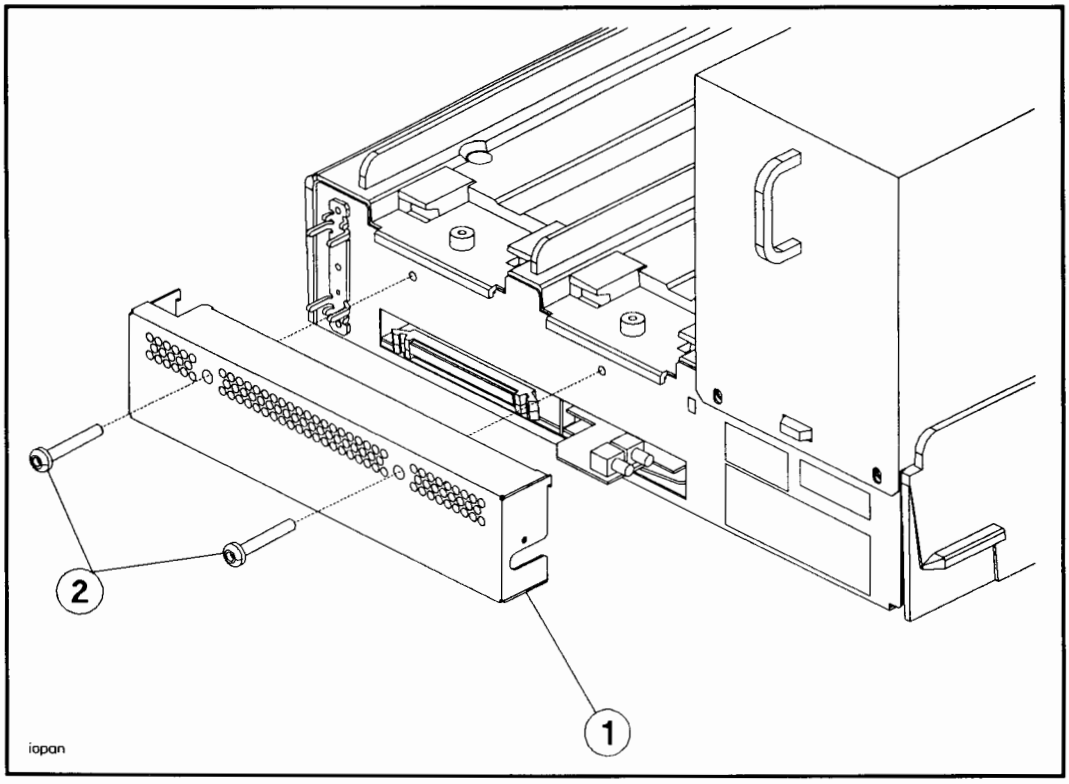

Figure 3-11. Removing an I/O Panel

1. I/O Panel
2. Mounting Screws

Connecting a PBus Cable

Note If there is only one disk array in the cabinet, skip this step.

Note

When making PBus connections, observe the following requirements:

- Although the PBus can accommodate up to eight disk arrays, the actual number of disk arrays supported on the HP-FL interface is dependent on the computer you are using. The cabinet can accommodate five disk arrays, but other disk storage products may also be connected to the PBus in the cabinet.
- The maximum cable length of a PBus cable is 6.4 meters. The PBus cables included with the disk array should be used to make all PBus connections within the cabinet.

Starting with the lowest disk array in the cabinet and continuing to the top disk array, connect a PBus cable between each pair of disk arrays as follows (see Figure 3-12):

1. Install each end of the PBus cable into the PBus bracket.
2. Press the PBus cable connectors into the PBus connectors on the rear of the disk arrays until the extraction levers snap into place.

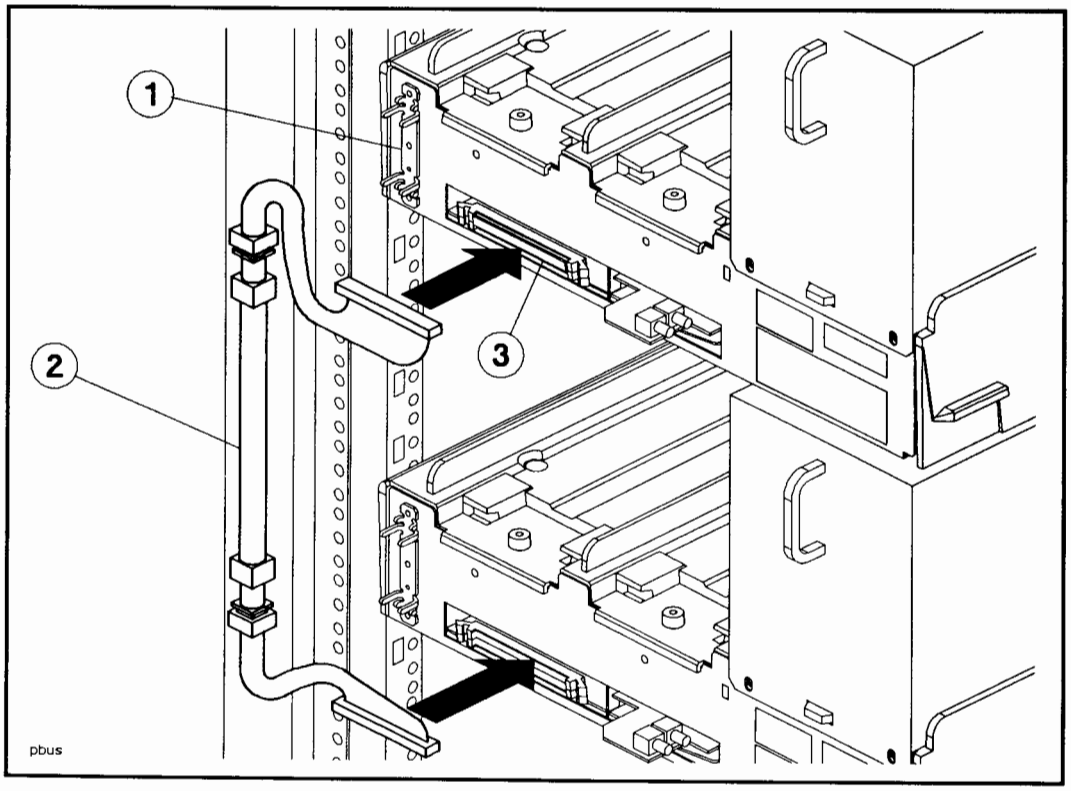

Figure 3-12. Connecting a PBus Cable

1. PBus Bracket
2. PBus Cable
3. PBus Connectors

Installing PBus Terminators

To install PBus terminators (see Figure 3-13):

1. If the cabinet contains only one disk array, install PBus terminators in opposite orientations on the PBus connectors (one with the white side visible, the other with the gray side visible).
2. If the cabinet contains multiple disk arrays, install PBus terminators in opposite orientations on the highest and lowest PBus connectors in the cabinet (one with the white side visible, the other with the gray side visible).

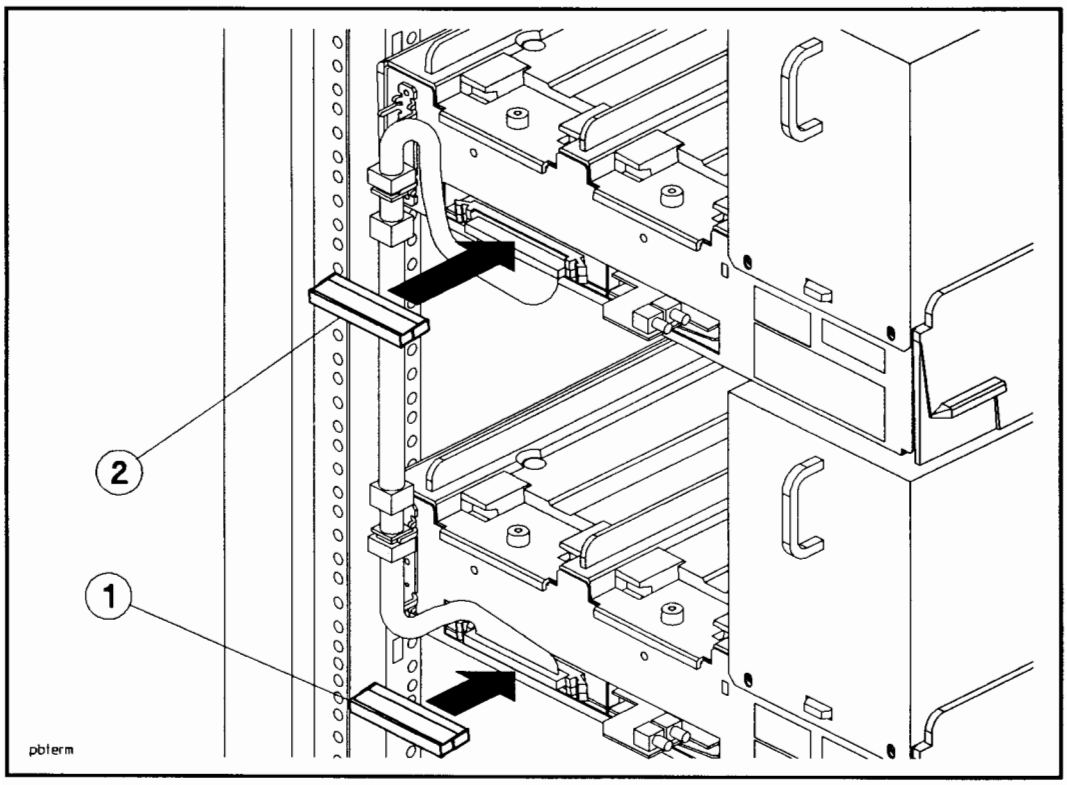

Figure 3-13. Installing PBus Terminators

1. PBus Terminator (white side out) 2. PBus Terminator (gray side out)

Setting the ADDRESS Switches

Each disk array must have a unique HP-FL address. To set the ADDRESS switches, see Figure 3-14.

Note

To change the ADDRESS switch settings after your disk array has been installed:

1. Set the array POWER/STANDBY switch to STANDBY.
2. Set the ADDRESS switches to a new address.
3. Set the array POWER/STANDBY switch to POWER.

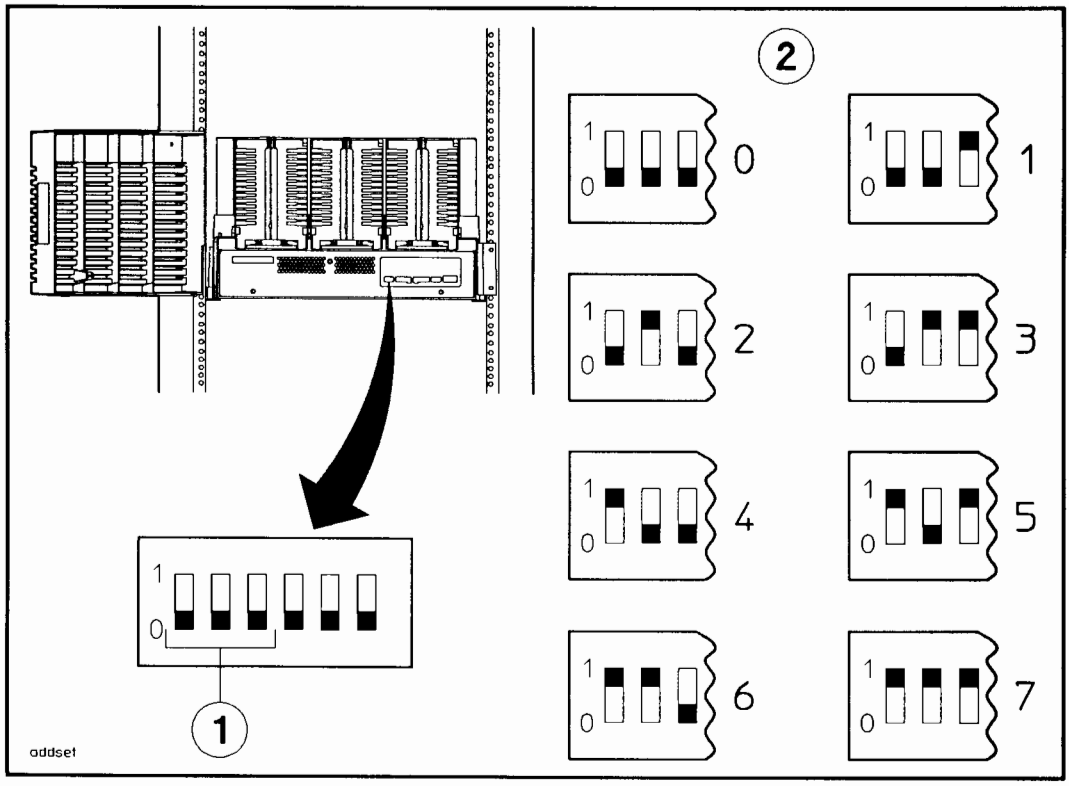

Figure 3-14. Setting the ADDRESS Switches

1. ADDRESS Switches
2. HP-FL Address Settings[1]

[1]*HP-FL address number is located on the right-hand side of the HP-FL address setting.*

Setting the MODE Switches

The MODE switches are used to set the operating mode of the disk array. To set the MODE switches, see Figure 3-15. Set the MODE switches initially to the Independent Mode.

Note

- There are no MODE switch settings for High Availability Mode. High Availability Mode is achieved by installing a disk drive module into slot 4 when the disk array is in Striped Mode.
- An abbreviated version of the MODE switch settings shown in Figure 3-15 is located on the array display panel under the word "MODE". The following symbols are used on the array display panel:

  0 Switch DOWN

  1 Switch UP

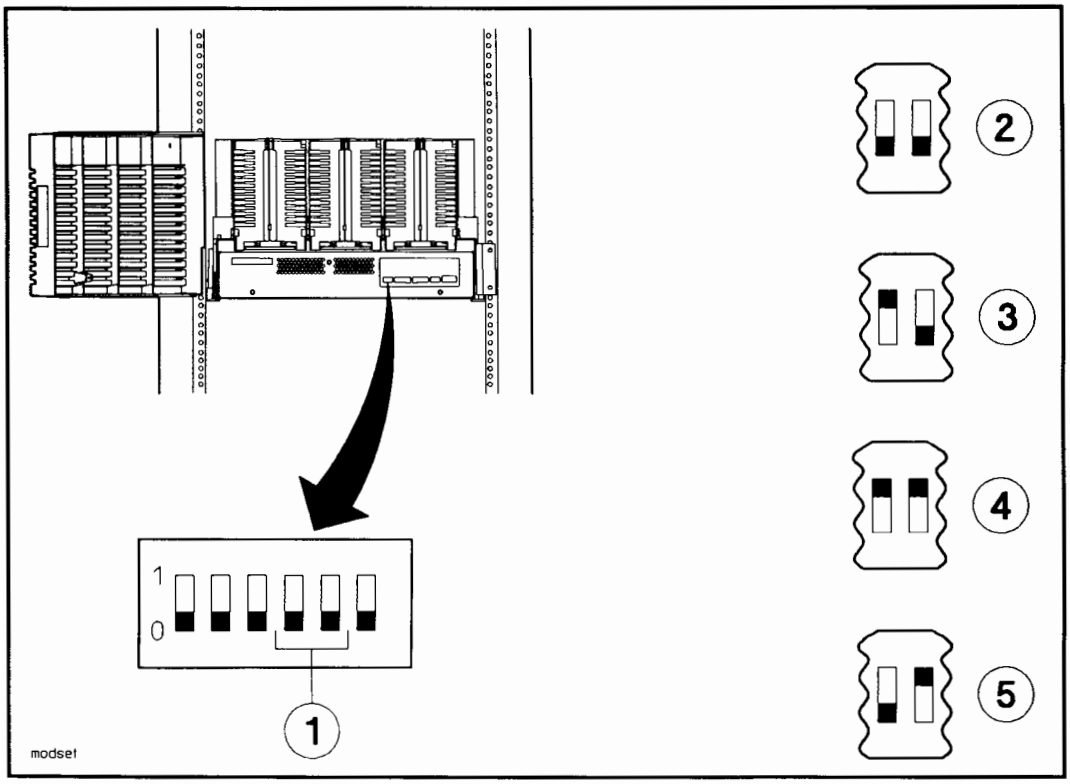

Figure 3-15. Setting the MODE Switches

1. MODE Switches
2. Independent Mode
3. Striped Mode
4. Mixed Mode
5. NOT USED

Setting the TEST switch

The TEST switch is used to set the self-test mode of the disk array to run mode or extended mode. To set the TEST switch, see Figure 3-16. Set the TEST switch initially to the extended mode.

Note

To change the self-test mode of the disk array:

1. Set the array POWER/STANDBY switch to STANDBY.
2. Change the TEST switch to the desired mode.
3. Set the array POWER/STANDBY switch to POWER.

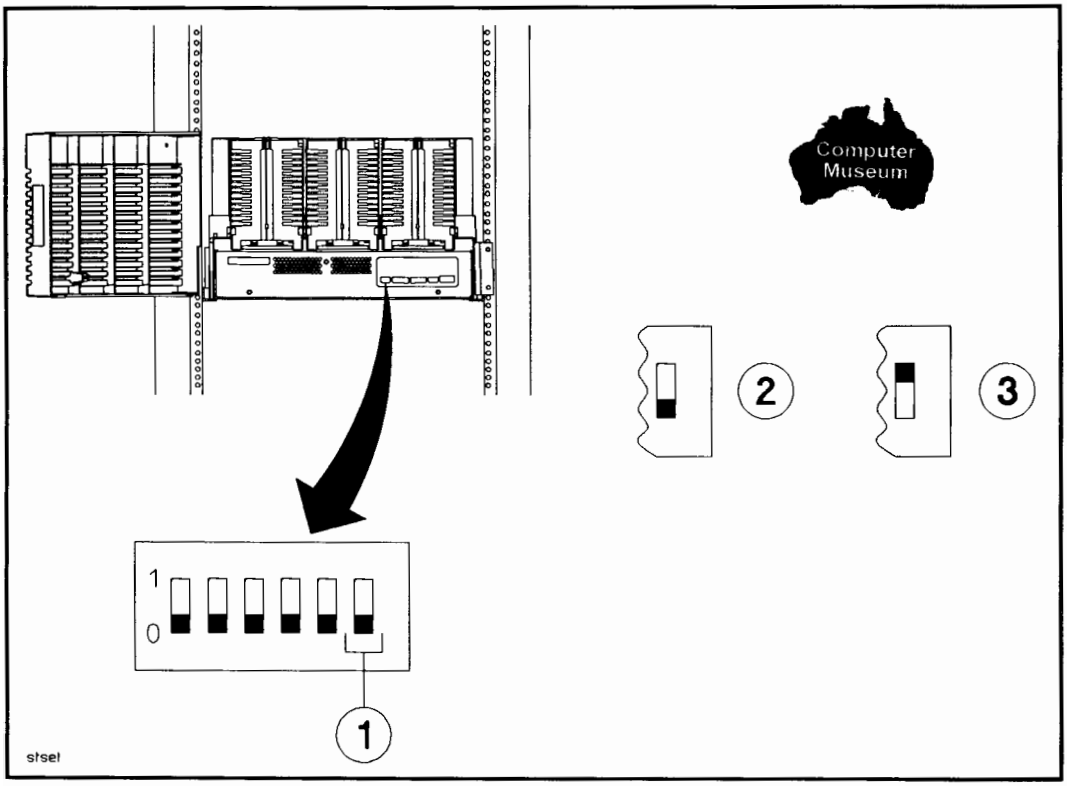

Figure 3-16. Setting the TEST Switch

1. TEST Switch
2. Run Mode
3. Extended Mode

Running an Extended Self-test

Caution

If the disk array has been exposed to temperature extremes, allow two hours for the disk array to stabilize at room temperature before operating it. Operating a disk array that is very cold or very hot could damage it.

The extended self-test will perform a series of looping self-tests continuously until the disk array power is cycled. During one loop of the extended self-test, a functional self-test of the array controller is performed, and a nondestructive full-volume read-only error rate test is performed on the disk drives in the disk array to verify media integrity. One loop of the extended self-test takes less than 20 minutes to complete. During the extended self-test, the module FAULT light will switch on whenever an error is detected, and the array FAULT lights will display a code for the mechanism with the most serious error or fault. The extended self-test will fail if an uncorrectable read error, a read fault, or a servo fault is detected. If an uncorrectable, recoverable, or correctable read error is detected during the extended self-test, read Run Log for each disk drive and spare any error sites.

To run an extended self-test:

1. Make sure the MODE switches are set to Independent Mode and the TEST switch is set to extended mode.
2. Connect a fiber optic loopback cable between the fiber optic connectors on the array controller PCA in each disk array (see Figure 3-17).
3. Set the cabinet ~LINE switch to 1.
4. Set the array POWER/STANDBY switch to POWER.
5. Wait for the array STATUS light to be green. If the array STATUS light is amber, refer to Chapter 6 for troubleshooting information.

6. Make sure the PBus FAULT lights are off. If one or both PBus FAULT lights come on, remove one of the PBus terminators and reinstall it in the opposite orientation. (Refer to Chapter 6 for information about troubleshooting PBus problems.)
7. Wait 20 minutes for the extended self-test to complete one loop. If the extended self-test fails, refer to Chapter 6 for troubleshooting information.

Note

After the extended self-test completes successfully, perform the following steps on each disk array before completing the installation procedure:

1. Set the array POWER/STANDBY switch to STANDBY.
2. Set the MODE switches to the proper mode for the desired disk array configuration.
3. Set the TEST switch to the run mode.
4. Remove the fiber optic loopback cable.

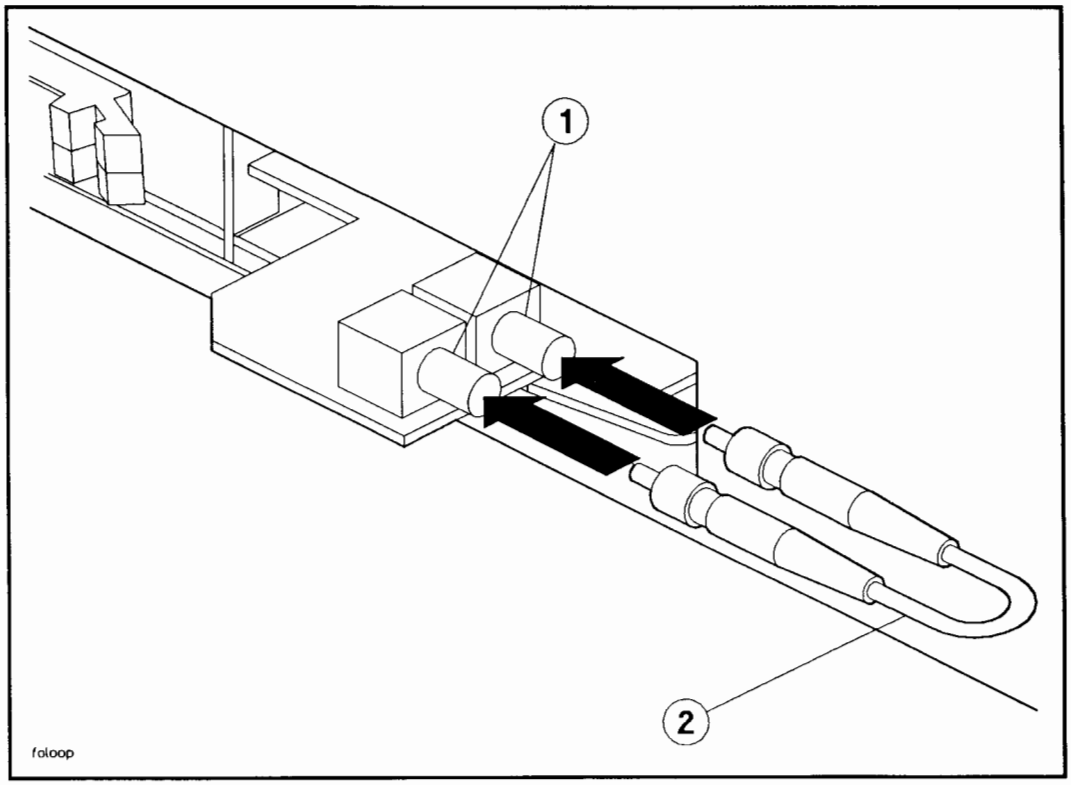

Figure 3-17. Connecting a Fiber Optic Loopback Cable

1. Fiber Optic Connectors
2. Fiber Optic Loopback Cable

Connecting the Fiber Optic Cable

Caution

- The length of fiber optic cable used to connect the computer to a disk array is limited to 500 meters. Poor data transmission will result if the fiber optic cable is too long.
- When handling and routing the fiber optic cable, avoid making any sharp bends or kinks that may damage the cable. All bends in the cable must have a radius of 25 mm (1 inch) or greater.
- Tighten the fiber optic cable connectors only with your finger. Using tools or excessive force to tighten the connectors may damage the HP-FL controller PCA.

To connect the fiber optic cable:

1. Install a strain relief collar 220 mm below the connectors on the fiber optic cable (see Figure 3-18).
2. Twist the strain relief collar into the strain relief slot in the lowest left-hand mounting rail (see Figure 3-18).
3. On the lowest disk array in the cabinet, connect the optical fiber with the white collar to the white fiber optic connector on the fiber optic interface PCA and tighten the connector with your fingers (see Figure 3-19).
4. Connect the other optical fiber to the black fiber optic connector on the fiber optic interface PCA and tighten the connector with your fingers (see Figure 3-19).
5. Install the I/O panel.
6. Connect the other end of fiber optic cable to the fiber optic interface PCA on the host computer.

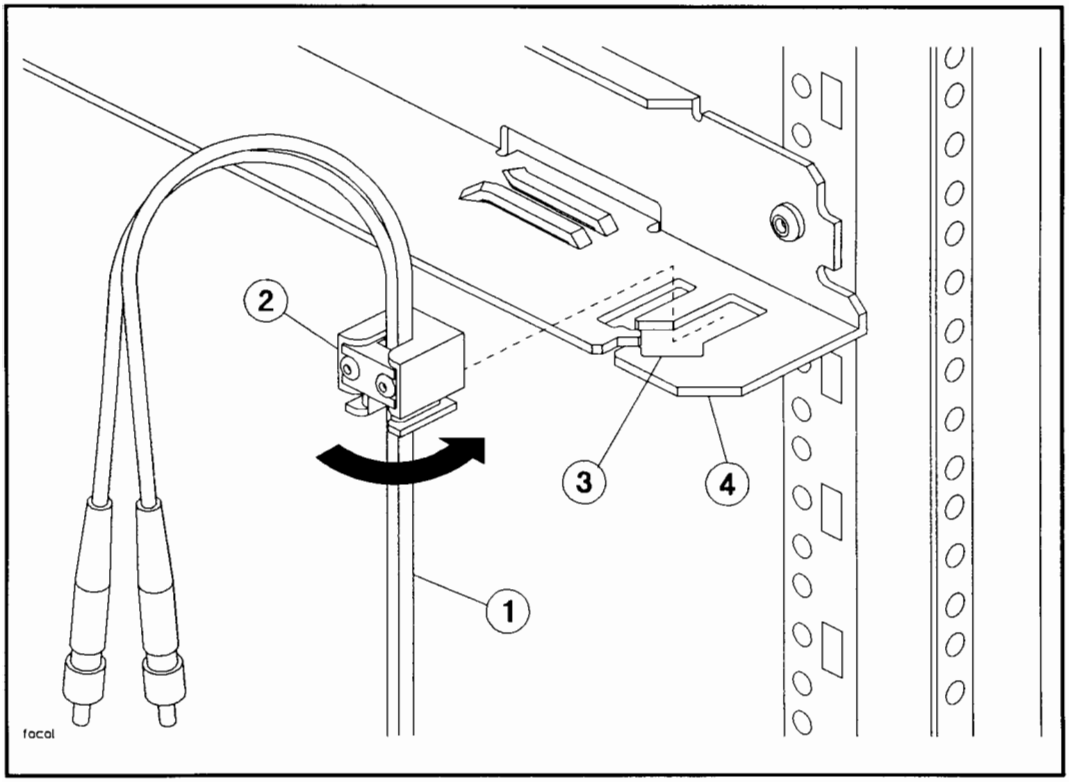

Figure 3-18. Installing a Fiber Optic Cable into a Strain Relief Slot

1. Fiber Optic Cable
2. Strain Relief Collar
3. Strain Relief Notch
4. Mounting Rail

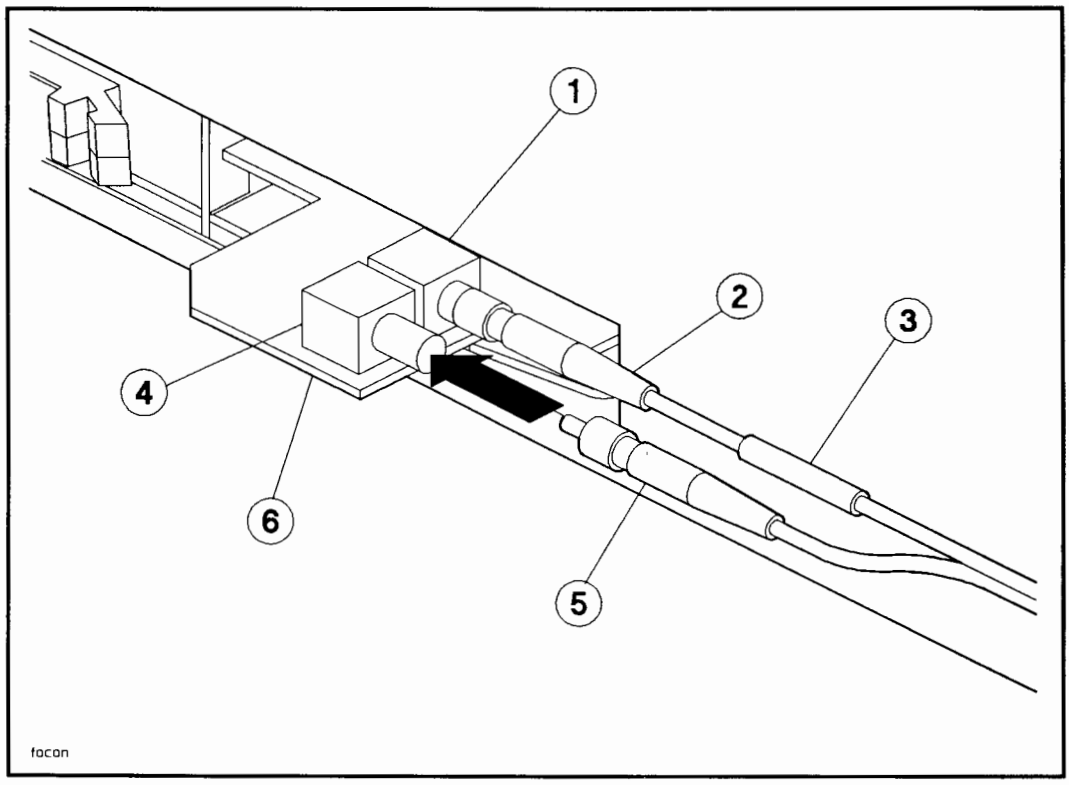

Figure 3-19. Connecting the Fiber Optic Cable

1. Transmit Fiber Optic Connector
2. Transmit Optical Fiber
3. White Collar
4. Receive Fiber Optic Connector
5. Receive Optical Fiber

Running a Final Power-on Test

To run a final power-on test:

1. Set the array POWER/STANDBY switch to POWER on each disk array.
2. Wait for the array STATUS light to be green (may take 60 seconds).
3. Check the fiber optic STATUS light to make sure it is on.
4. Check the PBus FAULT lights to make sure they are off.

Configuring the System

After the disk array has been installed and tested, it must be configured into the computer system. Refer to the appropriate system documentation for information on configuring the disk array into the system.

4

Reconfiguration Information

This chapter contains information about reconfiguring the disk array. Reconfiguring the disk array consists of one of the following tasks:

- Changing the operating mode of the disk array
- Changing the slot configuration of the disk array
- Changing the operating mode and slot configuration of the disk array

The configuration of the disk array is changed to optimize system performance. The configuration selected will depend upon the following system parameters:

- The type of system
- The system applications being used
- The level of I/O concurrency required
- The data transfer rate required
- The system availability required

Reconfiguration Types

There are two types of reconfigurations:

- Nondestructive reconfiguration will not destroy data in the disk array.
- Destructive reconfiguration will destroy data in the disk array.

Table 4-1 lists nondestructive reconfiguration procedures and Table 4-2 lists destructive reconfiguration procedures. Follow the steps in the appropriate reconfiguration procedure to reconfigure the disk array properly.

Note

Nondestructive reconfiguration procedures can be performed when the disk array is online or offline, and when disk array power is on or off.

Table 4-1. Nondestructive Reconfiguration Procedures

From Configuration[1]	To Configuration[1]	Procedure Letter
Independent-x	Independent-x	A
Mixed-2	Mixed-4	A
Mixed-4	Mixed-2	A
Striped-2/P	Striped-2	B
Striped-4/P	Striped-4	B
Striped-2	Striped-2/P	C
Striped-4	Striped-4/P	C
Striped-2	Mixed-2	D

[1] -x = 1 to 5 data modules; -2 = 2 data modules; -4 = 4 data modules; /P = with data protection module

Table 4-2. Destructive Reconfiguration Procedures

From Configuration[1]	To Configuration[1]	Procedure Letter
Independent-x	Mixed-2	E
Independent-x	Mixed-4	E
Independent-x	Striped-2	E
Independent-x	Striped-4	E
Independent-x	Striped-2/P	E
Independent-x	Striped-4/P	E
Mixed-2	Independent-x	F
Mixed-4	Independent-x	F
Striped-2	Independent-x	F
Striped-2/P	Independent-x	F
Striped-4	Independent-x	F
Striped-4/P	Independent-x	F
Mixed-2	Striped-2	F
Mixed-2	Striped-4	F
Mixed-4	Striped-2	F
Mixed-4	Striped-4	F
Striped-4	Mixed-4	F
Striped-2	Striped-4	F
Striped-4	Striped-2	F
Striped-2/P	Striped-4/P	F
Striped-4/P	Striped-2/P	F

[1] -x = 1 to 5 data modules; -2 = 2 data modules; -4 = 4 data modules; /P = with data protection module

Reconfiguration Procedures

Use the following reconfiguration procedures for reconfiguring the disk array.

Note Refer to Chapter 7 for information on adding and removing disk drive modules.

Procedure A

1. Add or remove the disk drive modules.
2. Set the array POWER/STANDBY switch to POWER.
3. Wait for the array STATUS light to be green (may take 60 seconds).
4. If modules were added, perform the media verification procedure.

Procedure B

1. Remove the disk drive module from slot 4.
2. Set the array POWER/STANDBY switch to POWER.
3. Wait for the array STATUS light to be green (may take 60 seconds).

Procedure C

1. Add a disk drive module to slot 4.
2. Run FLEXDIAG.
3. Send the REBUILD command to start the REBUILD process (30 minutes).
4. If the REBUILD process passes, the disk array is ready for use. If the REBUILD process fails:
   a. Run FLEXDIAG.
   b. Send the UNIT command.
   c. Send the RUN LOG command to find uncorrectable error sites.
   d. Send the SPARE command to spare uncorrectable error sites.

Procedure D

1. Set the array POWER/STANDBY switch to STANDBY.
2. Set the MODE switches to Mixed Mode.
3. Set the array POWER/STANDBY switch to POWER.
4. Wait for the array STATUS light to be green (may take 60 seconds).

Procedure E

1. Terminate all disk array activity on the system.
2. Back up all units in the disk array.
3. Set the array POWER/STANDBY switch to STANDBY.
4. Add or remove disk drive modules.
5. Set the MODE switches to the desired operating mode.
6. Set the array POWER/STANDBY switch to POWER.
7. Wait for the array STATUS light to be green (may take 60 seconds).
8. If the disk array contains a data protection module, perform the media initialization procedure. If any new data modules were added to the disk array and the disk array does not contain a data protection module, perform the media verification procedure.
9. Restore data to the disk array.

Procedure F

1. Terminate all disk array activity on the system.
2. Back up all units in the disk array.
3. Set the array POWER/STANDBY switch to STANDBY.
4. Set the MODE switches to Independent Mode.

Note

If you do not set the MODE switches to Independent Mode, the array FAULT lights will display a configuration fault.

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5. Set the array POWER/STANDBY switch to POWER.
6. Wait for the array STATUS light to be green (may take 60 seconds).
7. Set the array POWER/STANDBY switch to STANDBY.
8. Add or remove disk drive modules.
9. Set the MODE switches to the desired operating mode.
10. Set the array POWER/STANDBY switch to POWER.
11. Wait for the array STATUS light to be green (may take 60 seconds).
12. If the disk array contains a data protection module, perform the media initialization procedure. If any new data modules were added to the disk array and the disk array does not contain a data protection module, perform the media verification procedure.
13. Restore the data to the disk array.

Media Verification Procedure

The following media verification procedure should be performed for each new disk drive module added to the disk array:

1. Run FLEXDIAG.
2. Send the MECHANISM command to select the disk mechanism
3. Send the MEDIA TEST command. Select the following options:
   - Clear logs
   - Selected area
   - Vector addressing
   - Cylinder 0, Head 0, Sector 0
   - Volume
   - User input tranfer length
   - Maximum number of sectors
   - Internal pattern

Note

- Permanent uncorrectable media defects may have been created during shipping of the disk drive module. MEDIA TEST will check the disk mechanism for media defects so they can be spared.
- Correctable read errors will be spared automatically during normal operation.

4. If MEDIA TEST passes, the disk array is ready for use. If errors are detected during MEDIA TEST:
   a. Send the RUN LOG command to find uncorrectable error sites.
   b. Send the SPARE command to spare uncorrectable error sites.

Media Initialization Procedure

The following media initialization procedure should be performed if the unit is operating in High Availability Mode:

1. Run FLEXDIAG.
2. Send the UNIT command to select the unit.
3. Send the INIT MEDIA command and select A (retain all spares). The media in the unit will be initialized, then the data protection module will be initialized with a parity pattern.

5

Preventive Maintenance

These products require no preventive maintenance.

6

Troubleshooting and Diagnostics

This chapter contains information about troubleshooting and diagnostics used for repairing a disk array. It includes information about status and fault lights, self-test diagnostics, online diagnostics, logs, and error codes.

Troubleshooting Strategy

The troubleshooting strategy for disk arrays consists of the following steps:

1. Replace a suspect field replaceable assembly (FRA).
2. Recreate or simulate the environment in which the FRA failed.
3. Verify that the problem is solved.

Checking Disk Array Status

The following lights indicate the status of a disk array during normal and fault conditions:

- Array STATUS Light
- Array FAULT Lights
- Module FAULT Lights
- Fiber Optic STATUS Light
- PBus FAULT Lights

Note

System error messages can also indicate the status of a disk array. Refer to the system documentation for information about system error messages.

Array STATUS Light

The array STATUS light can be green or amber, and is located on the array display panel (see Figure 1-2). It can be seen through the array STATUS light lens on the array access door (see Figure 1-1). Table 6-1 describes the disk array STATUS light indications.

Note

An abbreviated version of Table 6-1 is located on the array display panel under the word "STATUS".

Table 6-1. Array STATUS Light Indications

Status	Indication
OFF	Disk array is not ready to transfer data. If no array FAULT lights are lit, the disk array does not have power or the array power supply failed.
GREEN	Disk array passed self-test; disk array is ready for transactions with the host.
AMBER	Disk array has a fault. (Check array FAULT lights.)
FLASHING GREEN	Disk array is active; a transaction is in progress.
FLASHING AMBER	Disk array has a fault and is active. (Check array FAULT lights.)

Array FAULT Lights

Four amber array FAULT lights are located on the array display panel located behind the array access door (see Figure 1-2). Table 6-2 describes the disk array FAULT light indications.

Note

An abbreviated version of Table 6-2 is located on the array display panel under the word "FAULT". The following symbols are used on the array display panel:

- o Array FAULT Light OFF
- • Array FAULT Light ON
- ▲ Array FAULT Light ON or OFF

Note

- If more than one type of array fault has occurred, the array FAULT lights will sequentially display up to four faults at a rate of one fault per second.
- Not all faults prevent the disk array from being accessed by the computer system. For example, if a fan failure occurs, the disk array still operates normally. However, if a disk drive module fails in a disk array operating in Mixed Mode or Striped Mode, the failed module and all of the modules in the unit associated with the failed module will go offline.

Table 6-2. Array FAULT Light Indications

Status	Indication
0 0 0 0	No fault if array status light is green. No power if array status light is off. Power supply failure if array POWER/STANDBY switch is in POWER position. (Replace power supply.)
0 0 0 1	Fan failure. (Replace fan.)
0 0 1 0	Fiber optic interface PCA failed during extended self-test. (Replace fiber optic interface PCA.)
0 0 1 1	NVRAM battery failure. (Replace array controller PCA.)
0 1 0 0	Power-on self-test in process.
0 1 0 1	Extended self-test media error. Unrecoverable data was detected by a disk drive module during read-only error rate tests.
0 1 1 0	The array controller PCA failed self-test. (Replace array controller PCA.)
0 1 1 1	Power supply failure. (Replace power supply.)
1 0 0 0	Slot 0 disk drive module failed. (Replace disk drive module.)
1 0 0 1	Slot 1 disk drive module failed. (Replace disk drive module.)
1 0 1 0	Slot 2 disk drive module failed. (Replace disk drive module.)
1 0 1 1	Slot 3 disk drive module failed. (Replace disk drive module.)
1 1 0 0	Slot 4 disk drive module failed. (Replace disk drive module.)
1 1 0 1	Extended self-test I/O error. Array controller PCA was unable to communicate with one or more disk drive module. (Check disk drive module connector, backplane PCA, or replace disk drive module.)
1 1 1 0	Configuration fault. (Check the disk array configuration.)
1 1 1 1	Array controller fault. (Replace array controller PCA.)
0 = OFF; 1 = ON	

Module FAULT Lights

The module FAULT light is an amber light located on the handle of each disk drive module in the disk array (see Figure 1-2 and Figure 1-3). Table 6-3 shows module FAULT light indications.

If a disk drive module fails, the module FAULT light will be on and the array FAULT lights will indicate an encoded failure for the the disk drive module that failed. If the disk array is operating in High Availability Mode, the failed module will be removed from the logical unit, but the logical unit will still be available. However, if more than two modules fail in High Availability Mode, the logical unit will no longer be available. If the disk array is operating in any other mode, the logical unit that contains the failed module will no longer be available.

Table 6-3. Module FAULT Light Indications

Status	Indication
OFF	Disk drive module passed self-test; functioning properly.
ON	Disk drive module failed during a self-test or during a transaction with the host, or a power-on self-test started[1].
[1]*The module FAULT light stays on for about 10 seconds during a power-on self-test, then goes off.*	

Drive Status Light

The drive status light is visible through the venting slots in each disk drive module. This light indicates activity with the host computer (refer to *5.25-inch Hard Disk Drive Service Manual*, part no. 5960-3881 for more information). The light will be on whenever a data transaction is occurring with the host computer.

Fiber Optic STATUS Light

The fiber optic status light (see Figure 1-3) indicates the status of the fiber optic link. When the fiber optic link is ready for communication, it will be on. If link problems occur, it will be off. Table 6-4 shows indications for the fiber optic status light.

Table 6-4. Fiber Optic STATUS Light Indications

Status	Indication
ON	A fiber optic cable is properly connected to the disk array *and* a functioning host computer.
OFF	One of the following problems exists: ■ The fiber optic cable from the host computer is not connected to the disk array. ■ If a functioning host computer is connected to the disk array, the fiber optic cable is faulty. ■ An improper fiber optic cable connection exists. ■ There is faulty circuitry on either the fiber optic interface PCA, the host computer HP-FL interface, or both.

PBus FAULT Lights

The two amber PBus fault lights (see Figure 1-3) indicate whether or not the PBus is properly terminated. If the PBus is not properly terminated, one or both of these lights will be on. These lights are direction sensitive and can help locate the source of a PBus termination problem (refer to Table 6-5).

Table 6-5. PBus FAULT Light Indications

Status	Indication
All PBus fault lights are off	Normal indication. No PBus problems.
All left-hand PBus fault lights are on, or all right-hand PBus fault lights are on.	Check the terminator connections at both ends of the PBus. Rotate a terminator at either end of the PBus. If the problem still exists, replace one or both array controller PCAs at either end of the PBus.
Some consecutive left-hand PBus fault lights are on, and some consecutive right-hand PBus fault lights are on.	Locate the PBus cable where the transition from left-hand to right-hand PBus fault lights occurs. Check the PBus cable connections or replace the PBus cable. If the problem still exists, replace one or both array controller PCAs at either end of the PBus.
Both PBus fault lights are on for one or more disk arrays.	Disconnect the PBus cable in either direction and check to see if the lights go off. If they go off, replace the PBus cable or replace one or both array controller PCAs at either end of the PBus.

FRA Failures

The disk array contains the following field replaceable assemblies (FRAs) (refer to Chapter 7 for information on removing and replacing these FRAs):

- Disk drive modules, each disk drive module including the following FRAs:
  - SCSI controller PCA
  - Disk mechanism
- Array controller PCA
- Fiber optic interface PCA
- Display PCA
- Backplane PCA
- Power supply

The locations of FRAs within the disk array are shown in Figure 7-2, the locations of FRAs within the disk drive module are shown in Figure 7-3, the locations of FRAs within the disk drive are shown in *5.25-inch Hard Disk Drive Service Manual*, part no. 5960-3881, and the locations of FRAs within the cabinet are shown in *HP C-Series Cabinet Service Manual*, part no. A1707-90016.

Once you have identified the type of array failure, you should replace the suspect FRA. If a disk drive is suspect, replace the SCSI PCA first, then the replace the disk mechanism.

Note

Some controller faults may be disguised as disk drive module faults. To determine whether or not the array controller PCA is at fault, replace the array controller PCA first, then replace the disk drive module. In this way, you avoid handling a good disk mechanism.

Configuration Faults

A configuration fault results from an invalid disk array configuration. The following parameters are used to determine if the disk array has a valid configuration (see Table 1-5):

- The mode switch settings
- The number of disk modules installed
- The slot positions of the disk modules
- The last known configuration of the disk array before a power-on or reset condition.

Caution

When disk array power is switched on, the array controller stores the following information in NVRAM:

- Operating mode of the disk array
- Serial numbers of the disk drive modules in the disk array

A battery on the array controller PCA prevents the loss of this information when the disk array loses power. If the array controller PCA is replaced and disk array power is switched on with the disk array in Striped Mode, this information is compared with the information stored in NVRAM from the last power cycle. If the serial numbers in NVRAM do not match the serial numbers of the disk drive modules currently in the disk array, the array controller will report a configuration fault.

Interface Failures

Interface failures may be caused by the following problems:

- Faulty array controller PCA
- Faulty fiber optic interface PCA
- Faulty PBus terminator
- Faulty PBus cable
- Faulty fiber optic cable
- Faulty cable connections

Note

While the fiber optic cable or PBus cabling is disconnected, any transaction in progress is aborted. When the cabling is reconnected, communication with the disk arrays is reestablished and the host computer retries all pending transactions.

The following tools are available for troubleshooting interface failures:

- Fiber Optic Loopback Cable, part number HFBR-3020
- PBus Tester, part number 5061-3200

PBus Failures

Refer to Table 6-5 for information on using the PBus FAULT lights to troubleshoot PBus failures.

Note

The PBus terminators should be installed on opposite ends of the PBus, and should be 180° out of phase with each other for proper operation of the PBus.

Fiber Optic Interface Failures

The fiber optic STATUS light indicates a fiber optic interface failure. To troubleshoot fiber optic interface failures, perform the following steps:

1. Move the fiber optic cable to another disk array in the cabinet. If the fiber optic STATUS light on the second disk array stays off, replace the fiber optic cable. If the fiber optic STATUS light stays on, perform steps 2 through 5:
2. Install a fiber optic loopback cable onto the disk array.
3. Run the extended self-test. The extended self-test performs a series of HP-FL interface loopback tests. Data is written out of the transmit port and then read back in the receive port. This checks all of the HP-FL interface circuitry, including circuits not tested during the power-on self-test.

Note

A fiber optic loopback cable must be connected to run an extended self-test. If a fiber optic loopback cable is not connected to the disk array, the loopback test fails with a controller fault indication and the self-test halts.

4. If the extended self-test fails, view the PBus fault lights and fiber optic status light. If any of the lights are on, refer to Table 5-6 for information on what to check or replace.
5. If the extended self-test does not fail repeatedly or if the host system has experienced intermittant HP-FL interface problems, refer to *Using the PBus Tester*, part no. 5960-0820, for information on using the PBus Tester to troubleshoot HP-FL and PBus problems.

Data Errors

Data errors consist of the following error types:

- Correctable - an error that was corrected using only ECC.
- Uncorrectable - an error that could not be corrected using only ECC. Read retries were required to correct the error.

Note 

During an ERT, the disk array does not perform read retries, so the error remains uncorrectable.

- Recoverable - an error that was corrected using one or more read retries.
- Unrecoverable - an error that could not be corrected within a number of read retries.

Note 

In High Availability Mode, uncorrectable errors are automatically spared by the host system during normal operation.

To troubleshoot data errors:

1. Run FLEXDIAG.
2. Send the UNIT command to select a logical unit or logical device, or send the MECHANISM command to select a disk mechanism.
3. Send the RUN LOG command.

4. Determine the error type of the data error and determine whether the error is "hard" or "soft". Hard errors are correctable or uncorrectable errors that are repeatable at a specific address, and are usually caused by a media defect. Soft errors are correctable errors that occur randomly at different addresses, or occur infrequently at a specific address.
5. Send the CLEAR LOGS command.

Caution

A WTR ERT will destroy any data on the tested portion of the media in the selected UNIT or MECHANISM. Back up all data before performing a WTR ERT.

6. If the errors are hard, perform a Read-Only Error Rate Test (RO ERT) or a Write-Then-Read (WTR) ERT on the uncorrectable sectors, then use the FLEXDIAG SPARE command or the REWRITE utility to spare uncorrectable sectors. If the errors are soft, run five passes of WTR ERT on the correctable sectors, then spare a sector if two or more new correctable errors are logged in the Run Log.

Note

- If a hard error disappears after performing a WTR ERT, the media is probably not at fault. The SCSI controller PCA may have caused the error.
- A high frequency of soft errors may be caused by problems with input power or RFI.

Self-test Diagnostics

The TEST switch is used to set the self-test mode of the disk array to the run mode or the extended mode. A run mode or extended mode self-test is performed in any of the following conditions:

- Whenever disk array power is switched on
- Following a bus Reset command
- Whenever a self-test is invoked using system-level diagnostics or when the DIAG command is executed using FLEXDIAG

If a failure occurs during a self-test, the array FAULT lights indicate which FRA failed. If a disk drive module fails, you may be able to access the disk array logs to retrieve status and error information. If the array controller PCA fails, you will not be able to communicate with the disk array.

Run Mode

Run mode is used during normal operation of the disk array. In run mode, a functional self-test of the array controller PCA is performed. A failure of the functional self-test will result in the array FAULT lights showing a pattern of 0110. Also, a disk drive log entry is made and the host computer is informed when it sends the next DEVICE CLEAR commmand.

When disk array power is switched on in run mode, the disk array performs the following self-test sequence:

1. Array FAULT lights switch on for 10 seconds during the array controller RAM and ROM self-tests.
2. Disk drives start the spin-up routine and array FAULT lights display the code 0100 (power-on self-test in process). Depending on the number of disk drive modules in the disk array, the spin-up process may take up to 60 seconds.
3. Disk drives complete the spin-up routine and array FAULT lights go off.
4. Array STATUS light is green if the self-test passed, amber if the self-test failed.

Extended Mode

Extended mode is used to verify the functionality of the array controller PCA and to verify media integrity. When disk array power is switched on in extended mode, the disk array will loop continuously on the following self-test sequence until disk array power is cycled (one loop takes about 20 minutes to complete):

1. Array FAULT lights switch on for 10 seconds during the array controller RAM and ROM self-tests.
2. Disk drives start the spin-up routine and array FAULT lights display the code 0100 (power-on self-test in process). Depending on the number of disk drive modules in the disk array, the spin-up process may take up to 60 seconds.
3. Disk drives complete the spin-up routine and array FAULT lights go off.
4. A full-volume read-only error rate test is performed on the disk drive modules.

Note

If a fault occurs during the spin-up process, the array FAULT lights will continue to display 0100 unless another error is detected.

5. Array STATUS light is green if the self-test passed, amber if the self-test failed.

During the error rate portion of the extended self-test, the module FAULT light will switch on whenever an error is detected, and the array FAULT lights will display a code for the disk drive module with the most serious error or fault.

The extended self-test will fail if an uncorrectable read error, a read fault, servo fault, array controller PCA, or a fiber optic PCA failure is detected. These failures are logged in the disk drive fault logs. Also, the array FAULT lights will indicate the occurrence of any read errors, faults, or PCA failures. If an uncorrectable, recoverable, or correctable read error is detected during the extended self-test, read the Run Log and spare the error site.

Note

If you only want to test the fiber optic interface PCA, remove all of the modules from the array base. This will cause the ERT portion of the test to be skipped.

To perform an extended self-test:

1. Switch off disk array power.
2. Install a fiber optic loopback cable, part number HFBR-3020.

Note

If a fiber optic loopback cable is not installed, the array FAULT lights will indicate a fiber optic interface PCA failure.

3. Set the TEST switch to the up position.
4. Switch on disk array power.

To return the disk array self-test mode to the run mode:

1. Switch off disk array power.
2. Remove the fiber optic loopback cable.
3. Set the TEST switch to the down position.
4. Switch on disk array power.

FLEXDIAG

FLEXDIAG is the online diagnostic program used for online troubleshooting and maintenance of HP-FL multiuser disk arrays. FLEXDIAG includes commands for accessing the Fault Log, Run Log, and ERT logs, as well as the following commands used only with disk array products (refer to *Online Diagnostics Subsystem Manual, Volume II: Peripherals*, part no. 09740-90031, for a description of these commands):

- CANCEL REBUILD
- FW UPDATE
- MECHANISM
- PROGRESS
- REBUILD
- SKIP MECH
- UNIT

Fault Log

The Fault Log is located in non-volatile RAM on the array controller PCA. The Fault Log maintains a record of array controller faults and is used to temporarily store faults from disk drives in the disk array. When the FAULT LOG command is sent to unit or mechanism 0 through 4, the Hardware Log entries from the selected unit or disk drive are stored in non-volatile RAM on the array controller PCA. (Refer to *5.25-inch Hard Disk Drive Service Manual*, part no. 5960-3881, for information on the Hardware Log.) Then, any entries pertaining to the array controller are added to the Hardware Log entries and the combined data is sent to the host. If the FAULT LOG command is sent to unit 15, only entries pertaining to the array controller are sent to the host.

The Fault Log contains the following information:

Note

Since the disk mechanism and the disk array maintain separate logs, it is possible that two log entries can be made for the same error: one from the disk mechanism and one from the disk array. Log entries from the disk mechanism will have a time stamp of zero and a non-zero Access Count. The DERROR number for both entries will be the same.

Address The address indicates where the error occurred. If no address is associated with the error, this field will contain FFFFFFFF (hex).

Logical Unit Number The logical unit (LU) number indicates the LU number for which the error was detected. The controller is LU 15.

Information Bytes For DERROR 0 through 99, these bytes contain the binary representation of the Vendor Unique ESDI Status byte (byte 24), the ESDI Status byte (byte 25), and two SCSI Status bytes (bytes 26 and 27) returned by the disk drive that reported the error. For all other DERRORS these bytes are reserved. Refer to *5.25-inch Hard Disk Drive Service Manual*, part no. 5960-3881, for more information about these bytes.

Derror Number The DERROR number indicates a specific malfunction that occurred during self-test or run-time operation of the disk array. Refer to Table 6-6 in this chapter for a list of DERROR codes, descriptions, and action required to repair the disk array.

Time Stamp A time stamp indicates the relative time when the error occurred. The disk array maintains an internal timer that increments once every second. When an error occurs the current timer value is placed in the log.

Note

- The internal timer only runs while the disk array is turned on.
- Log entries from a disk drive will have a time stamp of 0.

Activity Indicator The activity indicator indicates the number of seeks performed by the disk mechanism. This number is only available for log entries that were read from a disk drive. This field will contain a 0 for log entries from the array controller.

Refer to FAULT LOG, Output for HPC225X, in *Online Diagnostics Subsystem Manual, Volume II: Peripherals*, part no. 09740-90031, for more information about the Fault Log.

To read the Fault Log for a unit or a disk drive in the disk array:

1. Run FLEXDIAG.
2. Enter the UNIT command to select a unit number in the disk array, or enter the MECHANISM command to select a specific disk drive in the disk array.
3. Enter the FAULT LOG command.

Run Log

The Run Log is derived from entries in the Data Error Log located in each disk drive. When the Run Log command is executed using FLEXDIAG, the information is transferred temporarily to RAM on the array controller for formatting purposes, then sent to the host.

The Run Log contains information about data errors that have occurred in a disk drive during data transactions with the host. Refer to RUN LOG, Output for HPC225X, in *Online Diagnostics Subsystem Manual, Volume II: Peripherals*, part no. 09740-90031, for more information about the Run Log.

To read the Run Log for a unit or a disk drive in the disk array:

1. Run FLEXDIAG.
2. Enter the UNIT command to select a unit number in the disk array, or enter the MECHANISM command to select a specific disk drive in the disk array.
3. Enter the RUN LOG command.

Error Codes

Table 6-6 lists the error codes for the disk array.

Table 6-6. Error Codes

DERROR (hex)	DESCRIPTION	ACTION
00	No error. Used in IMS and status messages.	None.
1C	Disk drive reported Hardware Error and No Record Found. Sector header field is corrupted.	Spare the sector.
1D	Disk drive reported No Index Pulse Detected.	Replace the SCSI controller PCA.
1E	Disk drive reported No Seek Complete.	Replace the SCSI controller PCA.
1F	Disk drive reported Write Fault.	Replace the SCSI controller PCA. Could also be caused by excessive mechanical shock.
20	Disk drive reported Drive Not Ready. Disk drive has lost power, spun down, or has a spindle problem.	Replace the flexible circuit assembly, disk mechanism, SCSI controller PCA, backplane PCA, or power supply.
21	Disk drive reported CRC or ECC Error.	Read the Run-time Log and spare the error site.
22	Disk drive reported Unrecoverable Read Error.	Read the Fault Log and spare the error site.
23	Disk drive reported No Record Found.	None. Information only.
24	Disk drive reported Seek Positioning Error.	Replace the SCSI controller PCA. Could also be caused by excess mechanical shock.
25	Disk drive reported Read Recovered with Read Retries.	Read the Run-time Log and monitor the error site.
26	Disk drive reported Read Recovered with ECC.	Read the Run-time Log and monitor the error site.
27	Disk drive reported Defect List Error.	Replace the disk mechanism.

Table 6-6. Error Codes (continued)

DERROR (hex)	DESCRIPTION	ACTION
28	Disk drive reported Parameter List Length Error. Data between the array controller PCA and the disk drive was interpreted incorrectly.	Replace the array controller PCA, disk drive, or backplane PCA.
29	Disk drive reported Synchronous Transfer Error. Bus Reset failed command poll for Spindle Sync.	No action unless 5 errors occur within one week. Then, read the Fault Log to find the disk drive that failed and replace the flexible circuit assembly. If the error persists, replace the backplane assembly or power supply.
2A	Disk drive reported Illegal Opcode. Data between the array controller PCA and the disk drive was interpreted incorrectly.	Replace the array controller PCA, disk drive, or backplane PCA.
2B	Disk drive reported Illegal Logical Block Address. Data between the array controller PCA and the disk drive was interpreted incorrectly.	Replace the array controller PCA, disk drive, or backplane PCA.
2C	Disk drive reported Illegal Field in Command Descriptor Block. Data between the array controller PCA and the disk drive was interpreted incorrectly.	Replace the array controller PCA, disk drive, or backplane PCA.
2D	Disk drive reported Invalid Logical Unit. Data between the array controller PCA and the disk drive was interpreted incorrectly.	Replace the array controller PCA, disk drive, or backplane PCA.
2E	Disk drive reported Invalid Field in Parameter List. Data between the array controller PCA and the disk drive was interpreted incorrectly.	Replace the array controller PCA, disk drive, or backplane PCA.
2F	Disk drive reported Power-on or Reset.	None. Information only.
30	Disk drive reported Mode Select Parameters Changed.	Replace the SCSI controller PCA.
31	Disk drive reported Media Format Corrupted.	Replace the disk mechanism.
32	Disk drive reported No Defect Spare Location Available.	Replace the disk mechanism.

Table 6-6. Error Codes (continued)

DERROR (hex)	DESCRIPTION	ACTION
33	Disk drive reported Spare Operation Failed. The spare track may have a media defect.	Retry the spare operation, then replace disk mechanism or SCSI controller PCA.
34	Disk drive reported RAM Self-test Failure.	Replace the SCSI controller PCA.
35	Disk drive reported Data Path Self-test Failure.	Replace the SCSI controller PCA.
36	Disk drive reported Power-on Self-test Failure.	Replace the SCSI controller PCA.
37	Disk drive reported Message Reject Error. Data between the array controller PCA and the disk drive was interpreted incorrectly.	Replace the array controller PCA, disk drive, or backplane PCA.
38	Disk drive reported Internal Controller Error.	Replace the SCSI controller PCA.
39	Disk drive reported Select/Reselect Failed.	Replace the flexible circuit assembly or backplane PCA.
3A	Disk drive reported SCSI Parity Error.	Replace the flexible circuit assembly, SCSI controller PCA, or backplane PCA.
3B	Disk drive reported Illegal Message Received. Data between the array controller PCA and the disk drive was interpreted incorrectly.	Replace the array controller PCA, disk drive, or backplane PCA.
4F	Disk drive reported Servo Fault.	Replace the SCSI controller PCA.
50	Disk drive reported a recovered Internal Error.	None. Information only.
51	Disk drive reported a recovered Seel Positioning Error.	None. Information only.
52	Disk drive reported a recovered Write Fault.	None. Information only.
53	Disk drive reported a recovered No Record Found.	None. Information only.
54	Disk drive reported a recovered Unrecognized Sense Code.	None. Information only.
55	Disk drive reported a recovered Servo Error.	None. Information only.

Table 6-6. Error Codes (continued)

DERROR (hex)	DESCRIPTION	ACTION
56	Disk drive reported a Data Protect Sense Key. Disk drive cannot be written to.	Replace the SCSI controller PCA or disk mechanism.
64	Disk drive reported an unexpected Additional Sense Code. Sense Key and Additional Sense Code combination is illegal.	None. Information only.
65	Disk drive reported Check Condition after a Request Sense.	None. Information only.
66	Disk drive module 0 failed. Array controller removed the drive because of unacceptable error rate (High Availability Mode), or the drive could not spin up (other operating modes).	Replace the flexible circuit assembly, SCSI controller PCA, disk mechanism, or array controller PCA.
67	Disk drive module 1 failed. Array controller removed the drive because of unacceptable error rate (High Availability Mode), or the drive could not spin up (other operating modes).	Replace the flexible circuit assembly, SCSI controller PCA, disk mechanism, or array controller PCA.
68	Disk drive module 2 failed. Array controller removed the drive because of unacceptable error rate (High Availability Mode), or the drive could not spin up (other operating modes).	Replace the flexible circuit assembly, SCSI controller PCA, disk mechanism, or array controller PCA.
69	Disk drive module 3 failed. Array controller removed the drive because of unacceptable error rate (High Availability Mode), or the drive could not spin up (other operating modes).	Replace the flexible circuit assembly, SCSI controller PCA, disk mechanism, or array controller PCA.
6A	Disk drive module 4 failed. Array controller removed the drive because of unacceptable error rate (High Availability Mode), or the drive could not spin up (other operating modes).	Replace the flexible circuit assembly, SCSI controller PCA, disk mechanism, or array controller PCA.
6D	Array controller RAM required initialization. This error occurs after a firmware upgrade; may also be caused by low battery voltage.	Replace the array controller PCA.

Table 6-6. Error Codes (continued)

DERROR (hex)	DESCRIPTION	ACTION
6E	Could not get Sense data from one or more disk drives after a Rebuild.	Retry the Rebuild. If the problem persists, replace the SCSI controller PCA or the disk mechanism.
6F	Xanadu found a bad register combination. This indicates a firmware bug.	None. Information only.
70	Spare operation cannot complete and has left corrupted data on the disk mechanism media. This error is detected by firmware.	Retry the Rebuild or Reload the data.
71	Disk drive reported media error during extended self-test.	Read the Fault Log and spare the error site.
72	Disk drive reported error other than a media error during extended self-test.	Read the Fault Log and perform whatever action is necessary for the error that occurred.
73	The SPIFI chip reported a SCSI bus error. This error could be caused by a poor connection between the disk drive and the backplane PCA.	Replace the flexible circuit assembly, SCSI controller PCA, or array controller PCA.
74	The host sent DAT header that was invalid. System error.	None. Information only.
75	The host sent a header that was invalid. System error.	None. Information only.
76	The host tried to start a transaction on a used vc. System error.	None. Information only.
77	A transaction failed but may succeed if retried. System error.	None. Information only.
78	Battery failed.	Replace the array controller PCA.
79	Unexpected Interrupt during extended self-test.	Check PBus termination. Replace the disk drive if the module FAULT light does not come on during power-on self-test. Otherwise, replace array controller PCA or backplane PCA.

Table 6-6. Error Codes (continued)

DERROR (hex)	DESCRIPTION	ACTION
7A	SPIFI Select Timeout during extended self-test.	Check PBus termination. Replace the disk drive if the module FAULT light does not come on during power-on self-test. Otherwise, replace array controller PCA or backplane PCA.
7B	IO Self-test reported a fault.	Replace the array controller PCA.
7C	Fiber optic interface PCA failed self-test.	Replace the fiber optic interface PCA.
80	User caused a configuration fault when reconfiguring the disk array.	Check the configuration of the disk array.
82	Spindle synchronization failure. This error only affects the performance of the disk array, and is only a failure if a high number of these errors occur.	Remove the disk drives until the error goes away. Then replace the SCSI controller PCA in the disk drive that caused the error.
83	A parity error occured on a transport header.	Check PBus cabling and connections, then replace the array controller PCA.
84	Data structures for extra headers became exhausted. System error.	None. Information only.
85	Data structures to keep transactions become exhausted. System error.	None. Information only.
86	A power supply failed.	Replace the failed power supply.
87	A fan failed.	Replace the failed fan.
88	The PBus watch dog timer went off. May be caused by a system PBus time-out or a hardware problem on the array controller PCA.	Replace the array controller PCA or troubleshoot the PBus using the PBus tester.
89	Parity error detected between Xanadu and SPIFI. Could be caused by a firmware bug.	Replace the array controller PCA, SCSI controller PCA, or disk mechanism.
8A	Array controller firmware detected an illegal or unexpected condition.	None. Information only.

Table 6-6. Error Codes (continued)

DERROR (hex)	DESCRIPTION	ACTION
8B	Transaction timed out while polling SPIFI for data.	Replace the array controller PCA, SCSI controller PCA, or disk mechanism.
8D	PI Channel overflow detected. System error.	None. Information only.
8E	PI Channel done in error detected. System error.	None. Information only.
8F	Parity error occurred between PI and Xanadu.	Replace the array controller PCA or troubleshoot the PBus using the PBus tester.
91	SPIFI did not comlette a Write Full Sector.	Replace the array controller PCA, SCSI controller PCA, or disk mechanism.
92	SPIFI reported an error on the SCSI bus during a PIO operation.	Replace the array controller PCA, SCSI controller PCA, or disk mechanism.
9B	Transaction exceeded the time limit on P-Bus.	Replace the fiber optic interface PCA or troubleshoot the PBus using the PBus tester.
9C	PRONTO chip detected a parity error in the disk to host connection.	Troubleshoot the PBus using the PBus tester. Error may be caused by the system CIO card.
9D	The PRONTO chip detected an illegal protocol frame fron the Jupiter chips.	Troubleshoot the PBus using the PBus tester. Error may be caused by the system CIO card.
9E	Logs are full.	None. Information only.
A7	Unexpected SCSI bus state.	Replace the SCSI controller PCA, disk mechanism, or backplane PCA.
A9	SCSI bus Reset line was pulled by another device.	Replace the array controller PCA, flexible circuit assembly, SCSI controller PCA, or disk mechanism.
AA	Disk drive is present, but unassigned.	Check the disk array configuration.

7

Removal and Replacement

Introduction

This chapter includes removal and replacement procedures for the disk array, parts lists, and exploded views of the disk array, disk drive module, and cabinet assembly kit.

Service Preparation

Warning

To avoid electric shock, disconnect the disk array from ac power before servicing it.

Caution

The electronic components within the disk array are susceptible to electrostatic damage. Use the field service grounding kit, part no.9300-1155, to avoid electrostatic damage when servicing the disk array. Also, store electrostatic sensitive assemblies in an anti-static bag immediately after removing them.

Before removing any disk array parts, perform the following steps:

1. Switch off the disk array power.
2. Disconnect the ac power cord from the disk array.
3. Disconnect all interface cables from the disk array.
4. If necessary, move the disk array to a location where all FRAs are easily accessible.
5. Make sure you and the disk array are properly grounded using an anti-static work station and wrist strap.

Removal and Replacement Procedures

The following paragraphs provide instructions for removing and replacing disk array assemblies. The procedures are listed in the order of disassembly. Refer to Figure 7-3 when removing and replacing parts in a C2251A disk drive module. Refer to Figure 7-2 when removing and and replacing parts in a C2250A disk array base. To assist in the identification of parts, references are made to the index numbers used in Figure 7-2 and Figure 7-3.

Note

Unless noted, the following assemblies are installed in the reverse order of the removal procedures.

Disk Drive Module

Once a disk drive module has failed, the array controller will not allow the module to become part of a logical unit until it has been replaced. When the array controller sees a new module serial number for the slot that contained the failed module, the module becomes part of a logical unit again.

Note

When an HDA is replaced, customer data must be restored to the new HDA. Consequently, thorough troubleshooting must be performed to avoid replacing an HDA unnecessarily.

Caution

When reinstalling multiple disk drive modules, make sure each module is installed in its original slot to ensure proper operation of the disk array.

To remove a disk drive module (see Figure 7-1):

1. If you are removing a disk drive module from slot 0, 1, or 2, open the array access door. If you are removing a disk drive module from slot 3 or 4, open the cabinet rear door.
2. Push the disk drive module securing latch from to the left to unlock the disk drive module.
3. Grasp the disk drive module handle and pull it straight toward you out of the disk array base.

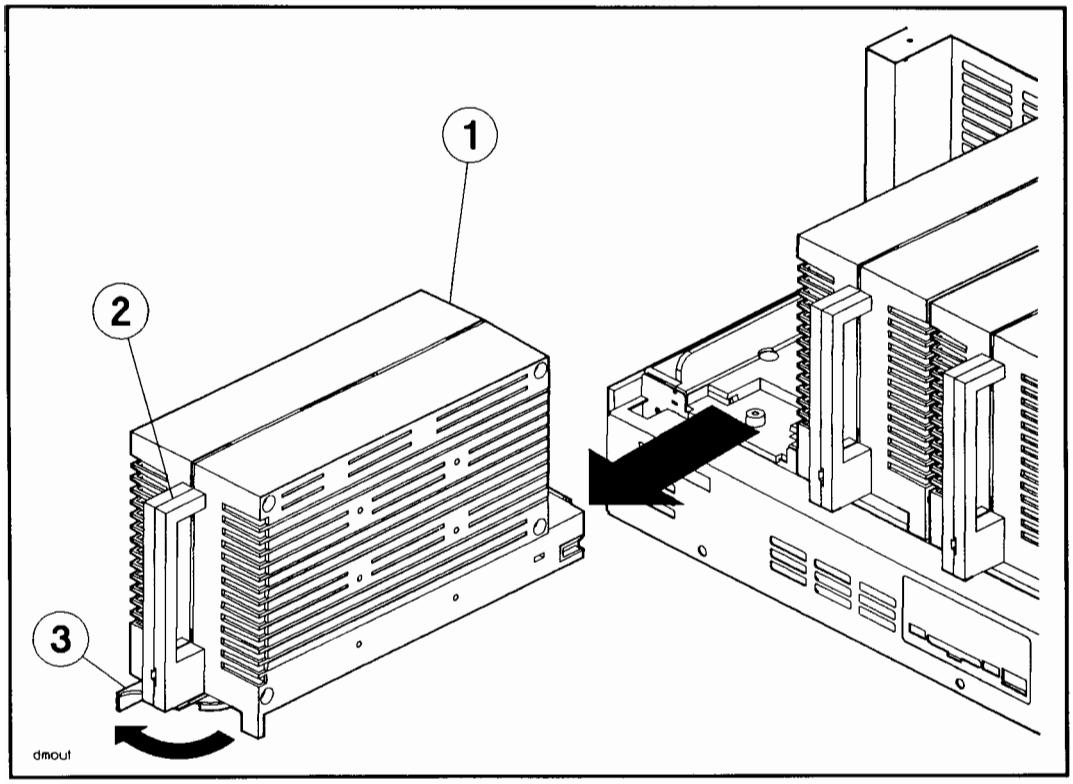

Figure 7-1. Removing a Disk Module

1—Disk Drive Module
2—Handle
3—Securing Latch

Disk Mechanism

To remove a disk mechanism (see Figure 7-3):

Caution 

The disk mechanism is susceptible to mechanical shock and vibration. The disk mechanism should be placed on a padded surface while it is out of the disk array chassis.

1. Remove the disk drive module from the disk array base.
2. Remove four screws from the right-hand module cover.
3. Remove the right-hand module cover.
4. Remove the securing latch.
5. Lay the left-hand module cover on its side with the mechanism facing down.
6. Remove four screws securing the disk mechanism to the left-hand module cover.
7. Disconnect the disk drive module status cable from the disk mechanism.
8. Remove the flexible cable.
9. Carefully lift the disk mechanism out of the module cover.

Caution

- When reassembling the module covers and the securing latch, be careful not to pinch the flexible circuit assembly. The disk array may not function properly if the flexible circuit assembly is pinched.
- Before installing a new disk mechanism, make sure the SCSI address switch on the mechanism is set to the 0. If the SCSI address switch is not set to 0, a configuration fault will occur during self-test.

I/O Panel

To remove the I/O panel (see Figure 7-2):

1. Remove the I/O panel mounting screws.
2. Lift the I/O panel up and away from the disk array base.

Array Controller PCA

To remove the array controller PCA (see Figure 7-2):

1. Remove the I/O panel.
2. Disconnect the PBus cables from the PBus connectors on the array controller PCA.
3. Disconnect the fiber optic cable from the fiber optic connectors on the fiber optic interface PCA.
4. Grasp the array controller PCA extractor ears and pull the array controller PCA out of the disk array base.

Fiber Optic Interface PCA

To remove the fiber optic interface PCA (see Figure 7-2):

1. Remove the array controller PCA.
2. Place the array controller PCA on an anti static pad.
3. Grasp the edges of the fiber optic interface PCA and slide it straight out of the PCA guides on the array controller PCA.

Note

When installing the fiber optic interface PCA, push on the plastic lever located on the right-hand side of the PCA and push on the left-hand side of the PCA to make sure the PCA slides straight into the PCA guides.

Display Panel

To remove the display panel (see Figure 7-2):

1. Remove the two display panel mounting screws.
2. Pull the display panel off of the disk array base.

Display PCA

To remove the display PCA (see Figure 7-2):

1. Remove the display panel.
2. Grasp the extractor ears on the display PCA and pull the PCA straight out of the the PCA guides.

Power Supply

To remove the power supply (see Figure 7-2):

1. Disconnect the power cord from the rear of the power supply.
2. Remove the two power supply mounting screws.
3. Lift the power supply up against the securing tab.
4. Grasp the power supply handle.
5. Slide the power supply out of the disk array base.

Disk Array Base

To remove a disk array base:

1. Remove all of the disk drive modules.
2. Remove the power supply.
3. Remove the two screws from the mounting ears.
4. Grasp the disk array base and slide it forward until it clears the disk array mounting rails.

Fan Assembly

To remove the fan assembly (see Figure 7-2):

1. Remove the disk array base.
2. Insert a screwdriver into the side of the fan assembly.
3. Pull the fan assembly vertically off of the disk array base.

Fan

To remove a fan (see Figure 7-2):

1. Remove all of the disk drive modules from the front slots of the disk array base.
2. Remove the plenum front panel.
3. Disconnect the fan cable.
4. Remove the fan.

Note

When replacing fans, observe the following guidelines:

- Always install the fans before installing the power supply.
- When installing the fans, connect the fan cables first and make sure they are not pinched between the plenum base and the disk array base.

Backplane PCA

To remove a backplane PCA (see Figure 7-2):

1. Remove the disk array base.
2. Remove the fan assembly.
3. Remove the display panel.
4. Remove the display PCA.
5. Remove the I/O panel.
6. Remove the array controller PCA.
7. Remove the five base cover mounting screws.
8. Lift the disk array base off of the bottom cover assembly.
9. Remove the front and rear RFI shields.
10. Pull the backplane PCA vertically out of the bottom cover assembly.

Cabinet FRAs

Note

Refer to *HP C-Series Cabinet Service Manual*, part no. A1707-90016, for information on removal and replacement of cabinet parts.

Field Stocking Inventory

Table 7-1 lists the parts recommended for field stocking inventory:

Table 7-1. Field Stocking Inventory

PART NUMBER	DESCRIPTION
C2250-69030*	POWER SUPPLY, automatic ranging
C2250-00002	PLENUM BASE
C2250-60029	PLENUM FRONT PANEL
0515-0433	SCREW, M4 x 0.x x 8 mm
C2250-60002	FAN ASSEMBLY
C2250-69007*	ARRAY CONTROLLER PCA
C2250-69008*	FIBER OPTIC INTERFACE PCA
C2250-69009*	DISPLAY PCA
C2250-60010	BACKPLANE PCA
C2250-60012	BOTTOM COVER ASSEMBLY
5021-1536	SCREW, M4 x 0.5 x 40 mm
C2250-00011	FRONT PANEL
C2250-60019	REAR (I/O) PANEL
C2250-00009	PBUS BRACKET
C2250-00013	RFI SHIELD
C2250-00014	RFI CLIP
C2250-60017	ARRAY ACCESS DOOR ASSEMBLY
C2250-00007	RAIL-RIGHT
C2250-00008	RAIL-LEFT
C2250-60020	DRIVE MODULE ENCLOSURE
5181-7720	SCREW, T20
C2250-60005	FLEXIBLE CIRCUIT ASSEMBLY
C2250-40006	SECURING LATCH
2360-0469	SCREW, 6-32 x .750
**Exchange parts*	

Replaceable Parts

This section contains the following information about disk array replaceable parts:

- Replaceable parts ordering information.
- Replaceable parts lists and illustrations:
  - Replaceable parts for the disk array base are listed in Table 7-2 and shown in Figure 7-2.
  - Replaceable parts for the disk drive module are listed in Table 7-3 and shown in Figure 7-3.
  - Replaceable parts for the cabinet assembly kit are listed in Table 7-4 and shown in Figure 7-4.

Ordering Information

To order replaceable parts for the disk array, address the order to your local Hewlett-Packard Sales Office. For the address of the nearest HP Sales Office, contact a Hewlett-Packard Headquarters Office.

Specify the following information in each order:

1. Model number and full serial number.
2. Complete Hewlett-Packard part number.
3. Complete description of each part, as provided in the replaceable parts listing.

Parts Lists and Illustrations

Table 7-2. Disk Array Replaceable Parts

FIG.-INDEX NO.	HP PART NO.	DESCRIPTION	UNITS PER ASSY
6-3-	C2251A	DISK DRIVE MODULE, 1.36 Gbyte	1
	C2252B	DISK ARRAY, 2.72 Gbyte, HP-FL	1
	C2252HA	DISK ARRAY, 2.72 Gbyte, HP-FL	REF
	C2254B	DISK ARRAY, 5.44 Gbyte, HP-FL	REF
	C2254HA	DISK ARRAY, 5.44 Gbyte, HP-FL	REF
1	C2250-60011	DISK DRIVE MODULE ASSEMBLY	1
2	C2250-60030	POWER SUPPLY, automatic ranging	1
3[1]	0515-0433	SCREW, T15, M4 x 8 mm	2
4	C2250-60016	PLENUM BASE	1
5	C2250-60002	FAN ASSEMBLY	2
6	C2250-60029	PLENUM FRONT PANEL	1
7[1]	0515-0433	SCREW, T15, M4 x 8 mm	1
8	C2250-40001	DISK ARRAY BASE (C2250A)	1
9	C2250-00022	BASE CLIP	5
10[1]	5021-1536	SCREW, M4 x 40 mm	5
11	C2250-60012	BOTTOM COVER ASSEMBLY	1
12	C2250-00009	PBUS BRACKET	2
13	1400-0937	PBUS CLIP	4
14[1]	0515-0372	SCREW, M3 x 0.5 x 8 mm	4
15	C2250-00011	FRONT PANEL	1
16[1]	5021-1536	SCREW, M4 x 40 mm	3
17	C2250-65009	DISPLAY PCA	1
18	09850-48301	POWER BUTTON	1
19	C2250-60019	REAR (I/O) PANEL ASSEMBLY	1
20[1]	5021-1536	SCREW, M4 x 40 mm	2

Table 7-2. Disk Array Replaceable Parts (continued)

FIG.-INDEX NO.	HP PART NO.	DESCRIPTION	UNITS PER ASSY
21	C2250-65007	ARRAY CONTROLLER PCA	1
22[1]	0515-0433	SCREW, T15, M4 x 8 mm	1
23	C2250-65008	FIBER OPTIC INTERFACE PCA	1
24	C2250-60026	BACKPLANE ASSEMBLY	1
25	C2250-00014	RFI CLIP	6
26	C2250-00013	RFI SHIELD	2
27	5062-9416	POWER CORD	1
28	5061-3199	PBUS CABLE, 600 mm	1

[1]These parts may be obtained locally by their description.

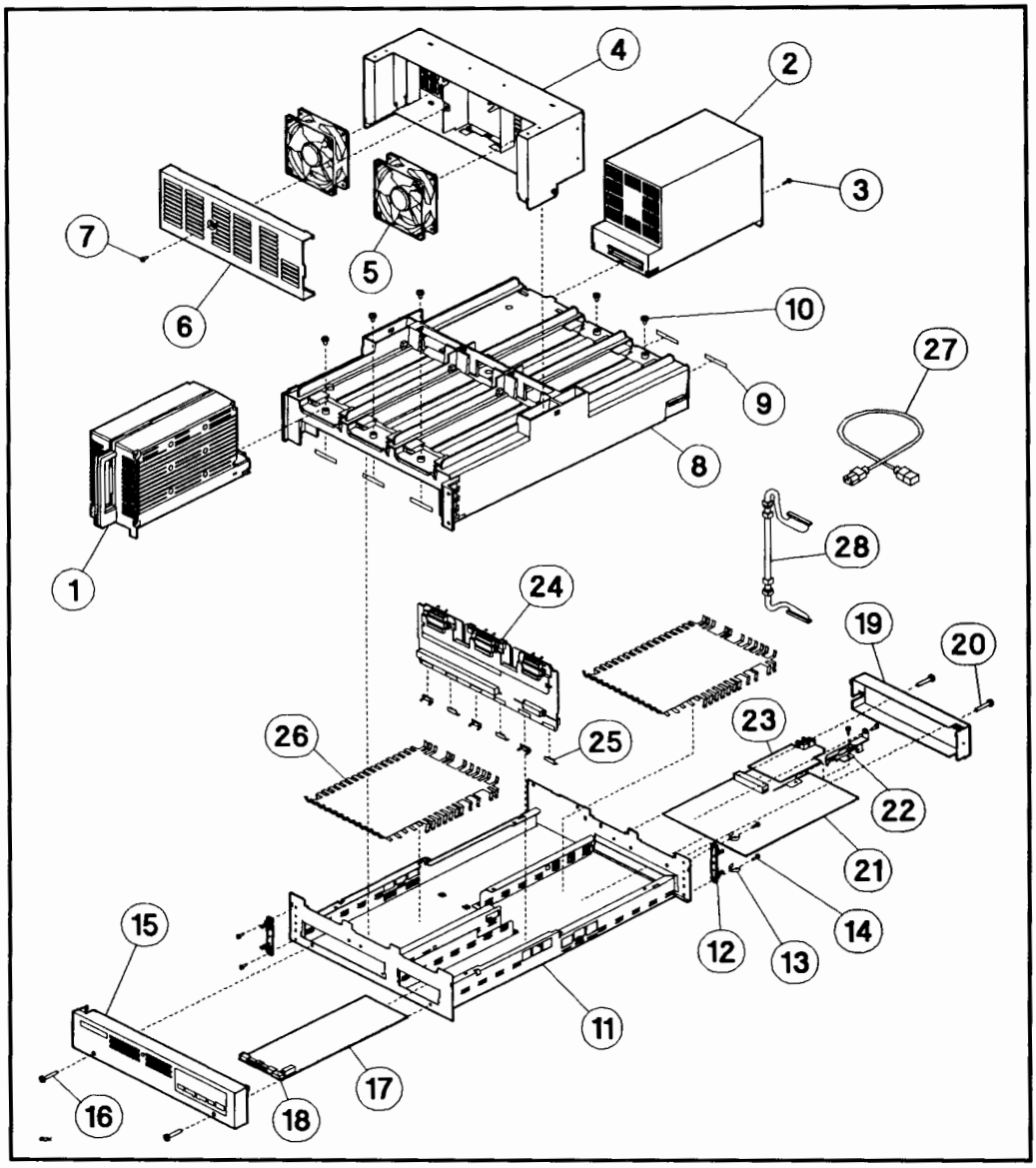

Figure 7-2. Disk Array Base Exploded View

Table 7-3. Disk Drive Module Replaceable Parts

FIG.-INDEX NO.	HP PART NO.	DESCRIPTION	UNITS PER ASSY
6-4-	C2250-60011	DISK DRIVE MODULE ASSEMBLY	1
1	C2250-40005	MODULE COVER-RIGHT	1
2	C2250-40004	MODULE COVER-LEFT	1
3	5181-7720	SCREW, T20	4
4	C2250-80038	RFI GASKET, .5 x .375 inch	1
5	C2250-40006	SECURING LATCH	1
6	2360-0469	SCREW, 6-32 x .750	4
7	C2250-60005	FLEXIBLE CIRCUIT ASSEMBLY	1
8	97560-60162	DISK DRIVE, 5.25-inch, 1.36 Gbyte	1

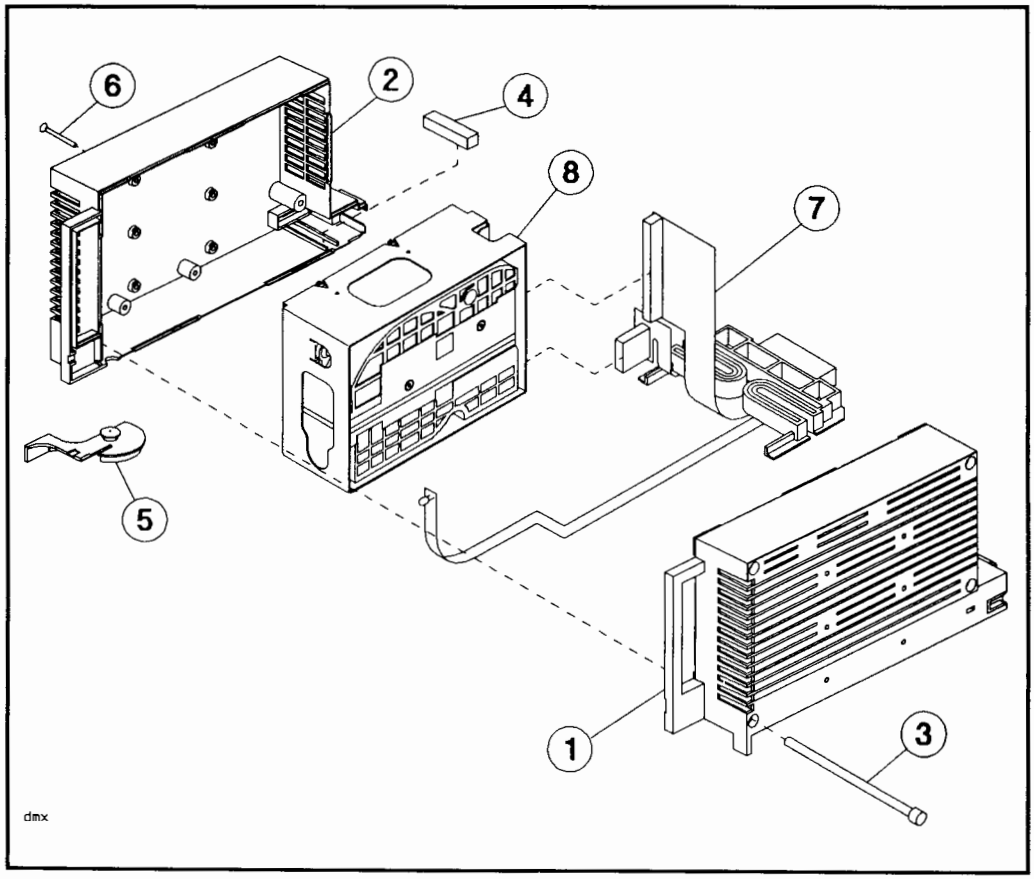

Figure 7-3. Disk Module Exploded View

Table 7-4. Cabinet Assembly Kit Parts

FIG.-INDEX NO.	HP PART NO.	DESCRIPTION	UNITS PER ASSY
6-4-	C2250-60021	CABINET ASSEMBLY KIT	1
1	C2250-60017	ARRAY ACCESS DOOR ASSEMBLY	1
2	C2786-40003	HANDLE	1
3	C2250-00019	HINGE	1
4	C2250-80013	NAMEPLATE	1
5	C2250-00020	LATCH PLATE	1
6	C2786-40002	SNAP	1
7	0515-2271	SCREW, M4 x 10 mm, panhead	1
8	C2250-00007	RAIL-RIGHT	1
9	C2250-00008	RAIL-LEFT	1
10	0535-0078	NUT, M6 hex	4
11	2680-0323	SCREW, TORX, 10-32 x .625	6
12	0590-0804	CLIP NUT, 10-32, sheetmetal	6
13	5041-3716	STRAIN RELIEF COLLAR	1
14	0624-0758	SCREW, panhead	2
15	C2250-00026	WRENCH, 10 mm	1

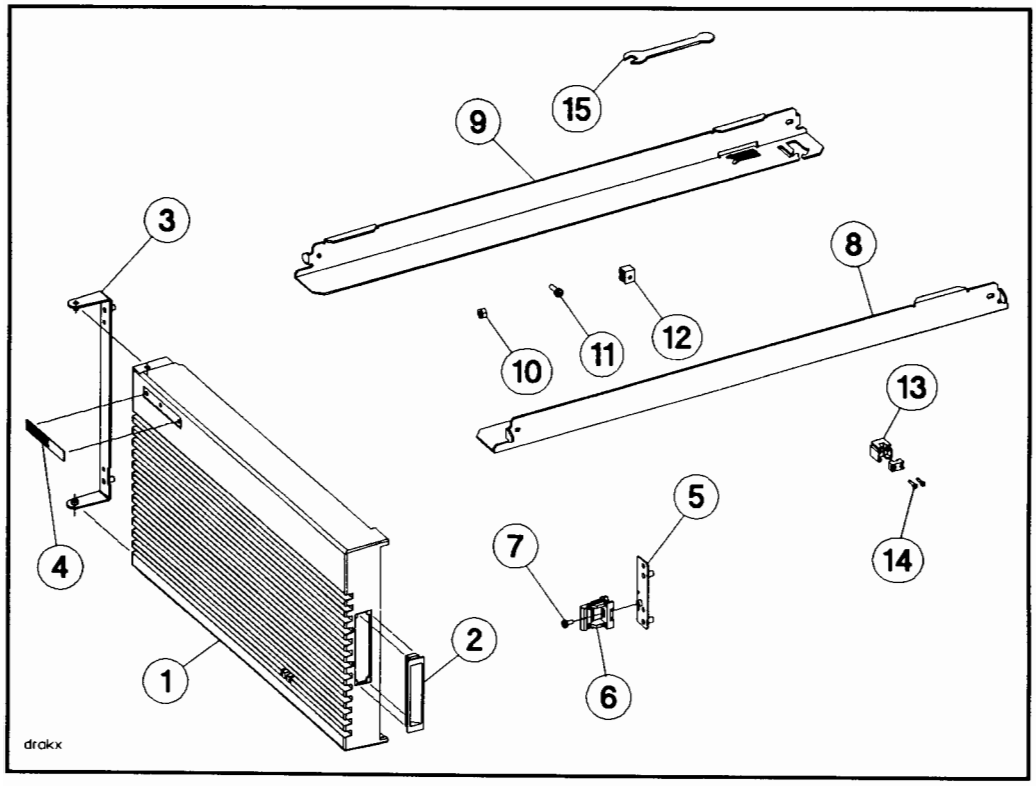

Figure 7-4. Cabinet Assembly Kit Exploded View

8

Diagrams

Figure 8-1 shows the data paths within the disk array.

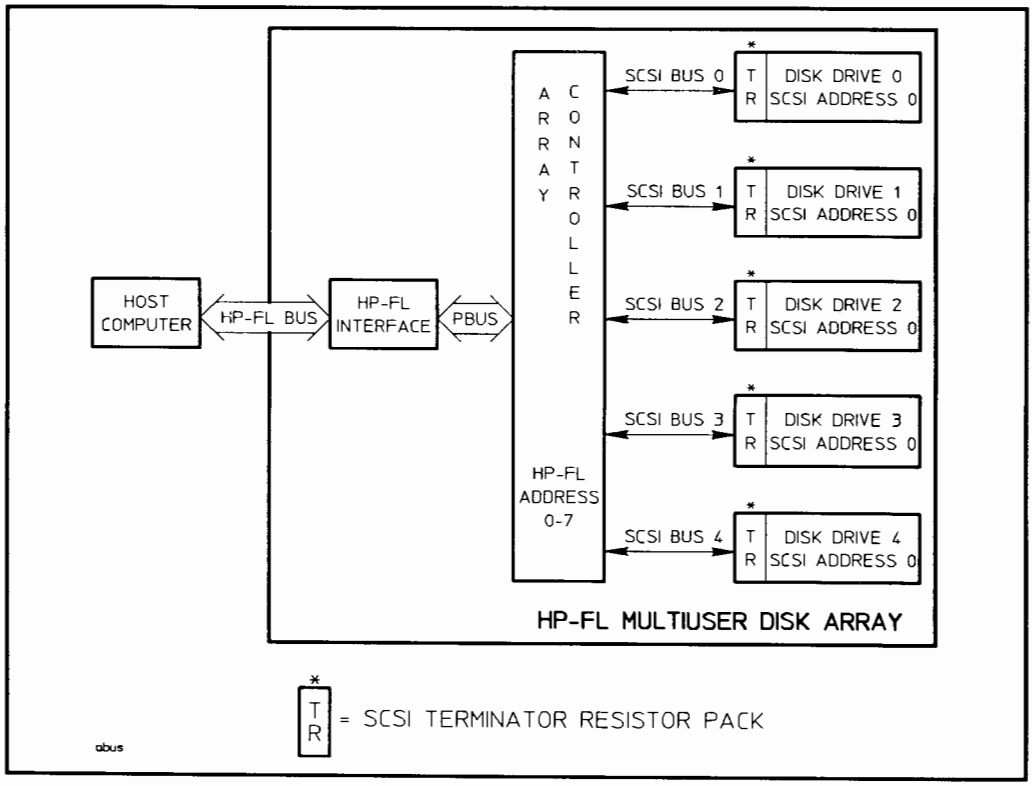

Figure 8-1. Disk Array Data Paths

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Reference

This chapter contains information about other documentation and training kits available for disk array products.

Related Documentation

The following additional documentation is available for disk array products:

- *HP Series 6000 HP-FL Multiuser Disk Arrays User's Manual*, part no. C2250-90901 (English part number)
- *HP C2251A Disk Drive Module Installation Manual*, part no. C2250-90903 (English part number)
- *HP C-Series Cabinet Service Manual*, part no. A1707-90016
- *5.25-inch Hard Disk Drive Service Manual*, part no. 5960-3881
- *HP Series 6000 HP-FL Multiuser Disk Arrays Configuration Details for 5.25-inch Hard Disk Drives*, part no. C2250-90923
- *Online Diagnostics Subsystem Manual, Volume II: Peripherals*, part no. 09740-90031
- *Using the PBus Tester*, part no. 5960-0820

Training Kits

The following training kits are available for disk array products (training kits include a training video, a final exam, and an answer sheet):

- NTSC Kit, part no. C2254+49A-60001
- APL Kit, part no. C2254+49A-60002

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Service Notes

This chapter contains a listing of all service notes issued for these products. No service notes were issued at the time of this printing.

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