HP StorageWorks
2012fc Modular Smart Array
user guide

Contents

About This Guide

Intended Audience

This guide is intended for use by system administrators and information professionals who are experienced with the following:

- Direct attach storage (DAS) or storage area network (SAN) management
- Network administration
- Network installation
- Storage system installation and configuration, including installing an HP rack

Prerequisites

Prerequisites for installing and configuring this product include familiarity with:

- Servers and computer networks
- Fibre Channel and Ethernet protocols

Document Conventions

Typeface	Meaning	Examples
AaBbCc123	Book title, new term, or emphasized word	See the *Release Notes*. A virtual disk (*vdisk*) can .... You *must* be an advanced user to ....
AaBbCc123	Directory or file name, value, command, or on-screen output	The default file name is store.logs. The default IP address is 10.0.0.1. Type exit.
AaBbCc123	Text you type, contrasted with on-screen output	# **set password** Enter new password:
AaBbCc123	Variable text you replace with an actual value	Use the format http://*ip-address*.

Rack Stability

Caution – To reduce the risk of personal injury or damage to the equipment:

- Extend leveling jacks to the floor.
- Ensure that the full weight of the rack rests on the leveling jacks.
- Install stabilizing feet on the rack.
- In multiple-rack installations, secure racks together.
- Extend only one rack component at a time. Racks may become unstable if more than one component is extended.

HP Technical Support

Telephone numbers for worldwide technical support are listed on the HP support website: http://www.hp.com/support/.

Collect the following information before calling:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Applicable error messages
- Operating system type and revision level
- Detailed, specific questions

For continuous quality improvement, calls may be recorded or monitored.

Customer Self Repair

HP customer self repair (CSR) programs allow you to repair your HP StorageWorks product. If a CSR part needs replacing, HP ships the part directly to you so that you can install it at your convenience. Some parts do not qualify for CSR. Your HP-authorized service provider will determine whether a repair can be accomplished by CSR.

For more information about CSR, contact your local service provider. For North America, see the CSR website:

http://www.hp.com/go/selfrepair

Product Warranties

For information about HP StorageWorks product warranties, see the warranty information website:

http://www.hp.com/go/storagewarranty

Subscription Service

HP strongly recommends that customers sign up online using the Subscriber's choice website: http://www.hp.com/go/e-updates.

Subscribing to this service provides you with e-mail updates on the latest product enhancements, newest versions of drivers, and firmware documentation updates as well as instant access to numerous other product resources.

HP Websites

For other product information, see the following HP websites:

- http://www.hp.com
- http://www.hp.com/go/storage
- http://www.hp.com/service_locator
- http://www.hp.com/support/manuals
- http://www.hp.com/support/downloads

Documentation Feedback

HP welcomes your feedback.

To make comments and suggestions about product documentation, please send a message to storagedocs.feedback@hp.com. All submissions become the property of HP.

Before You Begin

The MSA2000 Family 2012fc Modular Smart Array and MSA2000 Drive Enclosure are high-performance storage solutions that combine outstanding performance with high reliability, availability, flexibility, and manageability.

Supported configurations include a controller enclosure with or without attached drive enclosures. A controller enclosure can contain two controllers that interact and provide failover capability for the data path. The controller enclosure can use SATA or SAS disk drive modules. Enclosures can be installed in standard 19-inch EIA rack cabinets.

This chapter provides information that you must know before installing and initially configuring your storage system:

- "System Management Software" on page 12
- "Hardware Components and LEDs" on page 13
- "Installation Checklist" on page 23

System Management Software

Embedded management software includes a web-browser interface and the command-line interface described below.

HP StorageWorks MSA2000 Family Storage Management Utility (SMU)

SMU is the primary interface for configuring and managing the system. A web server resides in each controller module. SMU enables you to manage the system from a web browser that is properly configured and that can access a controller module through an Ethernet connection.

Information about using SMU is in its online help and in the *reference guide*.

Command-Line Interface (CLI)

The embedded CLI enables you to configure and manage the system using individual commands or command scripts through an out-of-band RS-232 or Ethernet connection.

Information about using the CLI is in the *CLI reference guide*.

Hardware Components and LEDs

This section describes the main hardware components of your storage system enclosures.

Controller Enclosure Components and LEDs

The controller enclosure can be connected to Fibre Channel host bus adapters (HBAs) or switches. Table 1-1 describes the controller enclosure components.

Table 1-1 Controller Enclosure Components

Description	Quantity
FC controller (I/O) module	1 or 2[1]
SAS or SATA drive module	2–12 per enclosure
AC power-and-cooling module	2 per enclosure
2- or 4-Gbps FC host port with SFP	2 per controller module
3-Gbps, 4-lane SAS expansion port	1 per controller module
Ethernet port (RJ-45)	1 per controller module
CLI port (RS-232 micro-DB9)	1 per controller module
Service port (RS-232 3.5-mm jack)	1 per controller module

1 Air-management system drive blanks or I/O blanks must fill empty slots to maintain optimum airflow through the chassis.

Figure 1-1 shows the LEDs on the front of a controller.

Enclosure ID — Drive module LEDs (top to bottom) Fault/UID Online/activity — Status LEDs (top to bottom): UID Fault ID Heartbeat

Drive modules are numbered by column top to bottom: 0–2, 3–5, 6–8, 9–11
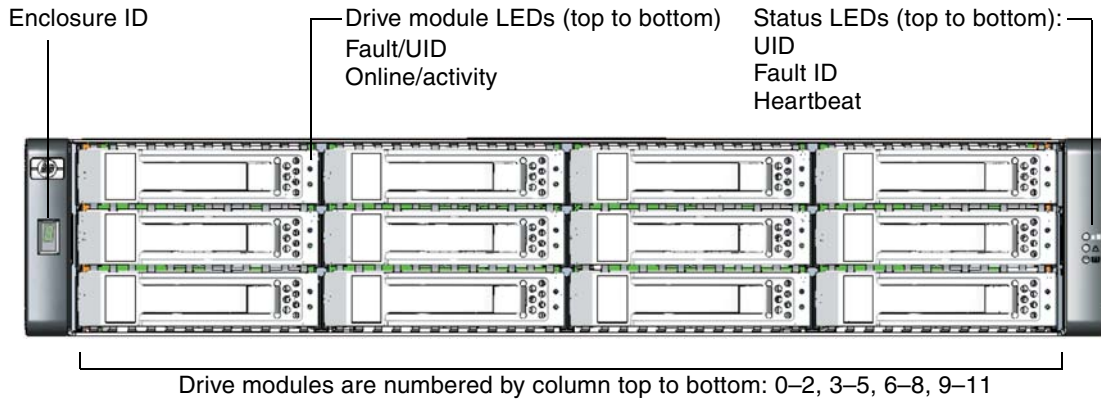
Figure 1-1 Controller (Front View)

Table 1-2 describes the LEDs on the front of a controller.

Table 1-2 Controller LEDs (Front)

LED	Color	Operating State	Description
Enclosure ID	Green	On	Shows the enclosure ID, which enables you to correlate an enclosure with logical views presented by management software. The enclosure ID for a controller enclosure is zero (0); the enclosure ID for an attached drive enclosure is nonzero.
UID (Unit Identification)	Blue	On	Identified.
		Off	Not identified.
⚠ Fault ID	Amber	Off	No fault condition exists.
		On	Fault condition exists. Service action is required. The event has been acknowledged but the problem needs attention.
⊿ Heartbeat LED	Green	On	The enclosure is powered on with at least one power and cooling module operating normally.
		Off	Both power and cooling modules are off.

Table 1-3 describes the LEDs on the drive module.

Table 1-3 Drive Module LED Combinations (Front)

Online/Activity (green)	Fault/UID (amber/blue)	Description
On	Off	The drive is online, but it is not currently active.
Blinking irregularly	Off	The drive is active and operating normally.
Off	Amber, blinking regularly (1 Hz)	Offline; the drive is not being accessed. A predictive failure alert has been received for this device. Further investigation is required.
On	Amber, blinking regularly (1 Hz)	Online; no activity. A predictive failure alert has been received for this device. Further investigation is required.
Blinking irregularly	Amber, blinking regularly (1 Hz)	The drive is active, but a predictive failure alert has been received for this drive. Further investigation is required.
Off	Amber, solid	Offline; no activity. A critical fault condition has been identified for this drive.
Off	Blue; solid	Offline. The drive has been selected by a management application.
On or blinking	Blue; solid	The drive is operating normally, and it has been selected by a management application.
Blinking regularly (1 Hz)	Off	**Do not remove the drive. Removing a drive may terminate the current operation and cause data loss.** The drive is rebuilding.
Off	Off	Either there is no power, the drive is offline, or the drive is not configured.

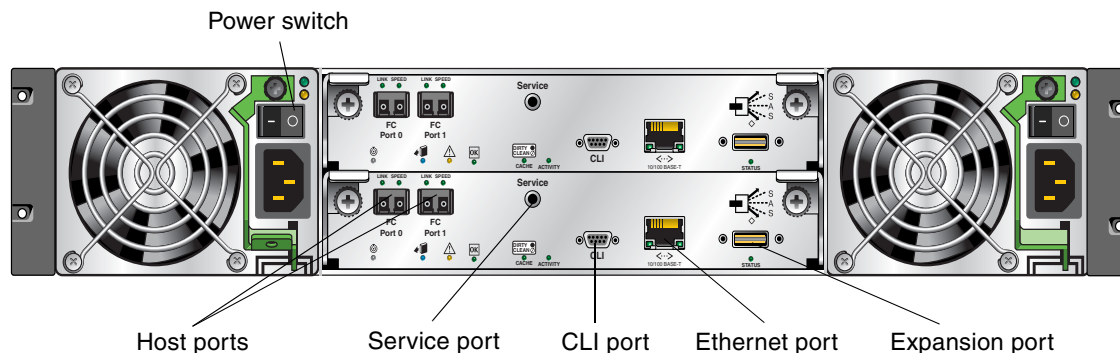Figure 1-2 shows the ports and switches at the back of the controller.

Power switch

Host ports   Service port   CLI port   Ethernet port   Expansion port

Figure 1-2 Controller Ports and Switches (Back View)

Table 1-4 describes the ports and switches on the back of the controller.

Table 1-4 Controller Ports and Switches (Back)

Location	Port/Switch	Description
Power and cooling module	Power switch	Toggle, where: • – is On • ○ is Off
Controller module	Host ports	4-Gbps FC ports used to connect to data hosts. Each port contains a Small Form-factor Pluggable (SFP) transceiver. Host port 0 and 1 correspond to host channel 0 and 1, respectively.
Controller module	Expansion port	3-Gbps, 4-lane (12 Gbps total) table-routed SAS Out port used to connect drive enclosures.
Controller module	Ethernet port	10/100BASE-T Ethernet port used for TCP/IP-based out-of-band management of the RAID controller. An internal Ethernet device provides standard 10 Mbit/second and 100 Mbit/second full-duplex connectivity.
Controller module	CLI port	Micro-DB9 port used to connect the controller enclosure to a local management host using RS-232 communication for out-of-band configuration and management.
Controller module	Service port	3.5-mm jack port used by service technicians only.

Figure 1-3 shows the LEDs at the back of the controller.
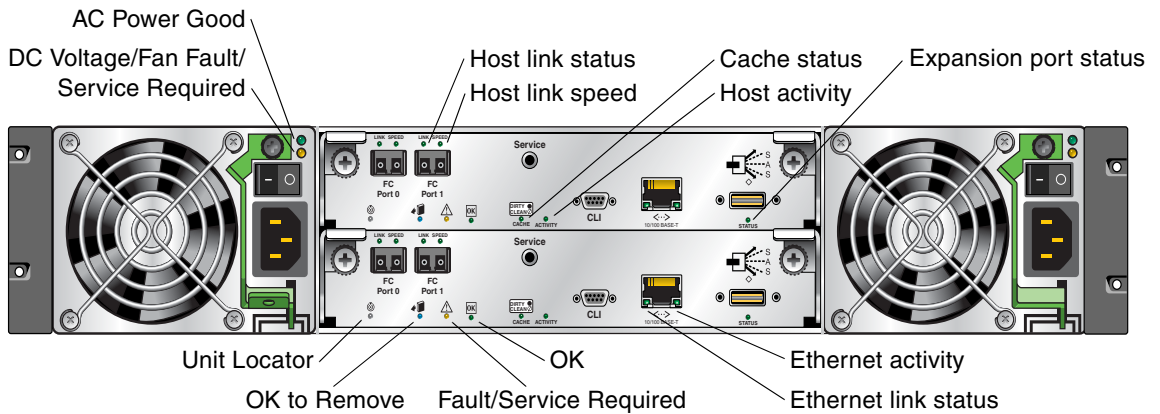
Figure 1-3 Controller LEDs (Back View)

Table 1-5 describes the LEDs on the back of the controller.

Table 1-5 Controller LEDs (Back)

Location	LED	Color	State	Description
Power and cooling module	AC Power Good	Green	Off	AC power is off or input voltage is below the minimum threshold.
			On	AC power is on and input voltage is normal.
Power and cooling module	DC Voltage/ Fan Fault/ Service Required	Amber	Off	DC output voltage is normal.
			On	DC output voltage is out of range or a fan is operating below the minimum required RPM.
Controller module	Host link status	Green	Off	The port is empty or the link is down.
			On	The port link is up and connected.
Controller module	Host link speed	Green	Off	The data transfer rate is 2 Gbps.
			On	The data transfer rate is 4 Gbps.

Table 1-5 Controller LEDs (Back) *(Continued)*

Location	LED		Color	State	Description
Controller module		Unit Locator	White	Off	Normal operation.
				Blink	Physically identifies the controller module.
Controller module		OK to Remove	Blue	Off	The controller module is not prepared for removal.
				On	The controller module can be removed.
Controller module		Fault/Service Required	Amber	On	A fault has been detected or a service action is required.
				Blink	Indicates a hardware-controlled power up or a cache flush or restore error.
Controller module		OK	Green	Off	Controller module is not OK.
				On	Controller module is operating normally.
				Blink	System is booting.
Controller module	Cache status		Green	Off	Cache is clean (contains no unwritten data).
				On	Cache is dirty (contains unwritten data) and operation is normal.
				Blink	A Compact Flash flush or cache self-refresh is in progress. Indicates cache activity.
Controller module	Host activity		Green	Off	The host ports have no I/O activity.
				Blink	At least one host port has I/O activity.
Controller module	Ethernet link status		Green	Off	The Ethernet port is not connected or the link is down.
				On	The Ethernet link is up.
Controller module	Ethernet activity		Green	Off	The Ethernet link has no I/O activity.
				Blink	The Ethernet link has I/O activity.
Controller module	Expansion port status		Green	Off	The port is empty or the link is down.
				On	The port link is up and connected.

Drive Enclosure Components and LEDs

A drive enclosure can be connected to a controller enclosure or to another drive enclosure to provide additional disk storage capacity. Table 1-6 describes the drive enclosure components.

Table 1-6 Drive Enclosure Components

Description	Quantity
Expansion (I/O) module	1 or 2[1]
SAS or SATA drive module	2–12 per enclosure
AC power and cooling module	2 per enclosure
3-Gbps, 4-lane SAS In port	1 per expansion module
3-Gbps, 4-lane SAS Out port	1 per expansion module
Service port (RS-232 micro-DB9)	1 per expansion module

1 Air-management system drive blanks or I/O blanks must fill empty slots to maintain optimum airflow through the chassis.

The components and LEDs on the front of a drive enclosure are the same as on a controller enclosure; see Figure 1-1 and Table 1-2.

Figure 1-4 shows the ports and switches at the back of the drive enclosure.
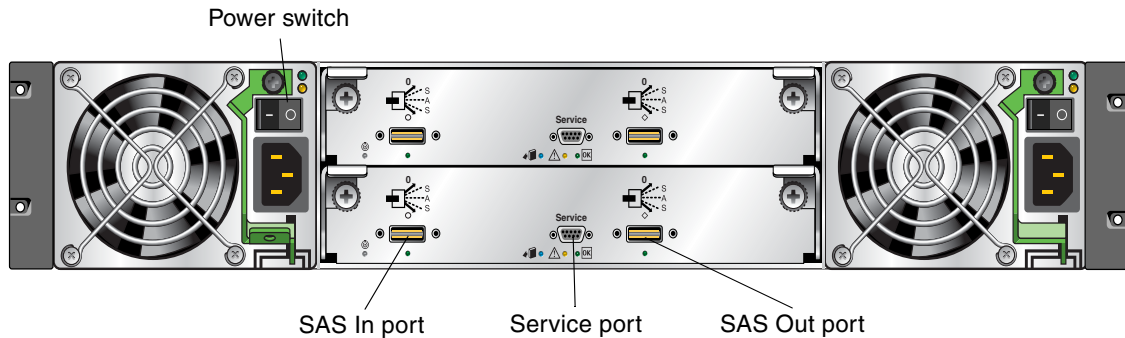
Figure 1-4 Drive Enclosure Ports and Switches (Back View)

Table 1-7 describes the ports and switches on the back of the drive enclosure.

Table 1-7 Drive Enclosure Ports and Switches (Back)

Location	Port/Switch	Description
Power and cooling module	Power switch	Toggle, where: • – is On • ○ is Off
Expansion module	SAS In port	3-Gbps, 4-lane (12 Gbps total) subtractive ingress port used to connect to a controller enclosure.
Expansion module	SAS Out port	3-Gbps, 4-lane (12 Gbps total) table-routed egress port used to connect to another drive enclosure.
Expansion module	Service port	Micro-DB9 port for manufacturing technicians.

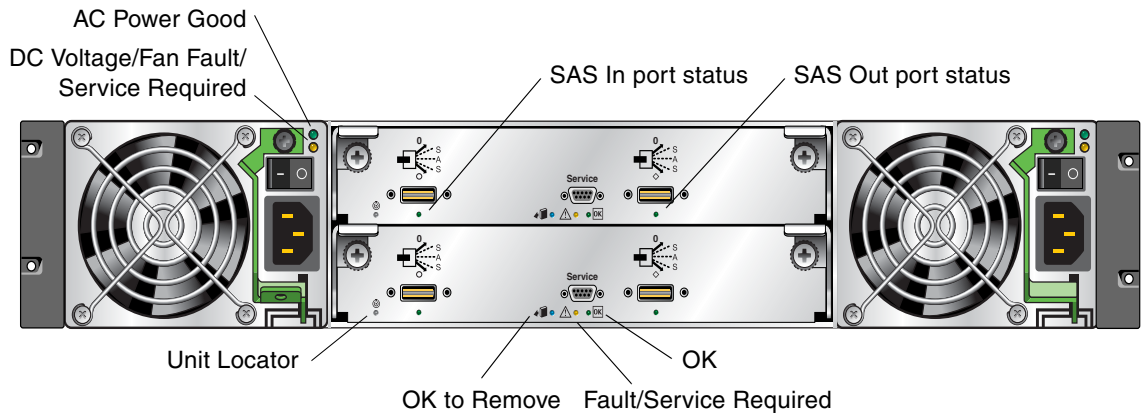Figure 1-5 shows the LEDs at the back of the drive enclosure.

Figure 1-5 Drive Enclosure LEDs (Back View)

Table 1-8 describes the LEDs on the back of the drive enclosure.

Table 1-8 Drive Enclosure LEDs (Back)

Location	LED	Color	State	Description
Power and cooling module	AC Power Good	Green	Off	AC power is off or input voltage is below the minimum threshold.
			On	AC power is on and input voltage is normal.
Power and cooling module	DC Voltage/ Fan Fault/ Service Required	Amber	Off	DC output voltage is normal.
			On	DC output voltage is out of range or a fan is operating below the minimum required RPM.
Expansion module	SAS In port status	Green	Off	The port is empty or the link is down.
			On	The port link is up and connected.
Expansion module	Unit Locator	White	Off	Normal operation.
			Blink	Physically identifies the expansion module.
Expansion module	OK to Remove	Blue	Off	Not implemented.

Table 1-8 Drive Enclosure LEDs (Back) *(Continued)*

Location	LED		Color	State	Description
Expansion module	⚠	Fault/Service Required	Amber	On	A fault has been detected or a service action is required.
				Blink	Indicates a hardware-controlled power up or a cache flush or restore error.
Expansion module	OK	OK	Green	Off	Expansion module is not OK.
				On	Expansion module is operating normally.
				Blink	System is booting.
Expansion module		SAS Out port status	Green	Off	The port is empty or the link is down.
				On	The port link is up and connected.

Installation Checklist

Table 1-9 outlines the steps required to install the enclosures and initially configure the system. To ensure a successful installation, perform the tasks in the order they are presented.

Table 1-9 Installation Checklist

Step	Installation Task	Where to Find Procedure
1.	Prepare the rack for installation.	"Preparing the Rack" on page 27
2.	Install the controller enclosure and optional drive enclosures in the rack.	"Rack Installation Overview and Procedure" on page 28
3.	Attach the ear caps.	"Attaching the Ear Caps" on page 31
4.	Connect the enclosures.	"Connecting Controller and Drive Enclosures" on page 32
5.	Connect the power cords.	"Connecting AC Power" on page 35
6.	Test the enclosure connections.	"Testing the Enclosure Connections" on page 36
7.	Obtain IP values.	"Obtaining IP Values for Your Storage System" on page 36
8.	Install required host software and drivers, including: • HBA driver • MSA2000 Family MPIO DSM • MSA2000 Family SES Driver	"Host System Requirements" on page 39
9.	Connect the data hosts.	"Connecting Hosts" on page 39
10.	Connect the management host.	"Connecting Remote Management Hosts" on page 48
11.	Perform initial configuration tasks: • Set management port IP properties on the controller enclosure • Verify that controllers and enclosures have the latest firmware • Set the date and time on the controller enclosure • Configure host ports on the controller enclosure • Create virtual disks and map volumes • Test the configuration	"Configuring a System for the First Time" on page 49

Installing and Cabling Enclosures

This chapter describes how to install and cable enclosures in a standard 19-inch EIA rack cabinet. It contains the following sections:

- "Required Tools" on page 25
- "Safety Precautions" on page 26
- "Installing Enclosures Into a Rack" on page 27
- "Attaching the Ear Caps" on page 31
- "Connecting Controller and Drive Enclosures" on page 32
- "Connecting AC Power" on page 35
- "Testing the Enclosure Connections" on page 36
- "Obtaining IP Values for Your Storage System" on page 36
- "Correcting Enclosure IDs" on page 37
- "Next Steps" on page 37

Required Tools

The installation procedures in this chapter require the following tools:

- #2 Phillips screwdriver
- Standard screwdriver
- Antistatic protection devices

Safety Precautions

For your protection, observe the following safety precautions when setting up your equipment:

- Follow all cautions and instructions marked on the equipment.
- Ensure that the voltage and frequency of your power source match the voltage and frequency inscribed on the equipment's electrical rating label.
- Never push objects of any kind through openings in the equipment. Dangerous voltages may be present. Conductive foreign objects could produce a short circuit that could cause fire, electric shock, or damage to your equipment.

Note – Do not make mechanical or electrical modifications to the product. The vendor is not responsible for the safety or regulatory compliance of a modified product.

Caution – Two people are needed to lift and move the enclosure. Use care to avoid injury. An enclosure with all drives installed can weigh 65 pounds (29.5 kilograms).

Caution – Electrostatic discharge can damage sensitive components. Be sure you are properly grounded before touching a static-sensitive component or assembly.

Installing Enclosures Into a Rack

This section describes how to install the enclosures into a standard 19-inch rack cabinet with a 28 to 36-inch (71.12 to 91.44-cm) depth.

Tip – Keep all hardware items in plastic bags until you are ready to use them. This enables you to correctly identify the screws and avoid confusion.

Preparing the Rack

Before installing enclosures in a rack cabinet, ensure the rack is installed according to its installation instructions and that the installation complies with local safety codes.

1. Stabilize the rack as described in its documentation.

2. If the rack has casters, make sure the casters are locked to prevent the rack from rolling.

3. Remove or open the top front panel and the vented back panel.

Rack Installation Overview and Procedure

Figure 2-1 provides a visual overview of rack installation and components and corresponds to the steps that follow.

#10-32 x 5/8-in. Truss screws
(**Step 6**)

#10-32 x 5/8-in. Truss screws
(**Step 9**)

Rear bracket connected to rack

Threaded PEMs (4)

Side bracket

#8-32 x 3/16-in. flathead screws
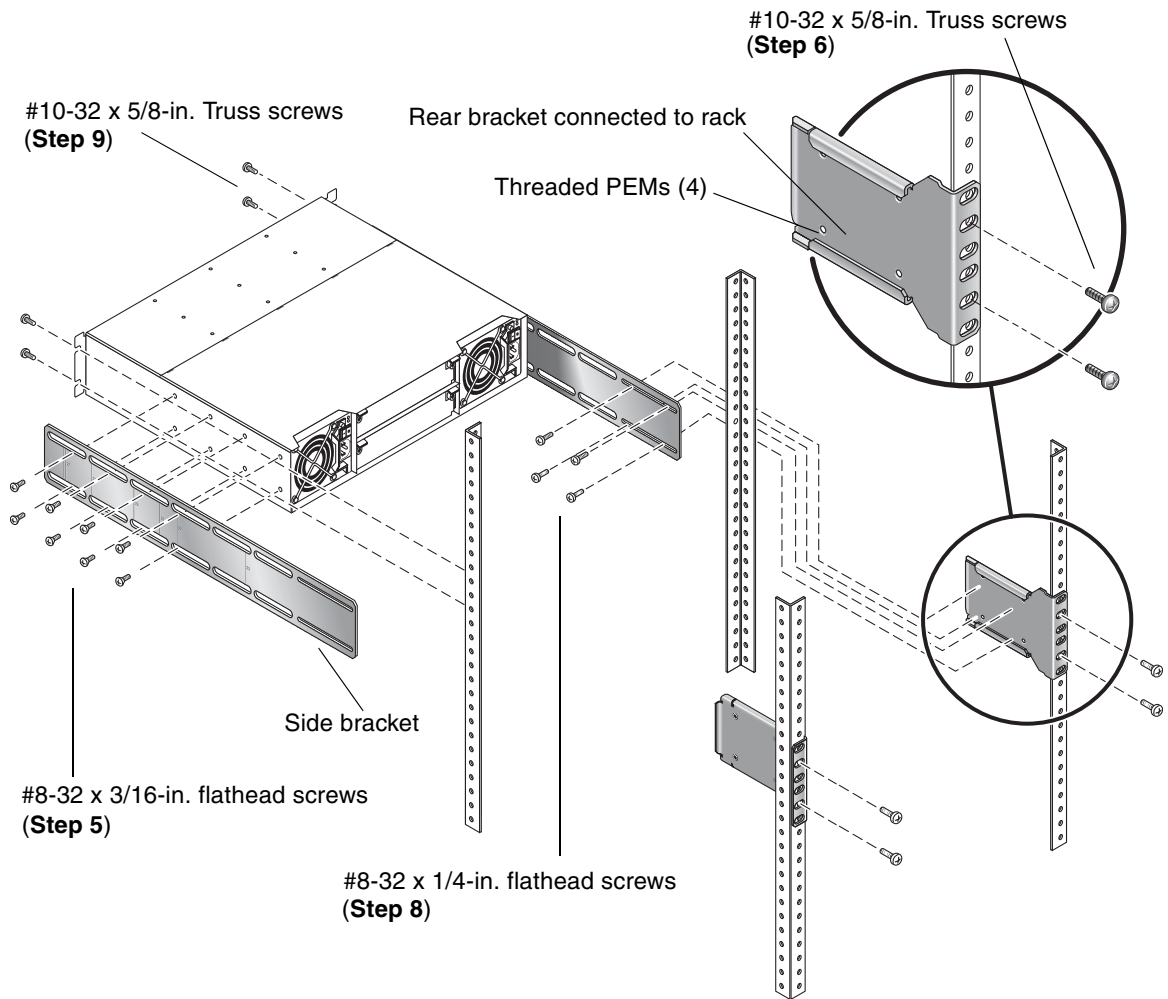(**Step 5**)

#8-32 x 1/4-in. flathead screws
(**Step 8**)

Figure 2-1 Overview of Standard 19-Inch EIA Rackmounting Components

Use the following procedure and refer to Figure 2-1 to install each enclosure into the rack.

When positioning an enclosure in the rack, do not block the air vents at the front or back of the enclosure.

⚠ **Caution –** If you only have one person to perform the installation, remove the power and cooling modules and drive modules from an enclosure before installation, and use the optional nylon front support brackets. If possible, position the enclosure on top of another device or shelf in the rack to hold the enclosure as you attach the front brackets.

1. Considering your system configuration and weight distribution in the rack, determine where you will install each enclosure in the rack.

2. Confirm that you have cables of adequate length to connect to hosts and to power outlets.

3. (Square-cut European-style racks only) Insert the cage nuts in the corresponding holes on the front and rear of the rack.

4. (Optional-one person installation) Screw the front support nylon brackets into position on the rack face using #10-32 x 5/8-inch screws (two per bracket).

   These brackets enable one person to easily position and support the front of the enclosure in the rack during installation.

5. Attach the side brackets to each side of the enclosure using #8-32 x 3/16-inch flathead screws (four to eight on each side). The right and left side brackets are identical.

   Note – To allow adjustment of the brackets, do not tighten the screws completely until the enclosure is mounted in the rack.

   a. Use the alignment marks (Figure 2-2) stamped into the side brackets to position the brackets and screws. The alignment marks show depth in inches.

      Determine the depth you require and align the rear-most alignment mark on the side bracket with the rear-most threaded holes on the enclosure. Make sure that the alignment mark corresponding to the depth you want lines up with both the top and bottom holes.
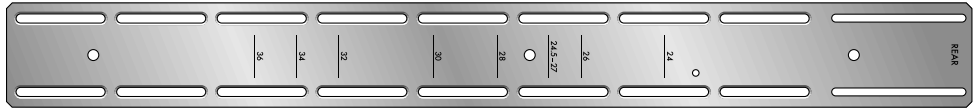
Figure 2-2 Side Bracket With Alignment Marks

    b. On one side, insert the first two screws through the side bracket slots above and below the alignment mark into the rear-most threaded holes in the enclosure.

       For example, to mount the enclosure in a 28-inch deep rack, position the side bracket so that the 28-inch alignment mark is aligned with the rear-most threaded holes in the enclosure.

    c. Insert up to six more screws through the side bracket slots into the other threaded holes in the side of the enclosure.

    d. Repeat Step b and Step c to attach the other side bracket to the enclosure.

6. Attach the rear brackets to the rear vertical posts of the rack using #'10-32 x 5/8-inch screws (two per bracket).

7. Lift the enclosure and slide the side brackets into the rear brackets, which are attached to the rear posts.

   Adjust the depth of the side brackets so that the slots nearest the ends of the *side brackets* align with the four PEM nuts in the *rear brackets*.

8. Attach each side bracket to a rear bracket using #8-32 x 1/4-inch screws (four per bracket).

9. Make sure that the enclosure is level and then secure the mounting ears on the front of the enclosure to the rack face using #10-32 x 5/8-inch screws (two per ear).

10. Tighten the screws on the side brackets.

11. If you removed modules from the enclosure, reinsert them.

12. If you attached the optional front support nylon brackets to the rack face, remove those brackets.

Note – When you finish installing an enclosure, you may have unused screws left in your rack kit; extra screws are provided in case any are misplaced.

Attaching the Ear Caps

The plastic ear caps are snap-on parts that require some care when attaching or removing them. After the enclosure has been installed in the rack cabinet, attach the ear caps, which are located in a plastic bag included in the controller enclosure package.

1. Remove the ear caps from the plastic package.

2. As you attach each ear cap, hold it so that its indent is closest to the chassis.
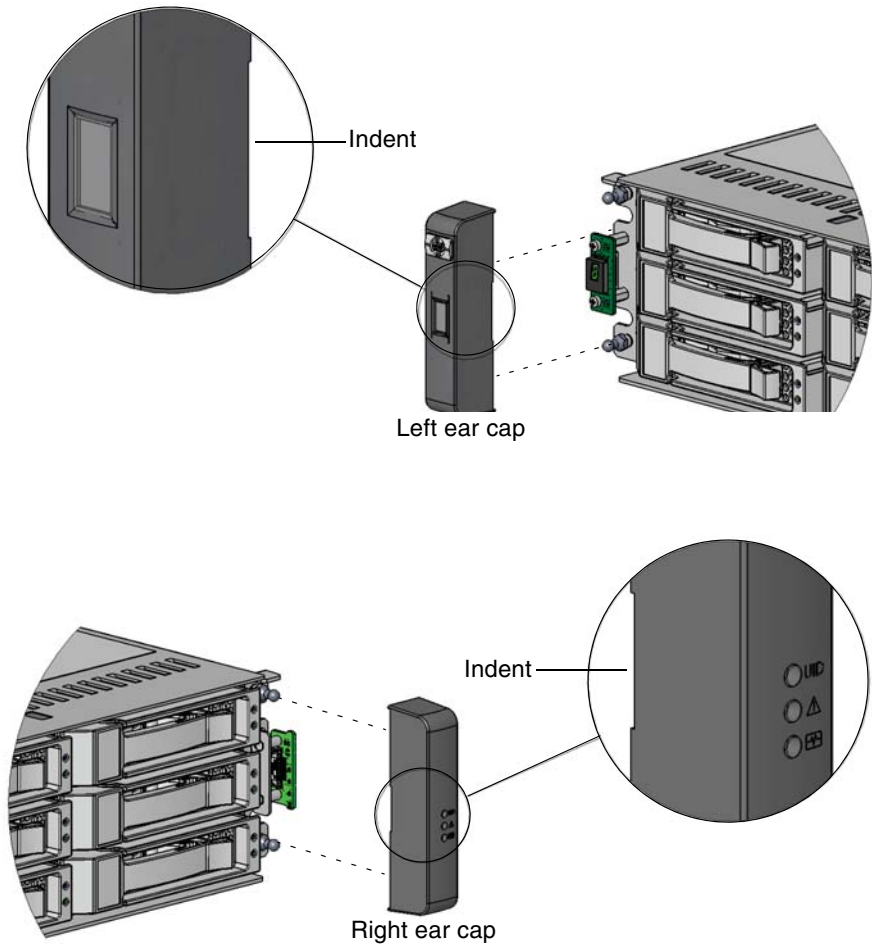

Left ear cap

Right ear cap

Figure 2-3 Ear Caps

3. Apply gentle pressure to snap the caps onto the chassis' ears.

Connecting Controller and Drive Enclosures

Use the supplied SAS cables to connect a controller enclosure to up to three drive enclosures. Figure 2-4 and Figure 2-5 show the recommended fault-tolerant cabling patterns. In an enclosure, the upper module is designated *A* and the lower module is designated *B*.

When connecting multiple drive enclosures, use reverse cabling to ensure the highest level of fault tolerance. For example, Figure 2-5 shows controller A connected to expansion module 1A, and the chain of connections continuing down. Controller B is connected to the lower module (B) of the last drive enclosure in the chain, with connections moving in the opposite direction.

Fault-tolerant cabling is recommended because it enables the controllers to access remaining drive enclosures if any one drive enclosure fails. However, the system also supports non-fault-tolerant cabling using the supplied SAS cables.

Figure 2-6 shows non-fault-tolerant cabling between a controller and up to three drive enclosures.

Note – For clarity, the schematic illustrations of the controllers shown in this section show only relevant details such as expansion ports. For detailed illustrations showing all components, see "Hardware Components and LEDs" on page 13.
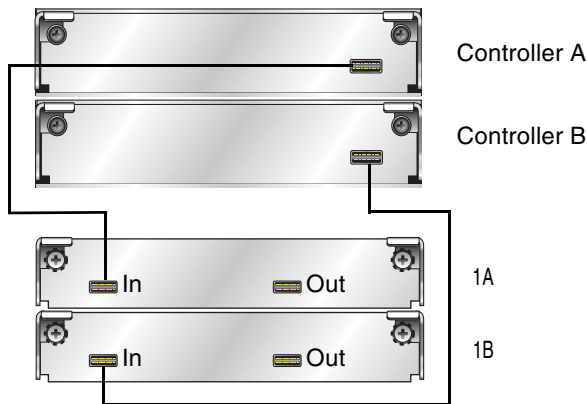

Figure 2-4 Cabling Connections Between One Controller Enclosure and One Drive Enclosure
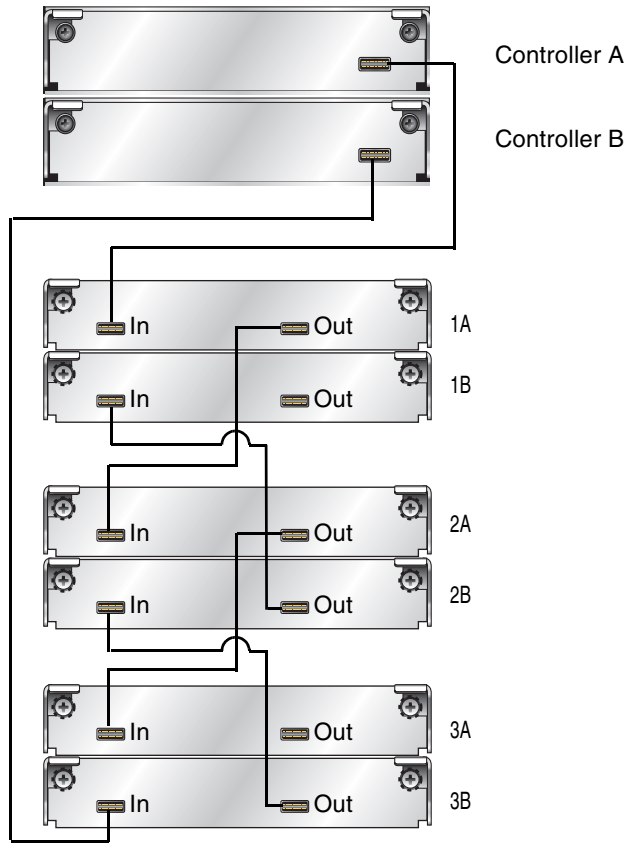
Figure 2-5 Fault-Tolerant Cabling Connections Between One Controller Enclosure and Up to Three Drive Enclosures
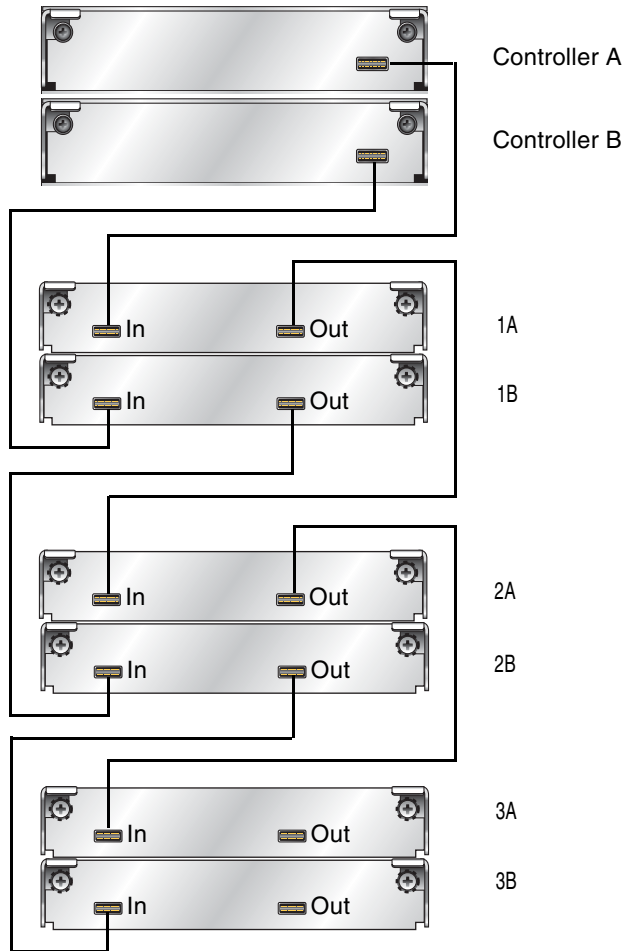
Figure 2-6 Non-Fault-Tolerant Cabling Connections Between One Controller and Up to Three Drive Enclosures

Connecting AC Power

Use this procedure to connect AC power to the enclosures.

1. Verify that both power switches are off.

2. Using the AC power cords, for each enclosure, connect one power and cooling module to one power source in the rack, and the other power and cooling module to a separate power source in the rack.
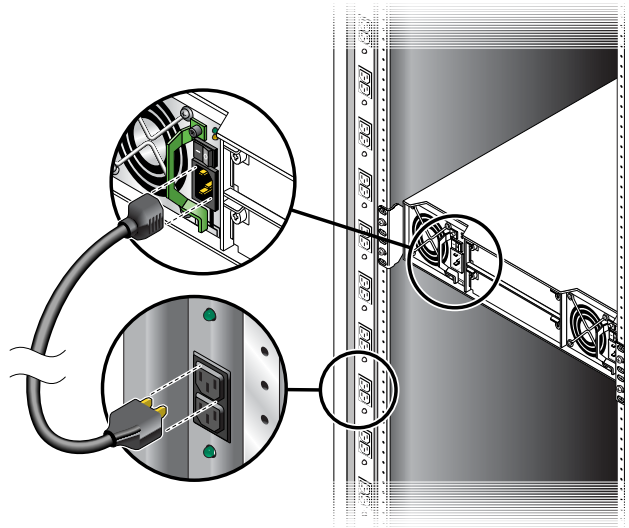
3. Connect the primary power cords from the rack to separate external power sources.

   Power on the system as described in the topic that follows.

Testing the Enclosure Connections

Use this procedure to power on the newly installed system.

1. Press the power switches at the back of each drive enclosure to the On (–) position.

   This ensures that the disks in the enclosures have enough time to completely spin up before being scanned by the RAID modules in the controller enclosure. Depending on your configuration, it can take several minutes for the system to power up.

   While enclosures power up, their LEDs blink. After the LEDs stop blinking, if no LEDs on the front and back of the enclosure are amber, the power-on sequence is complete and no faults have been detected.

   For a description of LED behavior and status, see "Hardware Components and LEDs" on page 13.

2. Press the power switches at the back of the controller enclosure to the On (–) position.

   If the enclosure's power-on sequence succeeds as described in Step 1, the system is ready to use.

Obtaining IP Values for Your Storage System

To obtain the IP values for your system:

1. Look in the DCHP server's address for the two IP addresses assigned to an "HP StorageWorks MSA2000 Family" storage device.

2. Use a network management utility to discover "HP StorageWorks MSA2000 Family" storage devices on the local LAN through SNMP.

3. Use a `ping` broadcast to try to identify the device through the host's ARP table.

   If you do not have a DHCP server, you will need to obtain the IP addresses from your network administrator, and set them using the CLI during initial configuration (see "Setting Management Port IP Addresses Using the CLI" on page 50).

Correcting Enclosure IDs

When installing a system with drive enclosures attached, the enclosure IDs might not agree with the physical cabling order. This is because the controller might have been previously attached to some of the same enclosures and it attempts to preserve the previous enclosure IDs if possible. To correct this condition, make sure that both controllers are up and perform a rescan using SMU or the CLI. This will reorder the enclosures, but can take up to two minutes for the enclosure IDs to be corrected.

To perform a rescan using the CLI, type the following command:

```
rescan
```

To rescan using SMU, as an Advanced Manage user:

1. Select Manage > Utilities > Disk Drive Utilities > Rescan.

2. In the Rescan For Devices panel, click Rescan.

Next Steps

Now you are ready to connect the data and management hosts, as described in Chapter 3.

Connecting Hosts

This chapter describes how to connect data and management hosts to controller enclosures. It contains the following sections:

- "Host System Requirements" on page 39
- "Configuration Considerations" on page 40
- "Connecting Direct Attach Configurations" on page 42
- "Connecting Switch Attach Configurations" on page 45
- "Connecting Remote Management Hosts" on page 48
- "Next Steps" on page 48

Host System Requirements

Data hosts connected to MSA2000 Family 2012fc Modular Smart Arrays must meet the following requirements:

- To configure an FC HBA that is directly attached to controller enclosure host ports, set the HBA parameters as specified in the MSA QuickSpecs. QuickSpecs can be found from your HP MSA products page at `http://www.hp.com/go/msa`. Select MSA SAN Arrays, and then select your product. The link for QuickSpecs will be on the right.

- Depending on your system configuration, data host operating systems may require that multipathing is supported. If a data host uses a single cable to attach to the storage, then multipathing software is not required. If a data host uses multiple cables to attach to the storage, and fault tolerance is expected, then multipathing software is required.

  To obtain the MSA2000 Family MPIO DSM, go to the HP MSA products page at `http://www.hp.com/go/msa`. Select MSA SAN Arrays, select your product, and go to Related products.

- To prevent Microsoft® Windows® data hosts from displaying the Found New Hardware Wizard when the storage system is discovered, install the MSA2000 Family SCSI Enclosure Services driver. For more information, see "Installing the MSA2000 Family SES Driver for Microsoft Windows Hosts" on page 40.

Installing the MSA2000 Family SES Driver for Microsoft Windows Hosts

Installing the MSA2000 Family SCSI Enclosure Services (SES) driver prevents Microsoft Windows hosts from displaying the Found New Hardware Wizard when the storage system is discovered.

1. Download MSA2000 Family SCSI Enclosure Services (SES) driver package `msa2000-ses-`*version*`.zip` from the http://www.hp.com/go/msa. Select MSA SAN Arrays, select your product, and go to Related products.

2. Extract the package contents to a temporary folder on the host.

3. In that folder, double-click `Setup.exe` to install the driver.

4. Click Finish.

   The driver is installed.

5. Optionally, delete the extracted files and the SES driver package.

Configuration Considerations

Before connecting the controller enclosure to one or more data hosts, consider the following options and limitations. Fault tolerance and performance requirements determine whether to optimize your configuration for high availability or high performance.

Using a Direct or Switch Attach Configuration

Attaching the controller enclosure directly to data hosts is suitable for environments where the storage is only used by one or two hosts.

Switch attach storage places one or more FC switches between the controller enclosure and data hosts. This enables more than one host to share a storage system and provides a level of redundancy if more than one switch is used.

Using Host Port Interconnects

When the internal connections between host ports are enabled through SMU, host port 0 on each controller is internally connected to host port 1 on the other controller. This provides redundancy in the event one controller fails (failover) by making volumes owned by the failed controller accessible on the surviving controller.

Enable port interconnects when controller enclosures are attached directly to hosts and high availability is required, or when switch ports are at a premium and fault tolerance is required but highest performance is not.

When ports are not interconnected, volumes owned by a controller are accessible from two of its host ports only. Use this default setting when controller enclosures are attached through one or more switches, or when they are attached directly but performance is more important than availability.

Using Loop or Point-to-Point Topology

MSA2000 Family 2012fc Modular Smart Arrays use Fibre Channel Arbitrated Loop (loop) topology by default.

Using loop topology enables hosts to see all volumes on all ports after failover. Use loop topology, where possible, as it provides the most flexible and host-independent, fault-tolerant configuration. Point-to-point topology restricts the ability for the system to present volumes from both controllers after a failover, limiting the overall configuration choices.

When ports are interconnected, you can use loop topology only. When ports are not interconnected, you can use either loop or point-to-point topology.

Note – Point-to-point topology is supported for switch attach configurations only.

For information on how controllers present volumes to data hosts, see the *reference guide*.

Connecting Direct Attach Configurations

This section explains how to connect the controller enclosure directly to data hosts. It shows configurations that support high availability and high performance, and notes when host port interconnects must be enabled.

The controller enclosure has four host connections, two per controller. Connect FC cables from host ports on each controller to FC HBAs on data hosts, as shown in the following figures. To maintain redundancy, connect each data host to both controller A and controller B.

⚠️ **Caution –** Fiber optic cables are fragile. Do not bend, twist, fold, pinch, or step on the fiber optic cables. Doing so can degrade performance or render data unavailable.

Note – For clarity, the schematic illustrations of the controllers shown in this section show only relevant details such as host ports. For detailed illustrations showing all components, see "Hardware Components and LEDs" on page 13.

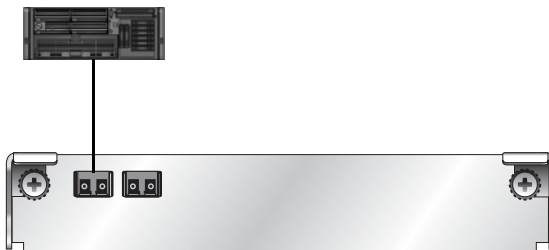Figure 3-1 shows a single-controller to a single-port data host configuration.

Figure 3-1 Single-Controller, Direct Attach Connection to One Single-Port Data Host

Figure 3-2 shows a single-controller to two single-port data hosts configurtion.Figure shows a single-controller to a single-port data host configuration.
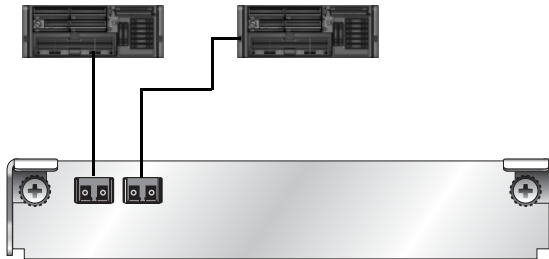

Figure 3-2 Single-Controller, Direct Attach Connection to Two Single-Port Data Hosts

Figure 3-3 shows the preferred redundant configuration. This configuration requires that host port interconnects are enabled as described in "Configuring Host Ports" on page 55.
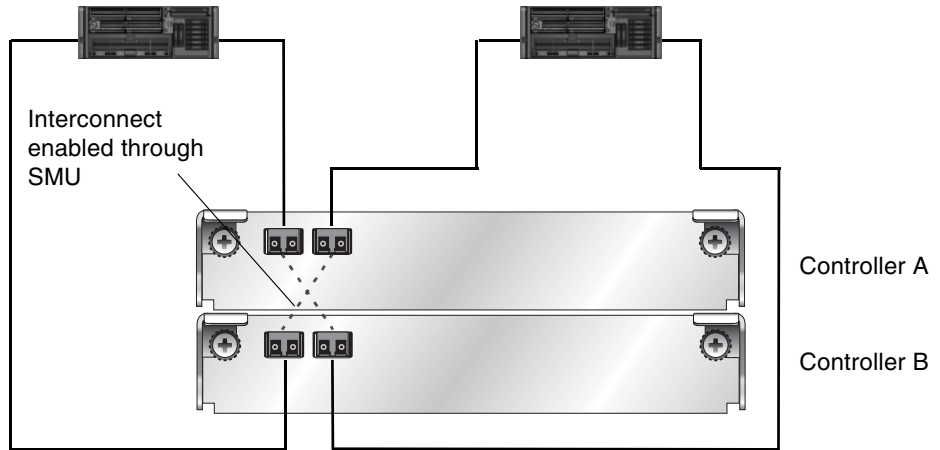

Interconnect enabled through SMU

Controller A

Controller B

Figure 3-3 High-Availability, Dual-Controller, Direct Attach Connection to Two Dual-Port Data Hosts

Figure 3-4 shows a non-redundant configuration that can be used when high performance is more important than high availability. This configuration requires host port interconnects to be disabled, which they are by default.
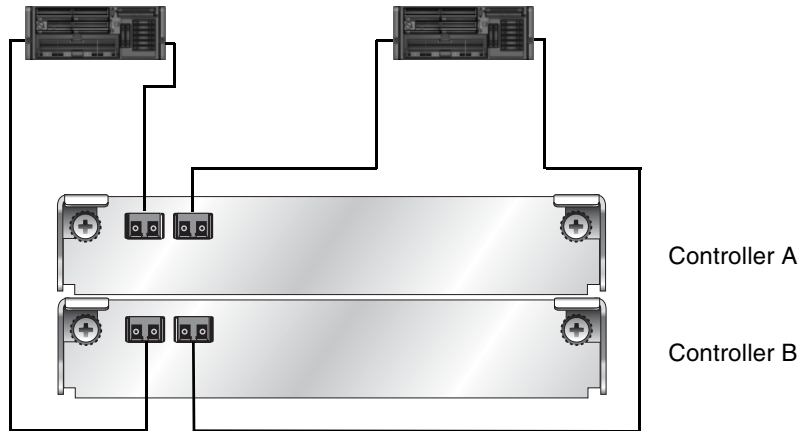

Controller A

Controller B

Figure 3-4 High-Performance, Dual-Controller, Direct Attach Connection to Two Dual-Port Data Hosts (Not Fault Tolerant)

Connecting Switch Attach Configurations

This section explains how to connect the controller enclosure to data hosts through one or more external FC switches.

The controller enclosure has four host connections, two per controller. Connect FC cables from controller hosts ports to switch ports, and from switch ports to data hosts, as shown in the following figures.

To maintain redundancy, connect each data host through the switch or switches to both controller A and controller B. Make sure that link speed and topology settings on switches match those on the controller host ports to which they are connected. A speed mismatch prevents the host from accessing the storage system.

Caution – Fiber optic cables are fragile. Do not bend, twist, fold, pinch, or step on the fiber optic cables. Doing so can degrade performance or cause data loss.

Note – For clarity, the schematic illustrations of the controllers shown in this section show only relevant details such as host ports. For detailed illustrations showing all components, see "Hardware Components and LEDs" on page 13.

Connecting One Data Host Through One Switch

Figure 3-5 shows a dual-controller connection through one switch to one dual-port data host with two FC HBA ports. This configuration requires that host port interconnects are disabled, which they are by default. It also requires host-based multipathing software.
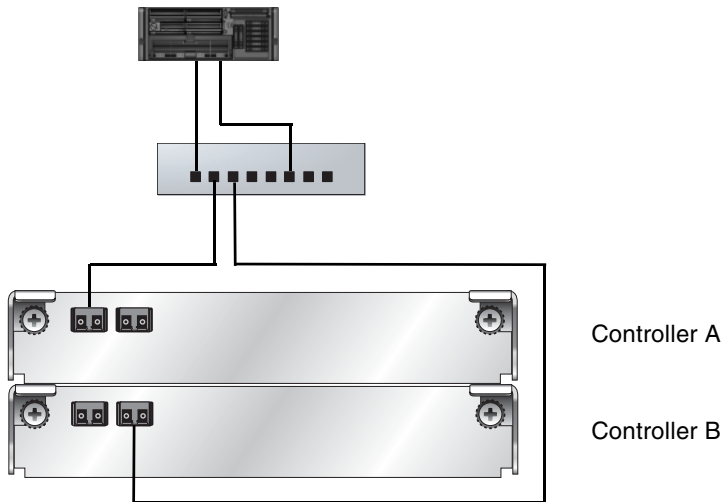

Controller A

Controller B

Figure 3-5 Dual-Controller Connection Through One Switch to One Dual-Port Data Host

Connecting Two Data Hosts Through Two Switches

Figure 3-6 shows the preferred high-availability dual-controller connection through two switches to two dual-port data hosts, in which each data host has two FC HBA ports with each port connected to a different switch. This configuration requires that host port interconnects are disabled, which they are by default.
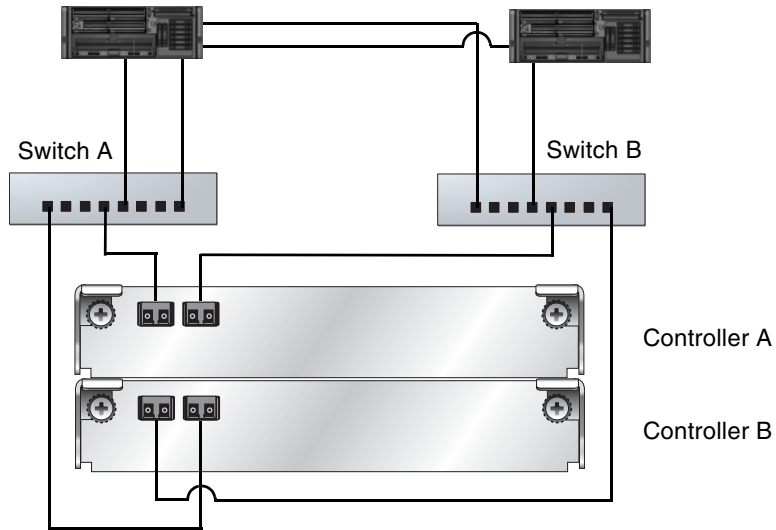

Figure 3-6 High-Availability Connection Through Two Switches to Two Dual-Port Data Hosts

Connecting Two Data Hosts Through a Zoned Switch

Figure 3-7 shows a high-availability, dual-controller connection through a two-zone switch. Each zone can be an independent switch (see Figure 3-6).
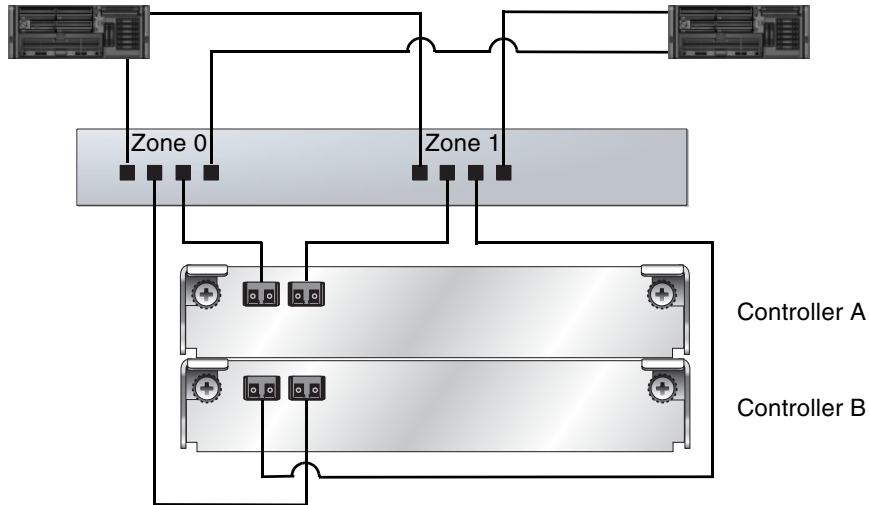
Figure 3-7 High-Availability Dual-Controller Connection Through a Two-Zone Switch to Two Dual-Port Data Hosts

Connecting Remote Management Hosts

The management host directly manages systems out-of-band over an Ethernet network. This section describes how to connect the Ethernet cables to the management host.

1. Connect an Ethernet cable to the Ethernet management port on each controller.

2. Connect the other end of each Ethernet cable to a network that your management host can access (preferably on the same subnet).

Next Steps

After you have connected the management host and data hosts, you are ready to perform first-time configuration on the storage system as described in Chapter 4.

Configuring a System for the First Time

This chapter describes how to perform first-time configuration on the storage system. It also describes how to perform basic storage configuration to verify that your system is working.

This chapter includes the following topics:

- "Setting Management Port IP Addresses Using the CLI" on page 50
- "Configuring Your Web Browser for SMU" on page 53
- "Logging in to SMU from a Local Management Host" on page 54
- "Updating Firmware" on page 54
- "Setting the Date and Time" on page 54
- "Configuring Host Ports" on page 55
- "Creating Virtual Disks" on page 57
- "Mapping a Data Host to a Volume" on page 58
- "Testing the Configuration" on page 59
- "Logging Out of SMU" on page 59
- "Next Steps" on page 59

For information about additional configuration and management tasks, including changing the `manage` user's password, refer to SMU's online help or the *reference guide*.

Setting Management Port IP Addresses Using the CLI

Note – If you used DHCP to set the IP addresses, you do not have to set them using the CLI as described in this section.

Ethernet Management ports on controller module A and controller module B are configured with the following default values:

- **Management Port IP Address:** 10.0.0.2 (controller A), 10.0.0.3 (controller B)
- **IP Subnet Mask:** 255.255.255.0
- **Gateway IP Address:** 10.0.0.1

If the default IP addresses are not compatible with your network, you must set an IP address for each management port using the command-line interface (CLI) embedded in each controller module. The CLI enables you to access the system using RS-232 communication and terminal emulation software.

Use the CLI commands described in the steps below to set the IP address for the Ethernet management port on each controller module.

Once new IP addresses are set, you can change them as needed using SMU.

Note – Changing IP settings can cause management hosts to lose access to the storage system.

1. From your network administrator obtain an IP address, subnet mask, and gateway address for controller A and controller B.

2. Use the provided micro-DB9 serial cable to connect controller A to a serial port on a host computer.
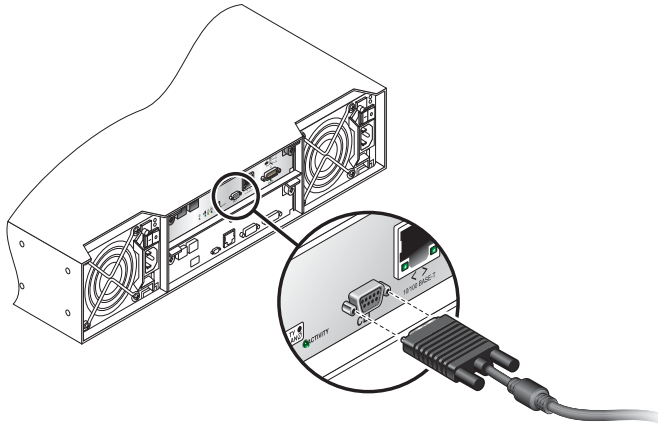
Your package contents include a micro-DB9-to-DB9 serial cable. If necessary, use a DB9-to-DB25 adapter (not included) for connecting the serial cable to a DB25 serial port on the host computer.

3. Start and configure a terminal emulator, such as HyperTerminal or VT-100, using the display settings in Table 4-1 and the connection settings in Table 4-2.

Table 4-1 Terminal Emulator Display Settings

Parameter	Value
Terminal Emulation Mode	VT-100 or ANSI (for color support)
Font	Terminal
Translations	None
Columns	80

Table 4-2 Terminal Emulator Connection Settings

Parameter	Value
Connector	COM1 (typically)
Baud rate (bits/sec)	115,200
Data bits	8
Parity	None
Stop bits	1
Flow control	None

4. In the terminal emulator, connect to controller A.

5. Press Enter to display the CLI prompt (#).

6. At the prompt, type the following command to set the values you obtained in Step 1 for each Ethernet management port, first for controller A and then for controller B:

```
set network-parameters ip address netmask netmask gateway gateway
controller a|b
```

where:
- *address* is the IP address of the controller
- *netmask* is the subnet mask
- *gateway* is the IP address of the subnet router
- a|b specifies the controller whose network parameters you are setting

For example:

```
# set network-parameters ip 192.168.0.10 netmask 255.255.255.0
gateway 192.168.0.1 controller a

# set network-parameters ip 192.168.0.11 netmask 255.255.255.0
gateway 192.168.0.1 controller b
```

7. Type the following command to verify the new IP addresses:

```
show network-parameters
```

Network parameters, including the IP address, subnet mask, and gateway address are displayed for each controller.

8. Disconnect from the CLI and exit the emulator.

9. In the host computer's command window, type the following command to verify Ethernet connectivity, first for controller A and then for controller B:

```
ping IP-address
```

If you cannot your access your system for at least three minutes after changing the IP address, your network might require you to restart the management controller using the serial CLI. When you restart a management controller, communication with it is temporarily lost until it successfully restarts.

Type the following command to restart the management controller on both controllers:

```
restart mc both
```

Configuring Your Web Browser for SMU

Before using SMU to perform remaining steps, ensure that your web browser is properly configured according to the following guidelines:

- Use one of the following browsers:
  - Microsoft Internet Explorer 5.5 or later
  - Mozilla Firefox 1.0.7 or later
- Because SMU uses popup windows to indicate the progress of user-requested tasks, disable any browser features or tools that block popup windows.
- For optimal performance, set your browser to use stored (cached) web pages.

Note – Changing your browser cache setting might affect other sites you visit with your browser.

- To optimize display, use a color monitor and set its color quality to the highest setting.
- For Internet Explorer, to ensure you can navigate beyond SMU login page, set the local-intranet security option to medium or medium-low.

Logging in to SMU from a Local Management Host

To log in to SMU from a local management host:

1. In your web browser's address field, type the IP address of one of the controller enclosure's Ethernet management ports and press Enter.

   The SMU Login page is displayed. If the Login page does not display, verify that you have entered the correct IP address.

2. On the login page, type the default management user name `manage` and default password `!manage`.

3. Click Log In.

   The Status Summary page is displayed.

Updating Firmware

After installing the hardware and powering up the enclosure for the first time, be sure to verify that the controllers and drive enclosures have the latest firmware. SMU enables you to view the software, hardware, and other version information for each controller and the enclosures. To view controller version information, select Monitor > Status > Advanced Settings > Controller Versions.To view drive enclosure information, select Manage > Update Software > Enclosure Firmware > Show Enclosures.

For software and firmware updates, go to http://www.hp.com/go/msa. Select MSA SAN Arrays, select your product, and go to Support.

Setting the Date and Time

You can set the date and time manually or configure the system to use Network Time Protocol (NTP) to obtain them from a network-attached server. When NTP is enabled, and if an NTP server is available, the system time and date can be obtained from the NTP server. This allows multiple storage devices, hosts, log files, and so forth to be synchronized.

NTP server time is provided in Universal Time (UT), which provides several options:

- If you want to synchronize the times and logs between storage devices installed in multiple time zones, set all the storage devices to use UT.
- If you want to use the local time for the device, set its time zone appropriately.

- If a time server can provide local time rather than UT, configure the storage devices to use that time server, with no further time adjustment.

If no NTP server is present, the date and time are maintained as if NTP had not been enabled.

To manually set the system date and time:

1. Select Manage > General Config > Set Date/Time.

2. In the Set System Date panel, select the current month, day, and year.

3. In the Set System Time panel, type time values using a 24-hour clock (where hour 8 represents 8 a.m. and hour 20 represents 8 p.m.) and select the proper time zone.

4. Click Change Date/Time.

   To obtain the date and time from an NTP server:

1. Select Manage > General Config > Set Date/Time.

2. In the Obtain Time With NTP panel, set Network Time Protocol to Enable and optionally type the IP address of an NTP server.

   If no IP server address is set, the system listens for time messages sent by an NTP server in broadcast mode.

3. In the Set System Time panel, select the proper time zone.

4. Click Change Date/Time.

   You might have to refresh the page to display updated values from the NTP server.

Configuring Host Ports

Note – If you need to change FC Loop ID settings as described below, consult with your network administrator on the best addresses to use.

To configure controller enclosure host ports:

1. Select Manage > General Config > Host Port Configuration.

2. In the Controller Module Host Port Configuration panels, for each port to which an HBA or switch is attached, set the appropriate link speed.

An FC port's link speed must match the speed of the FC HBA or switch to which the port is connected. In a dual-controller system, if FC port interconnects are enabled, changing the speed of a port on one controller also changes the speed of the interconnected port on the other controller.

3. Click Update Host Port Configuration.

4. In the Advanced Options panel, configure FC loop ID, port interconnect, and topology settings as required for your configuration:

   ■ **FC Loop ID:** (Loop topology configurations only) If you want data hosts to identify a controller using a specific address, click Change FC Loop ID. In the Requested Loop ID for Host Ports panel, select a specific number (from 1 to 125) for each controller, click Save and Continue, and then click OK to restart the controller.

   During loop initialization the controller will request the specified ID but it might be assigned another ID instead.

   ■ **Port Interconnect Settings:** (Direct attach configurations only) If your configuration requires that host port interconnects be enabled, click Change FC Port Interconnect Settings. In the Host Port Configuration panel, set Internal Host Port Interconnect to Interconnected (enabled), and click Save and Continue.

   This setting affects all FC ports on both controllers.

   Note – If one or more ports are set to use point-to-point topology, you cannot enable interconnects.

   ■ **Fibre Channel Topology:** (Switch attach configurations only) To change the topology used on controller FC ports from Loop to Point to Point, click Change Host Port Topology. In the Controller Module Host Port Configuration panels, select Point to Point for each port, and click Save and Continue.

   Note – If interconnects are enabled, you cannot use point-to-point topology.

The Host Port Configuration page displays again.

Creating Virtual Disks

Two or more disk drives can be logically combined to form a virtual disk. The combined storage capacity can then be partitioned into volumes. SMU provides both manual and automatic methods for creating virtual disks, as described in its online help and in the *reference guide*.

As an example, the following steps use the manual method to create two virtual disks with the following characteristics:

- RAID 5, in which parity is distributed across all disk drives in the virtual disk
- Five disk drives per virtual disk
- One spare disk drive dedicated to each virtual disk
- One volume per virtual disk, where the volume is not visible to data hosts

To create both virtual disks:

1. Select Manage > Virtual Disk Config > Create A Vdisk.

2. Select Manual Virtual Disk Creation (Detail-based).

3. Type a name for the virtual disk.

   The name is case-sensitive and can include 17 characters. Allowed characters include letters, numbers, hyphens, underscores, and spaces.

4. Select RAID 5 – Parity RAID, Parity Distributed.

5. Click Create New Virtual Disk.

6. Select five drives of the same size and type (all SAS or all SATA).

7. For the dedicated spare drive option, select Yes and click Continue.

8. Select a drive to be the spare and click Continue.

9. For the number of volumes, select 1.

   Notice that by default the volume will not be exposed to (accessible by) hosts.

10. Click Create Virtual Disk.

    A page is displayed that shows the progress of initializing the virtual disk.

11. Click the link to create another virtual disk.

12. Repeat Step 2 to Step 10 to create a second virtual disk with a different name.

Mapping a Data Host to a Volume

To enable a data host to access a volume you created, you must map the volume to the host. The port World Wide Name (WWN) of each host connected to the system is automatically added to the system's global host port list.

Before mapping a data host to a volume you must identify the data host's port WWN and a LUN that the host is not using.

To map a data host to a volume:

1. Select Manage > Volume Management > Volume Mapping > Map Hosts To Volume.

   Notice that your first virtual disk and its volume are selected, and the volume's host mapping values are set to None.

2. In the Assign Host Access Privileges panel:

   a. Select the host port WWN value that you identified before beginning.

   b. Type the LUN that you identified.

      Notice that the mapped host will have read-write access through all controller host ports.

   c. Click Map It.

Testing the Configuration

To determine that your system is ready for use, test the configuration as follows:

1. In SMU, select Monitor > Vdisk Status and view the configuration information for each virtual disk.

   The virtual disk status is Critical during initialization but you can perform I/O to the volume.

2. From the data host:

   a. Make the volume an operating system partition.

   b. Verify that you can access the mapped volume and the volume size shown on the data host matches the size shown in SMU.

   c. Verify that you can write data to the volume.

   If the above tests succeed, your system is ready for use.

3. Once you have determined that your system is ready for use, tighten the thumb screws on all SAS cables.

4. Optionally, unmount the volume and delete the test vdisks.

Logging Out of SMU

If you do not log out of SMU when you have finished using it, other manage users cannot log in to the same controller module and your IP address stays logged in for 30 minutes (the default auto-logout timeout setting).

To log out of SMU:

1. Click Log Off at the bottom of the menu.

   The Log Off page is displayed.

2. Click Log Off.

Next Steps

You have completed the initial configuration tasks covered in this guide. For additional information on configuring your system and performing administrative tasks, refer to SMU's online help or the *reference guide*.

Powering the System Off and On

This appendix describes how to power off and power on the system when needed.

Powering Off the System

The system rarely needs to be powered off. You remove power only when you plan to physically move the system to another location.

Use this procedure when you need to power off the system.

1. Stop all I/O from hosts to the system.

2. Use SMU to shut down both controllers.

   Wait until SMU indicates that processing is complete.

3. Press the power switches at the back of the controller enclosure to the Off (O) position.

4. Press the power switches at the back of each drive enclosure to the Off (O) position.

Powering On the System

Power on any drive enclosures before powering on the controller enclosure. This ensures that the disks in the drive enclosures have enough time to completely spin up before being scanned by the RAID controllers in the controller enclosure. Depending on your configuration, it can take several minutes for the system to power up.

Use this procedure to turn power on for all enclosures installed in a rack.

1. Press the power switches at the back of each drive enclosure to the On (–) position.

   While enclosures power up, their LEDs blink. After the LEDs stop blinking, if no LEDs on the front and back of the enclosure are amber, the power-on sequence is complete and no faults have been detected.

2. Press the power switches at the back of the controller enclosure to the On (–) position.

   If the enclosure's power-on sequence succeeds as described in Step 1, the system is ready to use.

Regulatory Compliance and Safety

Regulatory Compliance

Federal Communications Commission Notice

Part 15 of the Federal Communications Commission (FCC) Rules and Regulations has established Radio Frequency (RF) emission limits to provide an interference-free radio frequency spectrum. Many electronic devices, including computers, generate RF energy incidental to their intended function and are, therefore, covered by these rules. These rules place computers and related peripheral devices into two classes, A and B, depending upon their intended installation. Class A devices are those that may reasonably be expected to be installed in a business or commercial environment. Class B devices are those that may reasonably be expected to be installed in a residential environment (i.e., personal computers). The FCC requires devices in both classes to bear a label indicating the interference potential of the device as well as additional operating instructions for the user.

The rating label on the device shows which class (A or B) the equipment falls into. Class B devices have an FCC logo or FCC ID on the label. Class A devices do not have an FCC logo or FCC ID on the label. Once the class of the device is determined, refer to the following corresponding statement.

Class A Equipment

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

instructions, 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 personal expense.

Class B Equipment

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit that is different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or television technician for help.

Declaration of Conformity for Products Marked With the FCC logo, United States only

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

For questions regarding your product, visit http://www.hp.com.

For questions regarding this FCC declaration, contact us by mail or telephone:

- Hewlett-Packard Company
  P.O. Box 692000, Mailstop 510101
  Houston, Texas 77269-2000
- 1-281-514-3333

To identify this product, refer to the part, Regulatory Model Number, or product number found on the product.

Modifications

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Hewlett-Packard Company may void the user's authority to operate the equipment.

Cables

Connections to this device must be made with shielded cables with metallic RFI/EMI connector hoods in order to maintain compliance with FCC Rules and Regulations.

Regulatory Compliance Identification Numbers

For the purpose of regulatory compliance certifications and identification, your product has been assigned a unique Regulatory Model Number. The RMN can be found on the product nameplate label, along with all required approval markings and information. When requesting compliance information for this product, always refer to this RMN. The Regulatory Model Number should not be confused with the marketing name or model number of the product.

Regulatory Compliance Label Location

The Regulatory Compliance label for the 2012fc Modular Smart Array is located behind the left ear on the side of the chassis.

Laser Device

All HP systems equipped with a laser device comply with safety standards, including International Electrotechnical Commission (IEC) 825. With specific regard to the laser, the equipment complies with laser product performance standards set by government agencies as a Class 1 laser product. The product does not emit hazardous light.

Laser Safety Warning

Warning – To reduce the risk of exposure to hazardous radiation:

- Do not try to open the laser device enclosure. There are no user-serviceable components inside.
- Do not operate controls, make adjustments, or perform procedures to the laser device other than those specified herein.
- Allow only HP authorized service technicians to repair the laser device.

Certification and Classification Information

This product contains a laser internal to the fiber optic (FO) transceiver for connection to the Fibre Channel communications port.

In the USA, the FO transceiver is certified as a Class 1 laser product conforming to the requirements contained in the Department of Health and Human Services (DHHS) regulation 21 CFR, Subchapter J. A label on the plastic FO transceiver housing indicates the certification.

Outside the USA, the FO transceiver is certified as a Class 1 laser product conforming to the requirements contained in IEC 825-1:1993 and EN 60825-1:1994, including Amendment 11:1996 and Amendment 2:2001.

Laser Product Label

The optional label in Figure 4-1 or equivalent may be located on the surface of the HP supplied laser device.

CLASS 1 LASER PRODUCT

This optional label indicates that the product is classified as a CLASS 1 LASER PRODUCT. This label may appear on the laser device installed in your product.

Figure 4-1 Class 1 Laser Product Label

International Notices and Statements

Canadian Notice (avis Canadien)

Class A Equipment

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Class B Equipment

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

European Union Notice

Products bearing the CE marking comply with the EMC Directive (89/336/EEC) and the Low Voltage Directive (73/23/EEC) issued by the Commission of the European Community and if this product has telecommunication functionality, the R&TTE Directive (1999/5/EC).

Compliance with these directives implies conformity to the following European Norms (in parentheses are the equivalent international standards and regulations):

- EN55022 (CISPR 22) - Electromagnetic Interference
- EN55024 (IEC61000-4-2, IEC61000-4-3, IEC61000-4- 4, IEC61000-4-5, IEC61000-4-6, IEC61000-4-8, IEC61000-4-11) - Electromagnetic Immunity
- Power Quality:
  - EN61000-3-2 (IEC61000-3-2) - Power Line Harmonics
  - EN61000-3-3 (IEC61000-3-3) - Power Line Flicker
- EN60950 (IEC60950) - Product Safety

■ Also approved under UL 60950/CSA C22.2 No. 60950-00, Safety of Information Technology Equipment.

BSMI Notice

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
被要求探取某些適當的對策。

Japanese Notice

ご使用になっている装置にVCCIマークが付いていましたら、次の説明文を
お読み下さい。

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B情報技術装置です。この装置は、家庭環境で使用すること
を目的としていますが、この装置がラジオやテレビジョン受信機に近接して
使用されると、受信障害を引き起こすことがあります。
取扱説明書に従って正しい取り扱いをして下さい。

VCCIマークが付いていない場合には、次の点にご注意下さい。

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。

Korean Notices

A급 기기 (업무용 정보통신기기)

이 기기는 업무용으로 전자파적합등록을 한 기기이오니
판매자 또는 사용자는 이 점을 주의하시기 바라며, 만약
잘못판매 또는 구입하였을 때에는 가정용으로 교환하시기
바랍니다.

B급 기기 (가정용 정보통신기기)

이 기기는 가정용으로 전자파적합등록을 한 기기로서
주거지역에서는 물론 모든지역에서 사용할 수 있습니다.

Safety

Battery Replacement Notice

Your computer is equipped with a lithium manganese dioxide, a vanadium pentoxide, or an alkaline internal battery or battery pack. There is a danger of explosion and risk of personal injury if the battery is incorrectly replaced or mistreated. Replacement is to be done by an HP authorized service provider using the HP spare part designated for this product. For more information about battery replacement or proper disposal, contact an HP authorized reseller or HP authorized service provider.

Warning – Your computer contains an internal lithium manganese dioxide, a vanadium pentoxide, or an alkaline battery pack. There is risk of fire and burns if the battery pack is not properly handled. To reduce the risk of personal injury:

- Do not attempt to recharge the battery.
- Do not expose to temperatures higher than 60°C.
- Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.
- Replace only with the HP spare part designated for this product.
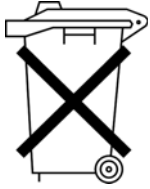
Batteries, battery packs, and accumulators should not be disposed of together with the general household waste. To forward them to recycling or proper disposal, please use the public collection system or return them to HP, an authorized HP Partner, or their agents.

For more information about battery replacement or proper disposal, contact an HP authorized reseller or service provider.

Taiwan Battery Recycling Notice

廢電池請回收

The Taiwan EPA requires dry battery manufacturing or importing firms in accordance with Article 15 of the Waste Disposal Act to indicate the recovery marks on the batteries used in sales, giveaway or promotion. Contact a qualified Taiwanese recycler for proper battery disposal.

Power Cords

The power cord set must meet the requirements for use in the country where the product was purchased. If the product is to be used in another country, purchase a power cord that is approved for use in that country.

The power cord must be rated for the product and for the voltage and current marked on the product electrical ratings label. The voltage and current rating of the cord should be greater than the voltage and current rating marked on the product. In addition, the diameter of the wire must be a minimum of 1.00 mm^2 or 18 AWG, and the length of the cord must be between 1.8 m (6 ft) and 3.6 m (12 ft). If you have questions about the type of power cord to use, contact an HP authorized service provider.

Note – Route power cords so that they will not be walked on and cannot be pinched by items placed upon or against them. Pay particular attention to the plug, electrical outlet, and the point where the cords exit from the product.

Japanese Power Cord Notice

製品には、同梱された電源コードをお使い下さい。
同梱された電源コードは、他の製品では使用出来ません。

Electrostatic Discharge

To prevent damage to the system, be aware of the precautions you need to follow
when setting up the system or handling parts. A discharge of static electricity from
a finger or other conductor may damage system boards or other static-sensitive
devices. This type of damage may reduce the life expectancy of the device.

Preventing Electrostatic Damage

To prevent electrostatic damage, observe the following precautions:

- Avoid hand contact by transporting and storing products in static-safe containers.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-free
  workstations.
- Place parts on a grounded surface before removing them from their containers.
- Avoid touching pins, leads, or circuitry.
- Always be properly grounded when touching a static-sensitive component or
  assembly (see "Grounding Methods" on page 71).

Grounding Methods

There are several methods for grounding. Use one or more of the following methods
when handling or installing electrostatic-sensitive parts:

- Use a wrist strap connected by a ground cord to a grounded workstation or
  computer chassis. Wrist straps are flexible straps with a minimum of 1 megohm
  (±10 percent) resistance in the ground cords. To provide proper ground, wear the
  strap snug against the skin.
- Use heel straps, toe straps, or boot straps at standing workstations. Wear the
  straps on both feet when standing on conductive floors or dissipating floor mats.
- Use conductive field service tools.
- Use a portable field service kit with a folding static-dissipating work mat.

If you do not have any of the suggested equipment for proper grounding, have an
HP authorized reseller install the part.

> **Note –** For more information on static electricity, or assistance with product installation, contact your HP authorized reseller.

Waste Electrical and Electronic Equipment Directive

Czechoslovakian Notice

Likvidace zařízení soukromými domácími uživateli v Evropské unii

Tento symbol na produktu nebo balení označuje výrobek, který nesmí být vyhozen spolu s ostatním domácím odpadem. Povinností uživatele je předat takto označený odpad na předem určené sběrné místo pro recyklaci elektrických a elektronických zařízení. Okamžité třídění a recyklace odpadu pomůže uchovat přírodní prostředí a zajistí takový způsob recyklace, který ochrání zdraví a životní prostředí člověka. Další informace o možnostech odevzdání odpadu k recyklaci získáte na příslušném obecním nebo městském úřadě, od firmy zabývající se sběrem a svozem odpadu nebo v obchodě, kde jste produkt zakoupili.

Danish Notice

Bortskaffelse af affald fra husstande i den Europæiske Union

Hvis produktet eller dets emballage er forsynet med dette symbol, angiver det, at produktet ikke må bortskaffes med andet almindeligt husholdningsaffald. I stedet er det dit ansvar at bortskaffe kasseret udstyr ved at aflevere det på den kommunale genbrugsstation, der forestår genvinding af kasseret elektrisk og elektronisk udstyr. Den centrale modtagelse og genvinding af kasseret udstyr i forbindelse med bortskaffelsen bidrager til bevarelse af naturlige ressourcer og sikrer, at udstyret genvindes på en måde, der beskytter både mennesker og miljø. Yderligere oplysninger om, hvor du kan aflevere kasseret udstyr til genvinding, kan du få hos kommunen, den lokale genbrugsstation eller i den butik, hvor du købte produktet.

Dutch Notice

Verwijdering van afgedankte apparatuur door privé-gebruikers in de Europese Unie

Dit symbool op het product of de verpakking geeft aan dat dit product niet mag worden gedeponeerd bij het normale huishoudelijke afval. U bent zelf verantwoordelijk voor het inleveren van uw afgedankte apparatuur bij een inzamelingspunt voor het recyclen van oude elektrische en elektronische apparatuur. Door uw oude apparatuur apart aan te bieden en te recyclen, kunnen natuurlijke bronnen worden behouden en kan het materiaal worden hergebruikt op een manier waarmee de volksgezondheid en het milieu worden beschermd. Neem contact op met uw gemeente, het afvalinzamelingsbedrijf of de winkel waar u het product hebt gekocht voor meer informatie over inzamelingspunten waar u oude apparatuur kunt aanbieden voor recycling.

English Notice

Disposal of waste equipment by users in private household in the European Union

This symbol on the product or on its packaging indicates that this product must not be disposed of with your other household waste. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service, or the shop where you purchased the product.

Estonian Notice

Seadmete jäätmete kõrvaldamine eramajapidamistes Euroopa Liidus

See tootel või selle pakendil olev sümbol näitab, et kõnealust toodet ei tohi koos teiste majapidamisjäätmetega kõrvaldada. Teie kohus on oma seadmete jäätmed kõrvaldada, viies need elektri- ja elektroonikaseadmete jäätmete ringlussevõtmiseks selleks ettenähtud kogumispunkti. Seadmete jäätmete eraldi kogumine ja ringlussevõtmine kõrvaldamise ajal aitab kaitsta loodusvarasid ning tagada, et ringlussevõtmine toimub viisil, mis kaitseb inimeste tervist ning keskkonda. Lisateabe saamiseks selle kohta, kuhu oma seadmete jäätmed ringlussevõtmiseks viia, võtke palun ühendust oma kohaliku linnakantselei, majapidamisjäätmete kõrvaldamise teenistuse või kauplusega, kust Te toote ostsite.

Finnish Notice

Laitteiden hävittäminen kotitalouksissa Euroopan unionin alueella

Jos tuotteessa tai sen pakkauksessa on tämä merkki, tuotetta ei saa hävittää kotitalousjätteiden mukana. Tällöin hävitettävä laite on toimitettava sähkölaitteid ja elektronisten laitteiden kierrätyspisteeseen. Hävitettävien laitteiden erillinen käsittely ja kierrätys auttavat säästämään luonnonvaroja ja varmistamaan, että laite kierrätetään tavalla, joka estää terveyshaitat ja suojelee luontoa. Lisätietoja paikoista, joihin hävitettävät laitteet voi toimittaa kierrätettäväksi, saa ottamalla yhteyttä jätehuoltoon tai liikkeeseen, josta tuote on ostettu.

French Notice

Élimination des appareils mis au rebut par les ménages dans l'Union européenne

Le symbole apposé sur ce produit ou sur son emballage indique que ce produit ne doit pas être jeté avec les déchets ménagers ordinaires. Il est de votre responsabilité de mettre au rebut vos appareils en les déposant dans les centres de collecte publique désignés pour le recyclage des équipements électriques et électroniques. La collecte et le recyclage de vos appareils mis au rebut indépendamment du reste des déchets contribue à la préservation des ressources naturelles et garantit que ces appareils seront recyclés dans le respect de la santé humaine et de l'environnement. Pour obtenir plus d'informations sur les centres de collecte et de recyclage des appareils mis au rebut, veuillez contacter les autorités locales de votre région, l es services de collecte des ordures ménagères ou le magasin dans lequel vous avez acheté ce produit.

German Notice

Entsorgung von Altgeräten aus privaten Haushalten in der EU

Das Symbol auf dem Produkt oder seiner Verpackung weist darauf hin, dass das Produkt nicht über den normalen Hausmüll entsorgt werden darf. Benutzer sind verpflichtet, die Altgeräte an einer Rücknahmestelle für Elektro- und Elektronik-Altgeräte abzugeben.   Die getrennte Sammlung und ordnungsgemäß Entsorgung Ihrer Altgeräte trägt zur Erhaltung der natürlichen Ressourcen bei und garantiert eine Wiederverwertung, die die Gesundheit des Menschen und die Umwelt schützt. Informationen dazu, wo Sie Rücknahmestellen für Ihre Altgeräte finder erhalten Sie bei Ihrer Stadtverwaltung, den örtlichen Müllentsorgungsbetrieben oder im Geschäft, in dem Sie das Gerät erworben haben.

Greek Notice

Απόρριψη άχρηστου εξοπλισμού από χρήστες σε ιδιωτικά νοικοκυριά στην Ευρωπαϊκή Ένωση

Το σύμβολο αυτό στο προϊόν ή τη συσκευασία του υποδεικνύει ότι το συγκεκριμένο προϊόν δεν πρέπει να διατίθεται μαζί με τα άλλα οικιακά σας απορρίμματα. Αντίθετα, είναι δική σας ευθύνη να απορρίψετε τον άχρηστο εξοπλισμό σας παραδίδοντάς τον σε καθορισμένο σημείο συλλογής για την ανακύκλωση άχρηστου ηλεκτρικού και ηλεκτρονικού εξοπλισμού.

Η ξεχωριστή συλλογή και ανακύκλωση του άχρηστου εξοπλισμού σας κατά την απόρριψη θα συμβάλει στη διατήρηση των φυσικών πόρων και θα διασφαλίσει ότι η ανακύκλωση γίνεται με τρόπο που προστατεύει την ανθρώπινη υγεία και το περιβάλλον. Για περισσότερες πληροφορίες σχετικά με το πού μπορείτε να παραδώσετε τον άχρηστο εξοπλισμό σας για ανακύκλωση, επικοινωνήστε με το αρμόδιο τοπικό γραφείο, την τοπική υπηρεσία διάθεσης οικιακών απορριμμάτων ή το κατάστημα όπου αγοράσατε το προϊόν.

Hungarian Notice

Készülékek magánháztartásban történő selejtezése az Európai Unió területén

A készüléken, illetve a készülék csomagolásán látható azonos szimbólum annak jelzésére szolgál, hogy a készülék a selejtezés során az egyéb háztartási hulladéktól eltérő módon kezelendő. A vásárló a hulladékká vált készüléket köteles a kijelölt gyűjtőhelyre szállítani az elektromos és elektronikai készülékek újrahasznosítása céljából. A hulladékká vált készülékek selejtezéskori begyűjtése és újrahasznosítása hozzájárul a természeti erőforrások megőrzéséhez, valamint biztosítja a selejtezett termékek környezetre és emberi egészségre nézve biztonságos feldolgozását. A begyűjtés pontos helyéről bővebb tájékoztatást a lakhelye szerint illetékes önkormányzattól, az illetékes szemételtakarító vállalattól, illetve a terméket elárusító helyen kaphat.

Italian Notice

Smaltimento delle apparecchiature da parte di privati nel territorio dell'Unione Europea

Questo simbolo presente sul prodotto o sulla sua confezione indica che il prodotto non può essere smaltito insieme ai rifiuti domestici. È responsabilità dell'utente smaltire le apparecchiature consegnandole presso un punto di raccolta designato al riciclo e allo smaltimento di apparecchiature elettriche ed elettroniche. La raccolta differenziata e il corretto riciclo delle apparecchiature da smaltire permette di proteggere la salute degli individui e l'ecosistema. Per ulteriori informazioni relative ai punti di raccolta delle apparecchiature, contattare l'ente locale per lo smaltimento dei rifiuti, oppure il negozio presso il quale è stato acquistato il prodotto.

Latvian Notice

Nolietotu iekārtu iznīcināšanas noteikumi lietotājiem Eiropas Savienības privātajās mājsaimniecībās

Šāds simbols uz izstrādājuma vai uz tā iesaiņojuma norāda, ka šo izstrādājumu nedrīkst izmest kopā ar citiem sadzīves atkritumiem. Jūs atbildat par to, lai nolietotās iekārtas tiktu nodotas speciāli iekārtotos punktos, kas paredzēti izmantoto elektrisko un elektronisko iekārtu savākšanai otrreizējai pārstrādei. Atsevišķa nolietoto iekārtu savākšana un otrreizējā pārstrāde palīdzēs saglabāt dabas resursus un garantēs, ka šīs iekārtas tiks otrreizēji pārstrādātas tādā veidā, lai pasargātu vidi un cilvēku veselību. Lai uzzinātu, kur nolietotās iekārtas var izmest otrreizējai pārstrādei, jāvēršas savas dzīves vietas pašvaldībā, sadzīves atkritumu savākšanas dienestā vai veikalā, kurā izstrādājums tika nopirkts.

Lihuanian Notice

Nolietotu iekārtu iznīcināšanas noteikumi lietotājiem Eiropas Savienības privātajās mājsaimniecībās

Šāds simbols uz izstrādājuma vai uz tā iesaiņojuma norāda, ka šo izstrādājumu nedrīkst izmest kopā ar citiem sadzīves atkritumiem. Jūs atbildat par to, lai nolietotās iekārtas tiktu nodotas speciāli iekārtotos punktos, kas paredzēti izmantoto elektrisko un elektronisko iekārtu savākšanai otrreizējai pārstrādei. Atsevišķa nolietoto iekārtu savākšana un otrreizējā pārstrāde palīdzēs saglabāt dabas resursus un garantēs, ka šīs iekārtas tiks otrreizēji pārstrādātas tādā veidā, lai pasargātu vidi un cilvēku veselību. Lai uzzinātu, kur nolietotās iekārtas var izmest otrreizējai pārstrādei, jāvēršas savas dzīves vietas pašvaldībā, sadzīves atkritumu savākšanas dienestā vai veikalā, kurā izstrādājums tika nopirkts.

Polish Notice

Pozbywanie się zużytego sprzętu przez użytkowników w prywatnych gospodarstwach domowych w Unii Europejskiej

Ten symbol na produkcie lub jego opakowaniu oznacza, że produktu nie wolno wyrzucać do zwykłych pojemników na śmieci. Obowiązkiem użytkownika jest przekazanie zużytego sprzętu do wyznaczonego punktu zbiórki w celu recyklingu odpadów powstałych ze sprzętu elektrycznego i elektronicznego. Osobna zbiórka oraz recykling zużytego sprzętu pomogą w ochronie zasobów naturalnych i zapewnią ponowne wprowadzenie go do obiegu w sposób chroniący zdrowie człowieka i środowisko. Aby uzyskać więcej informacji o tym, gdzie można przekazać zużyty sprzęt do recyklingu, należy się skontaktować z urzędem miasta, zakładem gospodarki odpadami lub sklepem, w którym zakupiono produkt.

Portuguese Notice

Descarte de Lixo Elétrico na Comunidade Européia

Este símbolo encontrado no produto ou na embalagem indica que o produto não deve ser descartado no lixo doméstico comum. É responsabilidade do cliente descartar o material usado (lixo elétrico), encaminhando-o para um ponto de coleta para reciclagem. A coleta e a reciclagem seletivas desse tipo de lixo ajudarão a conservar as reservas naturais; sendo assim, a reciclagem será feita de uma forma segura, protegendo o ambiente e a saúde das pessoas. Para obter mais informações sobre locais que reciclam esse tipo de material, entre em contato com o escritório da HP em sua cidade, com o serviço de coleta de lixo ou com a loja em que o produto foi adquirido.

Slovakian Notice

Likvidácia vyradených zariadení v domácnostiach v Európskej únii

Symbol na výrobku alebo jeho balení označuje, že daný výrobok sa nesmie likvidovať s domovým odpadom. Povinnosťou spotrebiteľa je odovzdať vyradené zariadenie v zbernom mieste, ktoré je určené na recykláciu vyradených elektrických a elektronických zariadení. Separovaný zber a recyklácia vyradených zariadení prispieva k ochrane prírodných zdrojov a zabezpečuje, že recyklácia sa vykonáva spôsobom chrániacim ľudské zdravie a životné prostredie. Informácie o zberných miestach na recykláciu vyradených zariadení vám poskytne miestne zastupiteľstvo, spoločnosť zabezpečujúca odvoz domového odpadu alebo obchod, v ktorom ste si výrobok zakúpili.

Slovenian Notice

Odstranjevanje odslužene opreme uporabnikov v zasebnih gospodinjstvih v Evropski uniji

Ta znak na izdelku ali njegovi embalaži pomeni, da izdelka ne smete odvreči med gospodinjske odpadke. Nasprotno, odsluženo opremo morate predati na zbirališče, pooblaščeno za recikliranje odslužene električne in elektronske opreme. Ločeno zbiranje in recikliranje odslužene opreme prispeva k ohranjanju naravnih virov in zagotavlja recikliranje te opreme na zdravju in okolju neškodljiv način. Za podrobnejše informacije o tem, kam lahko odpeljete odsluženo opremo na recikliranje, se obrnite na pristojni organ, komunalno službo ali trgovino, kjer ste izdelek kupili.

Spanish Notice

Eliminación de residuos de equipos eléctricos y electrónicos por parte de usuarios particulares en la Unión Europea

Este símbolo en el producto o en su envase indica que no debe eliminarse junto con los desperdicios generales de la casa. Es responsabilidad del usuario eliminar los residuos de este tipo depositándolos en un "punto limpio" para el reciclado de residuos eléctricos y electrónicos. La recogida y el reciclado selectivos de los residuos de aparatos eléctricos en el momento de su eliminación contribuirá a conservar los recursos naturales y a garantizar el reciclado de estos residuos de forma que se proteja el medio ambiente y la salud. Para obtener más información sobre los puntos de recogida de residuos eléctricos y electrónicos para reciclado, póngase en contacto con su ayuntamiento, con el servicio de eliminación de residuos domésticos o con el establecimiento en el que adquirió el producto.

Swedish Notice

Bortskaffande av avfallsprodukter från användare i privathushåll inom Europeiska Unionen

Om den här symbolen visas på produkten eller förpackningen betyder det att produkten inte får slängas på samma ställe som hushållssopor. I stället är det ditt ansvar att bortskaffa avfallet genom att överlämna det till ett uppsamlingsställe avsett för återvinning av avfall från elektriska och elektroniska produkter. Separat insamling och återvinning av avfallet hjälper till att spara på våra naturresurser och gör att avfallet återvinns på ett sätt som skyddar människors hälsa och miljön. Kontakta ditt lokala kommunkontor, din närmsta återvinningsstation för hushållsavfall eller affären där du köpte produkten för att få mer information om var du kan lämna ditt avfall för återvinning.

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