

# HP StorageWorks Modular Smart Array 500 Generation 2 Storage System Maintenance and Service Guide



April 2004 (First Edition)  
Part Number 354903-001

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### **Audience Assumptions**

This guide is for an experienced service technician. HP assumes you are qualified in the servicing of computer equipment and trained in recognizing hazards in products with hazardous energy levels and are familiar with weight and stability precautions for rack installations.

# Contents

<b>Illustrated Parts Catalog</b>	<b>5</b>
Mechanical and System Components .....	5
<b>Removal and Replacement Procedures</b>	<b>7</b>
Safety Considerations .....	7
Preventing Electrostatic Discharge .....	7
Warnings.....	8
Power Down the Storage System.....	9
Hard Drive Blank .....	10
Hot-Plug SCSI Hard Drive .....	11
Bezel Blank.....	13
Modular Smart Array 500 Generation 2 Controller .....	13
Battery-Backed Cache Module .....	15
Blower.....	16
Hot-Plug Power Supply .....	17
2-Port or 4-Port Shared Storage Module.....	18
Interconnect Blank .....	20
Power Button/LED Assembly.....	20
Storage System Chassis and Backplane .....	21
<b>Diagnostic Tools</b>	<b>23</b>
Server Utilities .....	23
HP Insight Diagnostics .....	23
HP Systems Insight Manager.....	23
Management Agents .....	24
Survey Utility .....	24
ROM Functions and Utilities .....	24
Smart Components for ROM Flash .....	25
Recovery ROM.....	25
Controller Firmware Auto Cloning.....	25
Array Configuration Utility .....	26
Array Diagnostic Utility.....	27
NetWare Online Array Configuration Utility (CPQONLIN).....	28
<b>Component Identification</b>	<b>29</b>
Front Panel Components.....	29
Enclosure LEDs .....	30

Rear Panel Components .....	31
Power Supply/Blower Assembly LEDs .....	32
Shared Storage Module with Integrated Environmental Monitoring Unit .....	32
2-Port Shared Storage Module Components.....	33
2-Port Shared Storage Module LEDs .....	34
4-Port Shared Storage Module Components.....	35
4-Port Shared Storage Module LEDs .....	36
Controller Components .....	36
Controller Display .....	37
Controller LEDs .....	38
Battery-Backed Write Cache Enabler Overview .....	39
SCSI IDs .....	40
Hot-Plug SCSI Hard Drive LEDs .....	41
Hot-Plug SCSI Hard Drive LED Combinations.....	42
<b>Specifications</b> .....	<b>45</b>
Environmental Specifications .....	45
Dimensions and Weight .....	45
Power Specifications.....	46
<b>Acronyms and Abbreviations</b> .....	<b>47</b>
<b>Index</b> .....	<b>51</b>

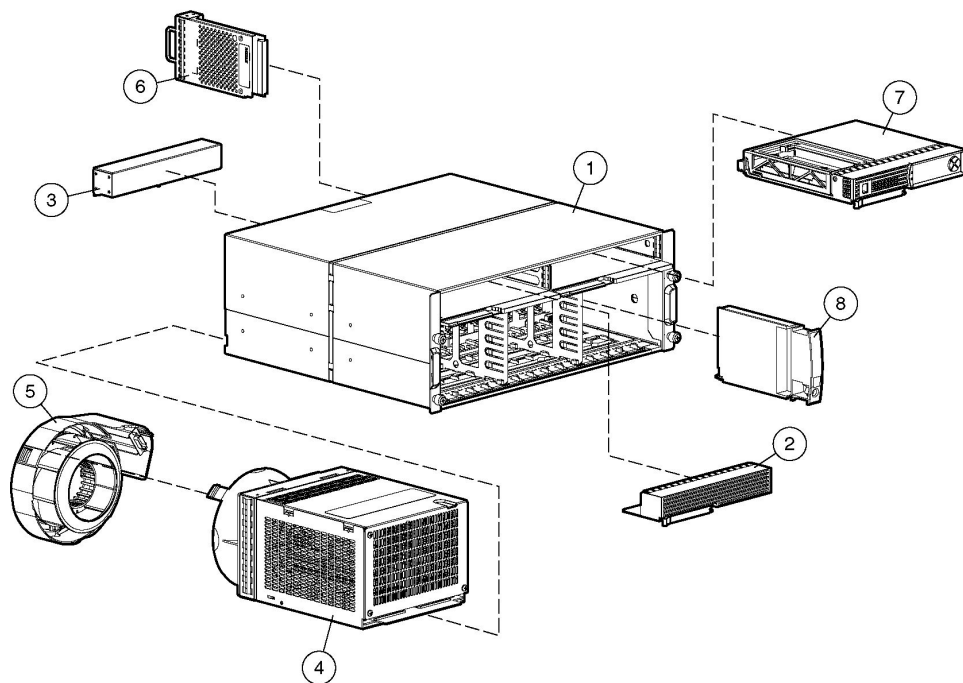
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# Illustrated Parts Catalog

## In This Section

Mechanical and System Components.....[5](#)

## Mechanical and System Components



Item	Description	Spare Part Number
	<b>Mechanical Components</b>	
1	Chassis, 4U, with backplane	229198-001
2	Bezel blank	229208-001
3	Interconnect blank	229200-001
	<b>System Components</b>	
4	AC power supply assembly, 499 W	212398-001
5	Blower	123482-001
	<b>Boards</b>	
6	2-Port Shared Storage Module for MSA500 G2 storage system	343826-001
7	MSA500 G2 controller	343827-001
8	Power button/LED assembly	229201-001
9	Cache module, DIMM, SDRAM, 128 MB, with battery *	171387-001
10	Cache module, DIMM, SDRAM, 256 MB, with battery *	262012-001
	<b>Miscellaneous</b>	
11	AC power cord *	187335-001
12	Rack mounting hardware kit *	349113-001
13	Return kit *	249670-001
	<b>Options</b>	
14	4-Port Shared Storage Module for MSA500 G2 storage system *	343825-001
15	Universal hard drive, 1-inch *	177986-001
16	M-Series Rack Rail option *	314635-001
	* Not shown	

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# Removal and Replacement Procedures

## In This Section

Safety Considerations .....	<a href="#">7</a>
Power Down the Storage System .....	<a href="#">9</a>
Hard Drive Blank .....	<a href="#">10</a>
Hot-Plug SCSI Hard Drive .....	<a href="#">11</a>
Bezel Blank .....	<a href="#">13</a>
Modular Smart Array 500 Generation 2 Controller .....	<a href="#">13</a>
Battery-Backed Cache Module.....	<a href="#">15</a>
Blower .....	<a href="#">16</a>
Hot-Plug Power Supply .....	<a href="#">17</a>
2-Port or 4-Port Shared Storage Module .....	<a href="#">18</a>
Interconnect Blank.....	<a href="#">20</a>
Power Button/LED Assembly .....	<a href="#">20</a>
Storage System Chassis and Backplane .....	<a href="#">21</a>

## Safety Considerations

Before performing service procedures, review all the safety information.

## Preventing Electrostatic Discharge

To prevent damaging 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.

To prevent electrostatic damage:

- 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.

## Warnings

Before installing a storage system, be sure that you understand the following warnings and cautions.



**WARNING:** To reduce the risk of electric shock or damage to the equipment:

- Do not disable the power cord grounding plug. The grounding plug is an important safety feature.
- Plug the power cord into a grounded (earthed) electrical outlet that is easily accessible at all times.
- Unplug the power cord from the power supply to disconnect power to the equipment.
- Do not route the power cord where it can be walked on or pinched by items placed against it. Pay particular attention to the plug, electrical outlet, and the point where the cord extends from the storage system.



**WARNING:** To reduce the risk of personal injury from hot surfaces, allow the drives and the internal system components to cool before touching them.



**22.7 kg**

**50 lb**

**This symbol indicates that the component exceeds the recommended weight for one individual to handle safely.**



**WARNING:** To reduce the risk of personal injury or damage to the equipment, observe local occupational health and safety requirements and guidelines for manual material handling.



**WARNING:** To reduce the risk of personal injury or damage to the equipment, be sure that:

- The leveling jacks are extended to the floor.
- The full weight of the rack rests on the leveling jacks.
- The stabilizing feet are attached to the rack if it is a single-rack installation.
- The racks are coupled together in multiple-rack installations.
- Only one component is extended at a time. A rack may become unstable if more than one component is extended for any reason.



**WARNING:** To reduce the risk of personal injury or equipment damage when unloading a rack:

- At least two people are needed to safely unload the rack from the pallet. An empty 42U rack can weigh as much as 115 kg (253 lb), can stand more than 2.1 m (7 ft) tall, and may become unstable when being moved on its casters.
- Never stand in front of the rack when it is rolling down the ramp from the pallet. Always handle the rack from both sides.

## Power Down the Storage System



**WARNING:** To reduce the risk of personal injury, electric shock, or damage to the equipment, remove the power cord to remove power from the storage system. The front panel Power On/Standby button does not completely shut off system power. Portions of the power supply and some internal circuitry remain active until AC power is removed.



**CAUTION:** In systems that use external data storage, be sure that the server is the first unit to be powered down and the last to be powered back up. Taking this precaution ensures that the system does not erroneously mark the drives as failed when the server is powered up.

**IMPORTANT:** If installing a hot-plug device, it is not necessary to power down the storage system.

1. Power down any attached servers. Refer to the server documentation.
2. Press the Power On/Standby button on the storage system. Wait for the system power LED to go from green to off.
3. Disconnect the power cords.

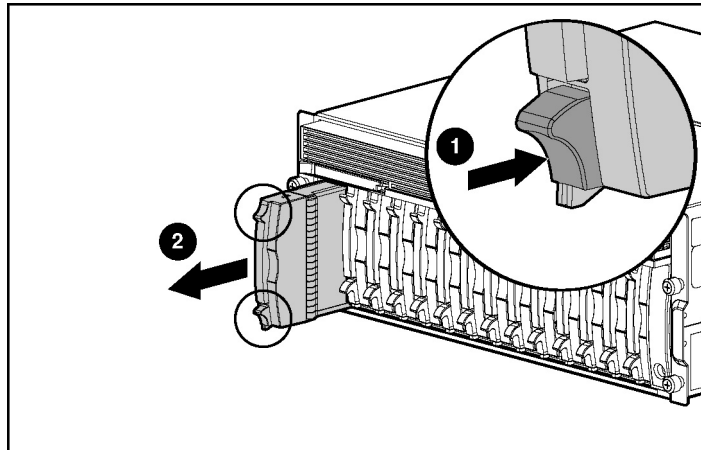
The system is now without power.

## Hard Drive Blank



**CAUTION:** To prevent improper cooling and thermal damage, do not operate the storage system unless all bays are populated with either a component or a blank.

To remove the component:



To replace the blank, slide the blank into the bay until it locks into place.

## Hot-Plug SCSI Hard Drive

You can replace hard drives without powering down the system. However, before replacing a degraded drive:

- Open HP SIM and inspect the Error Counter window for each physical drive in the same array to confirm that no other drives have any errors. (For details, refer to the HP SIM documentation on the Management CD.)
- Be sure that the array has a current, valid backup.
- Use replacement drives that have a capacity at least as great as that of the smallest drive in the array. The controller immediately fails drives that have insufficient capacity.

To minimize the likelihood of fatal system errors, take these precautions when removing failed drives:

- Do not remove a degraded drive if any other drive in the array is offline (the Online LED is off). In this situation, no other drive in the array can be removed without data loss.

Exceptions:

- When RAID 1+0 is used, drives are mirrored in pairs. Several drives can be in a failed condition simultaneously (and they can all be replaced simultaneously) without data loss, as long as no two failed drives belong to the same mirrored pair.
- When RAID ADG is used, two drives can fail simultaneously (and be replaced simultaneously) without data loss.
- If the offline drive is a spare, the degraded drive can be replaced.
- Do not remove a second drive from an array until the first failed or missing drive has been replaced **and** the rebuild process is complete. (The rebuild is complete when the Online LED on the front of the drive stops blinking.)

These cases are the exceptions:

- In RAID ADG configurations, any two drives in the array can be replaced simultaneously.

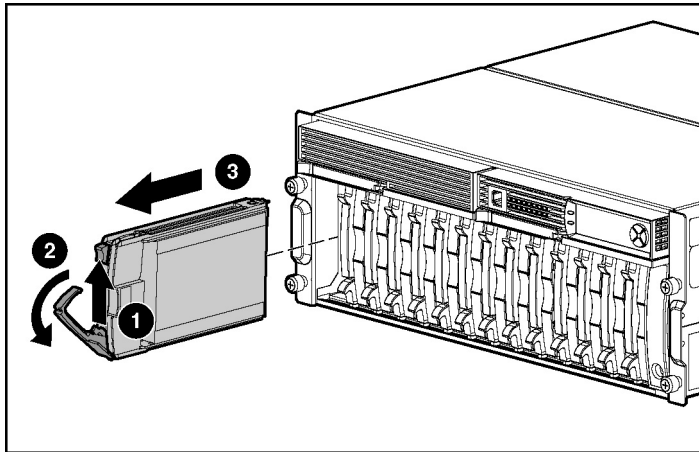
- In RAID 1+0 configurations, any drives that are not mirrored to other removed or failed drives can be simultaneously replaced offline without data loss.

To remove the component:



**CAUTION:** To prevent improper cooling and thermal damage, do not operate the storage system unless all bays are populated with either a component or a blank.

1. Determine the status of the hard drive from the hot-plug hard drive LEDs ("Hot-Plug SCSI Hard Drive LEDs" on page [41](#)).
2. Back up all data on the hard drive.
3. Remove the hard drive.



To replace the hot-plug SCSI hard drive:

1. Slide the drive into the cage until it clicks, locking the drive into place.
2. Close the lever.
3. Be sure that the drive LEDs illuminate one at a time and then turn off together to indicate that the system has recognized the new drive.

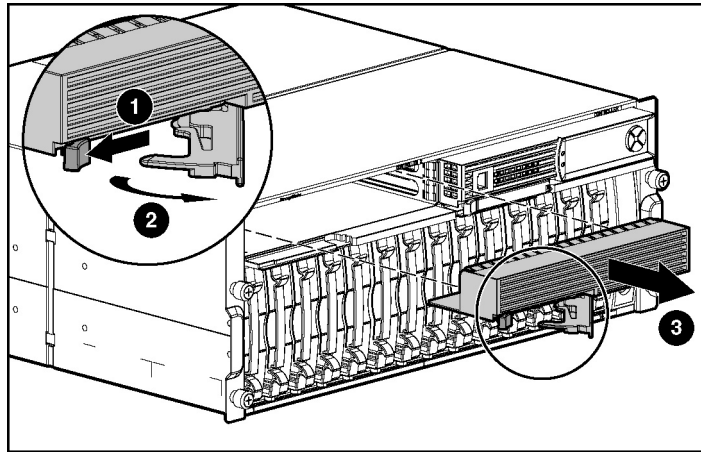
In fault-tolerant configurations, allow the replacement drive to be reconstructed automatically with data from the other drives. While reconstruction is in progress, the online LED flashes.

## Bezel Blank

To remove the component:



**CAUTION:** To prevent improper cooling and thermal damage, do not operate the storage system unless all bays are populated with either a component or a blank.



To replace the bezel blank:

1. Slide the bezel blank into the bay until it locks into place.
2. Close the lever.

## Modular Smart Array 500 Generation 2 Controller

When the controller in a single-controller storage system fails, HP recommends that you migrate the cache module to a new controller. Battery-backed cache data in a failed controller can remain intact for up to 3 days with 256-MB modules.



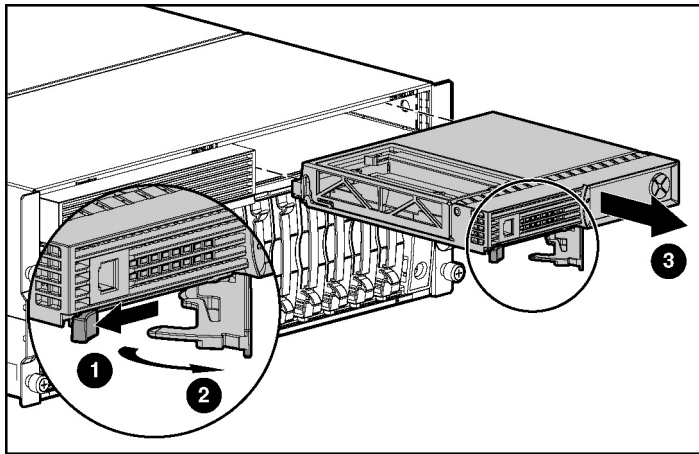
**CAUTION:** Failure to migrate the cache to a new controller and flush the data can result in loss of data that is written in the cache but was unable to be written to the hard drives before controller failure.

To remove the component:



**CAUTION:** To prevent improper cooling and thermal damage, do not operate the storage system unless all bays are populated with either a component or a blank.

1. Power down the storage system (on page [9](#)).
2. Remove the controller.



To restore the data:

1. Remove the cache modules from the failed controller.
2. Install the cache modules in the new controller.
3. Install the new controller and allow the cache to write the stored data.

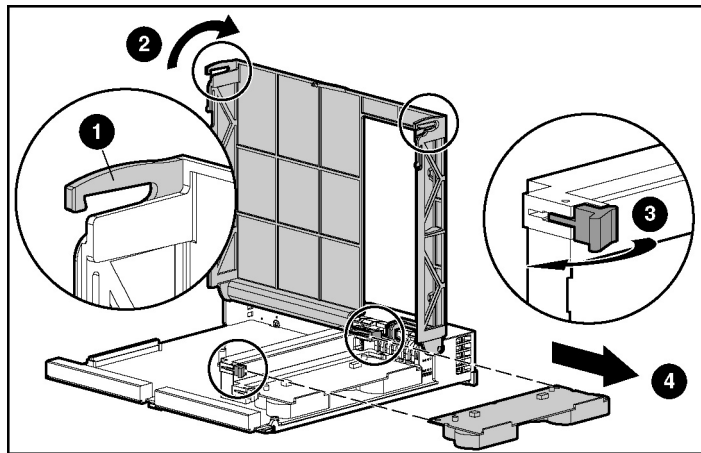
To replace the controller:

1. Slide the controller into the bay until it locks into place.
2. Close the lever.
3. Verify that the controller is seated properly by observing the controller LEDs. When seated properly, the LEDs illuminate when the system is powered.

## Battery-Backed Cache Module

To remove the component:

1. Determine if the controller configuration supports hot-plug cache replacement:
  - If the storage system is equipped with a single controller, power down the storage system (on page [9](#)).
  - If the system has redundant controllers and the replacement cache is a different capacity than the failed cache, power down the storage system (on page [9](#)).
  - If the system has redundant controllers and the replacement cache is the same capacity as the failed cache, proceed with step 2.
2. Remove the controller ("Modular Smart Array 500 Generation 2 Controller" on page [13](#)).
3. Remove the existing cache module.



4. Repeat steps 2 and 3 if the storage system has redundant controllers and the replacement cache is a different capacity than the failed cache.

To replace the cache module:

1. Install the module in the slot.

2. Close the slot latches.
3. Close the controller.

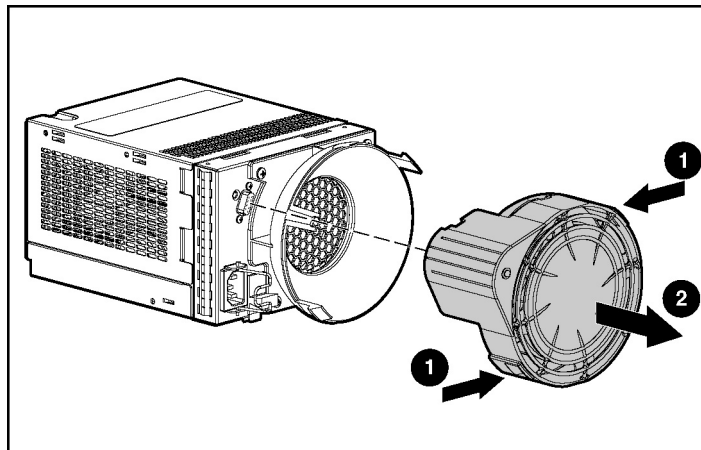
## Blower

To remove the component:



**WARNING:** The blower blades rotate at a high speed. Avoid touching the rotating blades when removing the blower.

**NOTE:** The power supply is designed so that removing a blower does not adversely affect system performance. However, do not remove a blower until the replacement blower is available.



To replace the blower:

1. Align the guidepost on the blower with the connector on the power supply.



**CAUTION:** Do not press on the center section of the blower because this action can damage the blades. Press only on the outer edge of the blower.

2. Slide the blower into the connector until it locks into place.
3. Be sure the following conditions occur:



- The blower begins operating immediately.
- The power supply/blower assembly LED is green.

## Hot-Plug Power Supply

Observe the following conditions for AC power supplies:



**CAUTION:** Removing a power supply significantly changes the airflow within the chassis. The storage system will shut down to prevent overheating unless the power supply is replaced within 5 minutes.



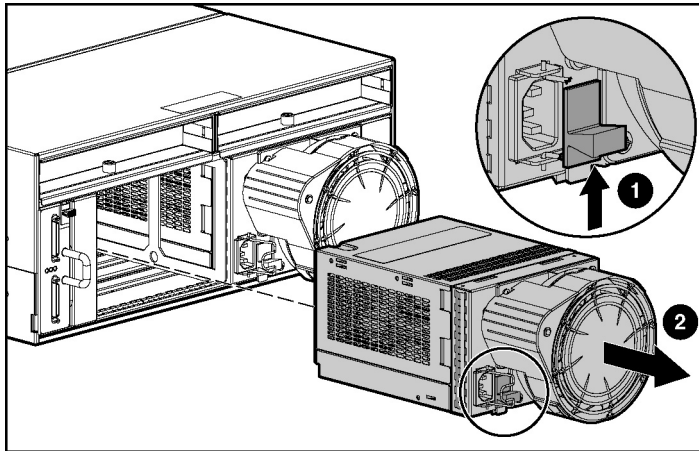
**CAUTION:** Handle the blower carefully to avoid damaging the housing:

- Do not press on the center section of the blower because this action can damage the blades. Press only on the outer edge of the blower.
- Do not rest the power supply on the blower because the weight of the power supply can damage the blower housing.

To remove the component:

1. Disconnect the power cord from the power supply.
2. Remove the blower ("Blower" on page [16](#)).

3. Remove the power supply.



To replace the power supply:

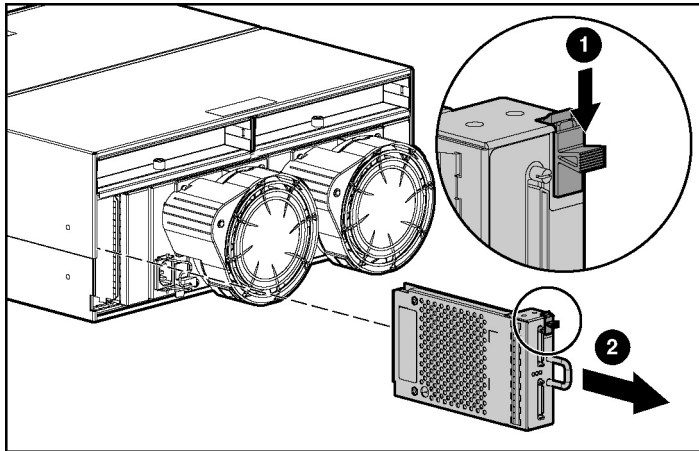
1. Lift the locking latch.
2. Slide the power supply into the bay until it locks into place.
3. Install the blower on the power supply.
4. Connect the power cord to the power supply.

## 2-Port or 4-Port Shared Storage Module

To remove the component:

1. Power down the storage system (on page [9](#)).
2. Disconnect the SCSI cabling connected to the 2-Port Shared Storage Module.

3. Remove the module.



To replace the component, reverse the removal procedure.

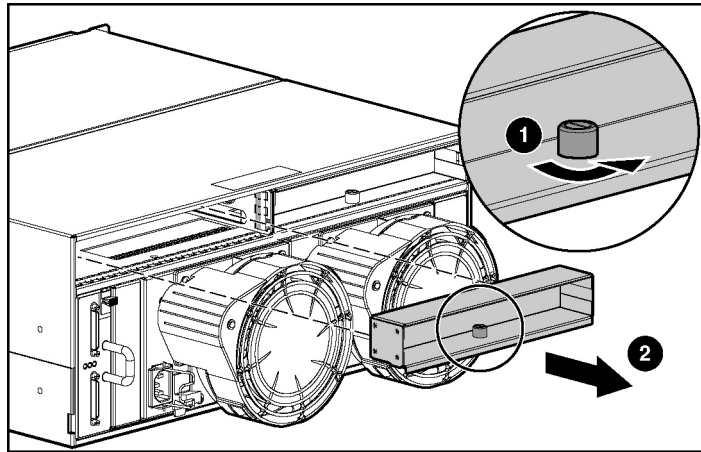
If you are replacing a failed 2-Port Shared Storage Module with a 4-Port Shared Storage Module, refer to the *4-Port Shared Storage Module Installation Instructions* that ship with the option.

## Interconnect Blank

To remove the component:



**CAUTION:** To prevent improper cooling and thermal damage, do not operate the storage system unless all bays are populated with either a component or a blank.



To replace the component, reverse the removal procedure.

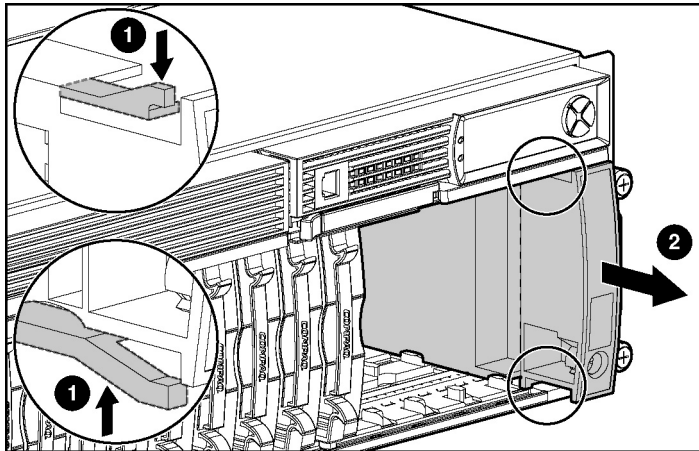
## Power Button/LED Assembly

To remove the component:

1. Power down the storage system (on page [9](#)).
2. Remove the hot-plug SCSI hard drives in bays 10 through 14 ("SCSI IDs" on page [40](#)).

**IMPORTANT:** To press the plastic latches behind the front bezel, you may choose to use a flat-head screwdriver.

3. Remove the power button/LED assembly.



To replace the component, slide the power button/LED assembly into the bay until it locks into place.

## Storage System Chassis and Backplane

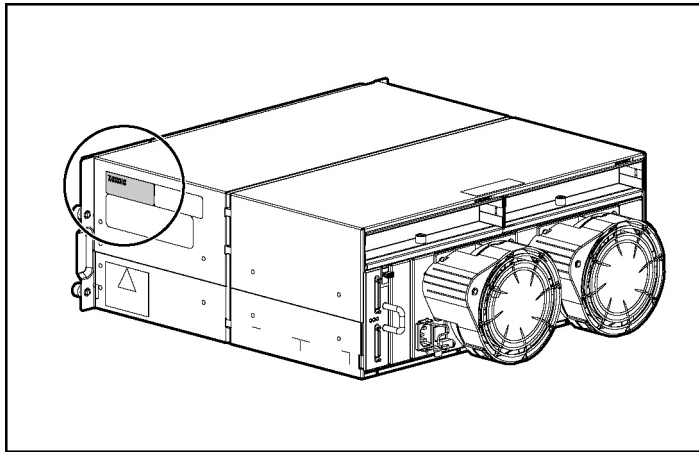
If the backplane board fails or the chassis sustains significant damage, you must order a replacement chassis.

To replace the chassis and backplane:

1. Power down the storage system (on page [9](#)).
2. Remove all hard drive blanks ("Hard Drive Blank" on page [10](#)).
3. Remove all hot-plug SCSI hard drives ("Hot-Plug SCSI Hard Drive" on page [11](#)).
4. Remove the bezel blank ("Bezel Blank" on page [13](#)).
5. Remove the controllers ("Modular Smart Array 500 Generation 2 Controller" on page [13](#)).
6. Remove all hot-plug power supplies ("Hot-Plug Power Supply" on page [17](#)).
7. Remove the 2-Port or 4-Port Shared Storage Module ("2-Port or 4-Port Shared Storage Module" on page [18](#)).

8. Remove the interconnect blanks ("Interconnect Blank" on page [20](#)).
9. Remove the power button/LED assembly ("Power Button/LED Assembly" on page [20](#)).
10. Handwrite the serial number of the original chassis on the label of the replacement chassis.

**IMPORTANT:** Always keep the serial number of the original chassis for warranty validation purposes. After chassis replacement, HP SIM only recognizes the new serial number.



11. Install all removed components in the new chassis. To replace each component, refer to the procedures in this section.

# Diagnostic Tools

## In This Section

Server Utilities .....	<a href="#">23</a>
ROM Functions and Utilities.....	<a href="#">24</a>
Array Configuration Utility .....	<a href="#">26</a>
Array Diagnostic Utility .....	<a href="#">27</a>
NetWare Online Array Configuration Utility (CPQONLIN) .....	<a href="#">28</a>

## Server Utilities

HP utilities provide reporting functions that enable event-focused management and diagnostics. To install and run these utilities, refer to the server documentation.

## HP Insight Diagnostics

The HP Insight Diagnostics utility displays information about the server hardware and tests the system to be sure it is operating properly. The utility has online help and can be accessed using the SmartStart CD. Online Diagnostics for Microsoft® Windows® is available for download from the HP website (<http://www.hp.com/support>).

## HP Systems Insight Manager

HP SIM is a web-based application that allows system administrators to accomplish normal administrative tasks from any remote location, using a web browser. HP SIM provides device management capabilities that consolidate and integrate management data from HP and third-party devices.

**IMPORTANT:** You must install and use HP SIM to benefit from the Pre-Failure Warranty for processors, hard drives, and memory modules.

For additional information, refer to the Management CD in the HP ProLiant Essentials Foundation Pack.

## Management Agents

Management Agents provide the information to enable fault, performance, and configuration management. The agents allow easy manageability of the server through HP Systems Insight Manager software, and third-party SNMP management platforms. Management Agents are installed with every SmartStart assisted installation or can be installed through the HP PSP. The System Management homepage provides status and direct access to in-depth subsystem information by accessing data reported through the Management Agents. For additional information, refer to the Management CD in the HP ProLiant Essentials Foundation Pack or the HP website (<http://www.hp.com/servers/manage>).

## Survey Utility

Survey Utility, a feature within Insight Diagnostics, gathers critical hardware and software information on ProLiant servers.

This utility supports operating systems that may not be supported by the server. For operating systems supported by the server, refer to the HP website (<http://www.hp.com>).

If a significant change occurs between data-gathering intervals, the Survey Utility marks the previous information and overwrites the Survey text files to reflect the latest changes in the configuration.

Survey Utility is installed with every SmartStart assisted installation or can be installed through the HP PSP.

## ROM Functions and Utilities

Each MSA500 G2 controller has a ROM that contains the controller firmware.



## Smart Components for ROM Flash

To update the firmware on the server, controller, or hard drives, use Smart Components. These components are available on the Firmware Maintenance CD. A more recent version of a particular component might be available on the support page of the HP website (<http://www.hp.com/support>). Components for controller and hard drive firmware updates are also available from the software and drivers page for storage products (<http://www.hp.com/support/proliantstorage>).

1. Find the most recent version of the component that you require. Components for controller firmware updates are available in offline and online formats.
2. Follow the instructions for installing the component on the server. These instructions are given with the CD and are provided on the same Web page as the component.

Follow the additional instructions that describe how to use the component to flash the ROM. These instructions are provided with each component.

## Recovery ROM

The Recovery ROM feature stores two complete firmware images in the ROM: one active image and one backup image. When the controller is powering up, it checks both firmware images to be sure they are valid. If either image is invalid, the system overwrites the invalid image with the valid image.

This process, commonly called auto-flashing, is performed automatically by the controller and does not require any user intervention. The controller display provides messages for the status of this process.

## Controller Firmware Auto Cloning

In a redundant controller configuration, both controllers must execute the same version of firmware. During power up (or when a redundant controller is installed as a hot-plug procedure), the storage system compares the controller firmware versions. If the versions differ, the controller displays a user input message seeking to initiate Controller Firmware Auto Cloning.

If 60 seconds elapse with no user input, one of the following actions occurs:

- In a non-hot-plug environment, the controller with the most recent firmware disables the controller with the older firmware and continues the power-up sequence. This method prevents automatic loss of a previous version of firmware.
- In a hot-plug environment, cloning begins automatically, and the storage system overwrites one firmware version with the other version.

When the cloning is complete, the storage system resets the modified controller. After the modified controller powers up, the controllers begin operating in redundant mode.

The storage system clones firmware based on the following criteria:

- **Non-Hot-Plug Cloning**—If the storage system powers up with both controllers installed, the storage system clones the most recent firmware version from either controller.
- **Hot-Plug Cloning**—If the storage system is operating and an optional redundant controller is installed, the storage system clones the firmware version from the primary controller, regardless of which firmware version is more recent. This cloning method ensures that all host-initiated I/O remains uninterrupted during storage system operation.
- **Incompatible Version Cloning**—If a specific version of firmware is incompatible with certain hardware revisions of a controller, the storage system displays the user input message seeking to initiate Controller Firmware Auto Cloning and clones the most recent firmware version that is compatible with both controllers.

**IMPORTANT:** During incompatible version cloning, the storage system does not reset the updated controller if the controller is operating and processing I/O. In this case, the storage system does not enter redundant mode and provides an informational message on the controller display. To configure redundancy, cycle the storage system power.

## Array Configuration Utility

ACU is a browser-based utility with the following features:

- Runs as a local application or remote service
- Supports online array capacity expansion, logical drive extension, assignment of online spares, and RAID or stripe size migration
- Suggests the optimum configuration for an unconfigured system
- Provides different operating modes, enabling faster configuration or greater control over the configuration options
- Remains available any time that the server is on
- Displays on-screen tips for individual steps of a configuration procedure

The minimum display settings for optimum performance are 800 × 600 resolution and 256 colors. The server must have Microsoft® Internet Explorer 5.5 (with Service Pack 1) installed and be running Microsoft® Windows® 2000, Windows® Server 2003, or Linux. Refer to the *README.TXT* file for further information about browser and Linux support.

For more information, refer to the *HP Array Configuration Utility User Guide* on the Documentation CD or the HP website (<http://www.hp.com>).

## Array Diagnostic Utility

ADU is a Linux-based tool that collects information about array controllers and generates a list of detected problems. You can save this data to a file for analysis. In most cases, ADU provides sufficient information for troubleshooting procedures.

To obtain ADU, download the utility from the HP website (<http://www.hp.com>).

## NetWare Online Array Configuration Utility (CPQONLIN)

The NetWare Online Array Configuration Utility, also called CPQONLIN, is an NLM for configuring drive arrays without shutting down the storage system. CPQONLIN also provides information about the status of drives attached to the MSA500 G2 controller. It indicates drive failure, expansion, or waiting for expansion or rebuild (queued). Before loading *CPQONLIN.NLM*, you must load the appropriate device drivers: *CPQRAID.HAM* and *CPQSHD.CDM*.

*CPQONLIN.NLM* is located in the ProLiant Support Pack found on the SmartStart CD and it is available on the support software CD that ships with the storage system.

**IMPORTANT:** CPQONLIN supports SSP configurations; however, you can also use ACU 7.10 (or later) offline to enable SSP configurations in a NetWare environment.

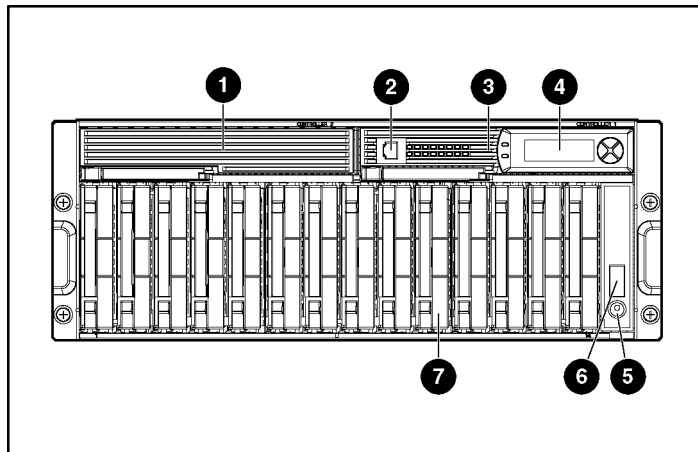
For more information about CPQONLIN, refer to the *HP StorageWorks Modular Smart Array 500 Generation 2 Storage System User Guide* or the *HP Array Configuration Utility User Guide* on the Documentation CD.

# Component Identification

## In This Section

Front Panel Components .....	<a href="#">29</a>
Enclosure LEDs .....	<a href="#">30</a>
Rear Panel Components.....	<a href="#">31</a>
Power Supply/Blower Assembly LEDs.....	<a href="#">32</a>
Shared Storage Module with Integrated Environmental Monitoring Unit .....	<a href="#">32</a>
Controller Components.....	<a href="#">36</a>
SCSI IDs .....	<a href="#">40</a>
Hot-Plug SCSI Hard Drive LEDs.....	<a href="#">41</a>
Hot-Plug SCSI Hard Drive LED Combinations .....	<a href="#">42</a>

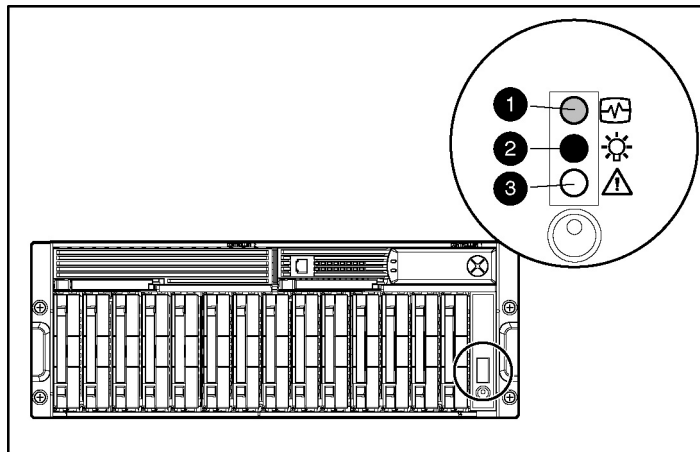
## Front Panel Components



Item	Description
1	Bezel blank (bay for optional redundant controller)
2	Service port (for HP service technicians only)
3	Hot-plug HP StorageWorks Modular Smart Array 500 Generation 2 controller

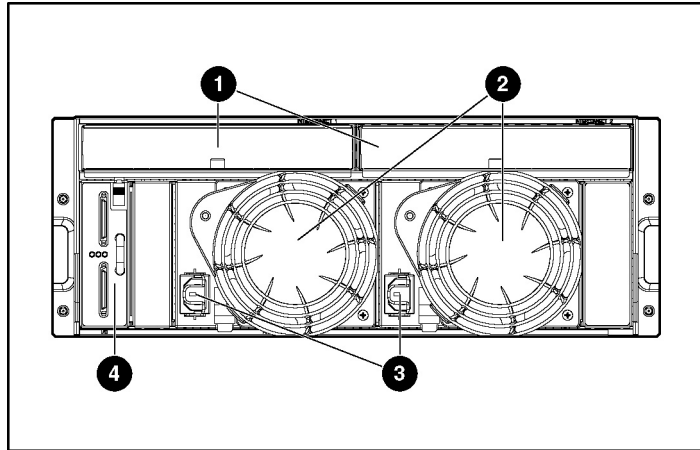
Item	Description
4	Controller display
5	Power On/Standby button
6	Enclosure LEDs
7	Hot-plug SCSI hard drive bays with blanks

## Enclosure LEDs



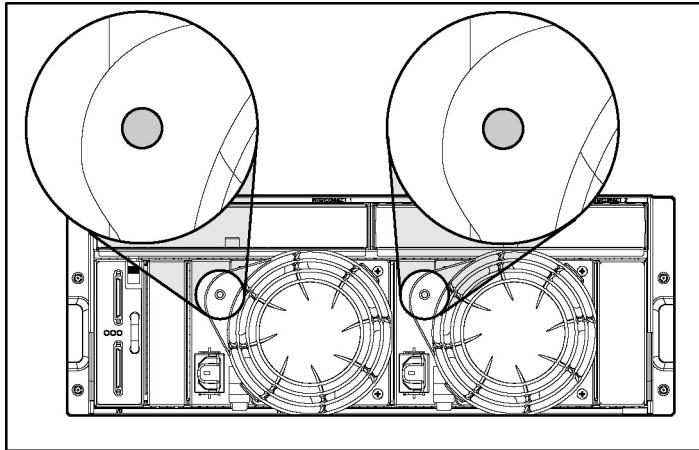
Item	Description	Status
1	EMU heartbeat	Green flashing = Shared storage module is operating normally. Green/Off = Shared storage module is not operating normally.
2	System power	Green = System power is On. Off = System is in standby mode or power is removed from the system.
3	Fault	Amber = Fault is detected in a subsystem. Off = No faults are detected.

## Rear Panel Components



Item	Description
1	Interconnect blanks (required for proper airflow)
2	Power supply/blower assemblies
3	AC power connectors
4	2-Port Shared Storage Module

## Power Supply/Blower Assembly LEDs



The power supply/blower assembly LEDs have two functions:

- Green—The power supply is receiving power, and the blower is operating normally.
- Off—No power is present; the power supply or the blower has failed.

## Shared Storage Module with Integrated Environmental Monitoring Unit

The storage system supports multipath two-node clustering and up to four-node shared storage with Ultra320 SCSI I/O hardware. The storage system ships standard with the 2-Port Shared Storage Module. A 4-Port Shared Storage Module is available as an option.

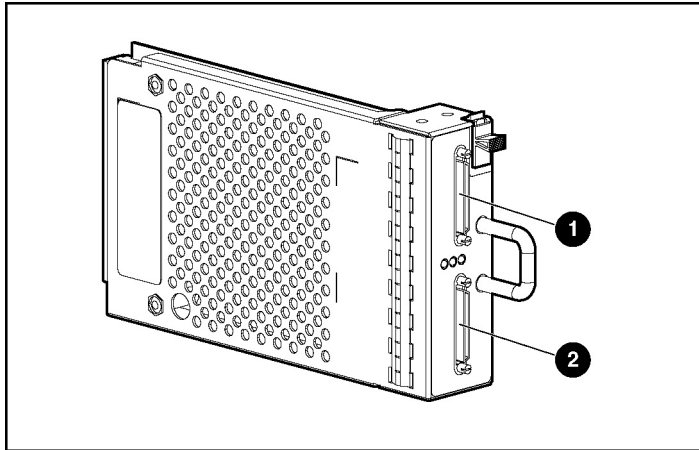
Functions include:

- Provides the interconnect function to the server nodes
- Monitors the enclosure operation for:
  - Temperature
  - Power supplies



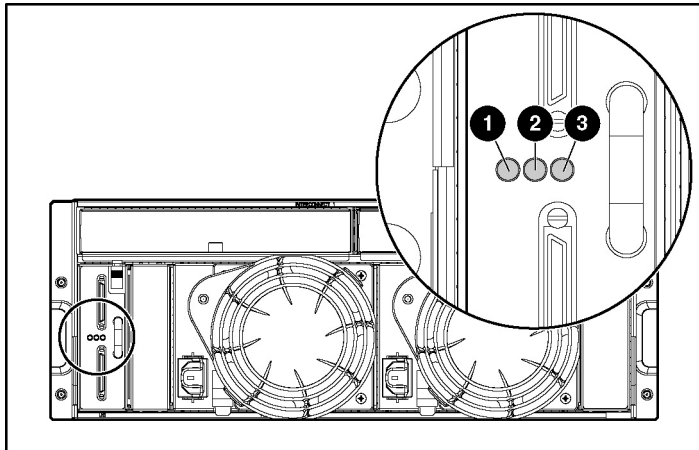
- Blowers
- Drive presence
- Detects and reports component changes in the enclosure (identifies hot-plug addition and removal)
- Controls drive and enclosure LEDs

## 2-Port Shared Storage Module Components



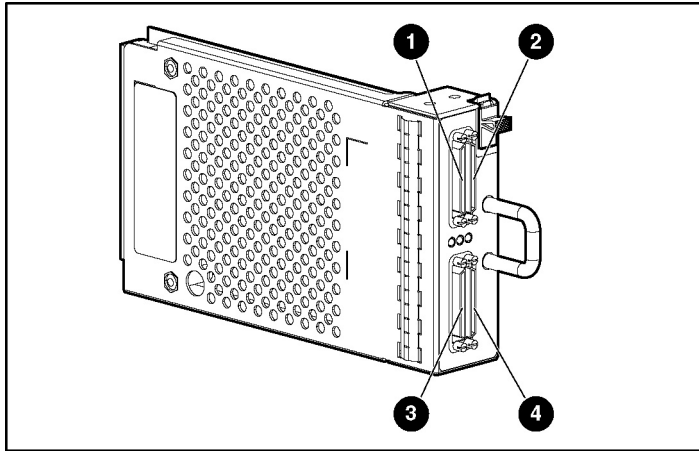
Item	Description	Bus
1	SCSI port connector	A
2	SCSI port connector	B

## 2-Port Shared Storage Module LEDs



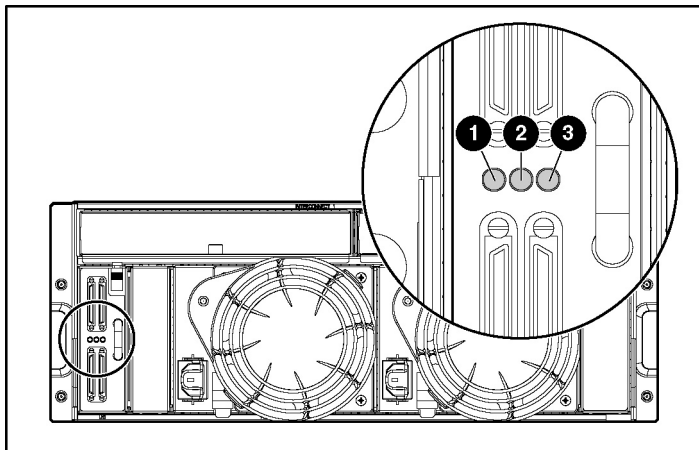
Item	LED Description	Status
1	Power	Flashing green = Power on Off = Power off
2	SCSI host port A	Flashing green = On/Activity Off = Off
3	SCSI host port B	Flashing green = On/Activity Off = Off

## 4-Port Shared Storage Module Components



Item	Description	Bus
1	SCSI port connector A1	A
2	SCSI port connector A2	A
3	SCSI port connector B1	B
4	SCSI port connector B2	B

## 4-Port Shared Storage Module LEDs



Item	LED Description	Status
1	Power	Flashing green = Power on Off = Power off
2	SCSI host port A connectors 1 and 2	Flashing green = On/Activity Off = Off
3	SCSI host port B connectors 1 and 2	Flashing green = On/Activity Off = Off

## Controller Components

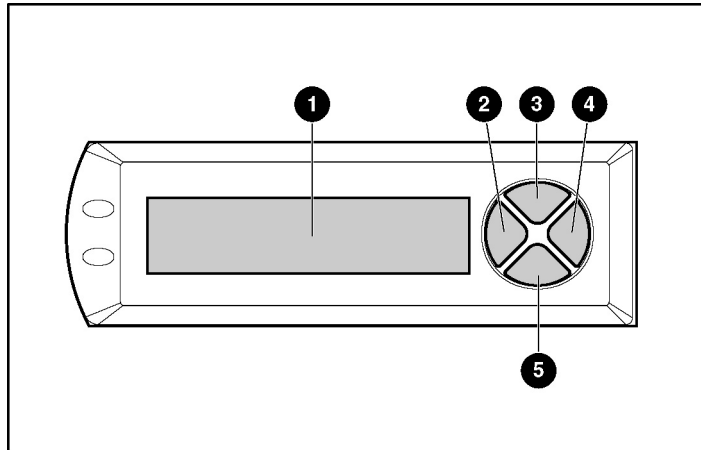
Controller Display (on page [37](#))

Controller LEDs (on page [38](#))

Battery-Backed Write Cache Enabler Overview (on page [39](#))

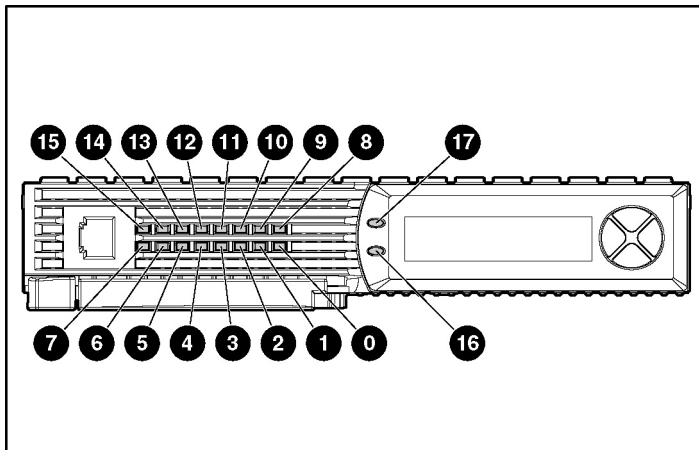
## Controller Display

Each controller LCD provides informational and error messages.



Item	Description
1	Display
2	Left button
3	Up button
4	Right button
5	Down button

## Controller LEDs



Item	LED Description	Status
0-2	Busy status	Green = Controller is idle. Off = Controller is operating at full capacity.
3-5	No function	—
6	Host port A notification	Green = Notify On Event command is active. Off = No Notify On Event command is active.
7	Host port B notification	Green = Notify On Event command is active. Off = No Notify On Event command is active.
8	Idle heartbeat	Controller is idle and functioning.
9	Active/Standby	Green = Controller is active. Off = Controller is in standby.
10	DMA activity	Green = DMA transfers are active. Off = No DMA transfers are active.

Item	LED Description	Status
11	Logical I/O activity	Green = System is currently processing logical requests from the host adapter. Off = System is not processing any logical requests.
12	SCSI bus 0 activity	Green = Outstanding requests exist on the SCSI bus. Off = No outstanding requests exist.
13	SCSI bus 1 activity	Green = Outstanding requests exist on the SCSI bus. Off = No outstanding requests exist.
14	Cache activity	Green = Cache activity is present. Off = No cache activity is present. Flashing green = Cache transfer is pending.
15	Drive failure	Green = An array-configured drive has failed. Off = No drives have failed.
16	Active redundancy	Green = Controllers are operating with redundancy. Off = No redundancy exists.
17	Fault	Amber = Error message has been received by the controller display. Off = No error message has been received or no error message is displayed currently.

## Battery-Backed Write Cache Enabler Overview

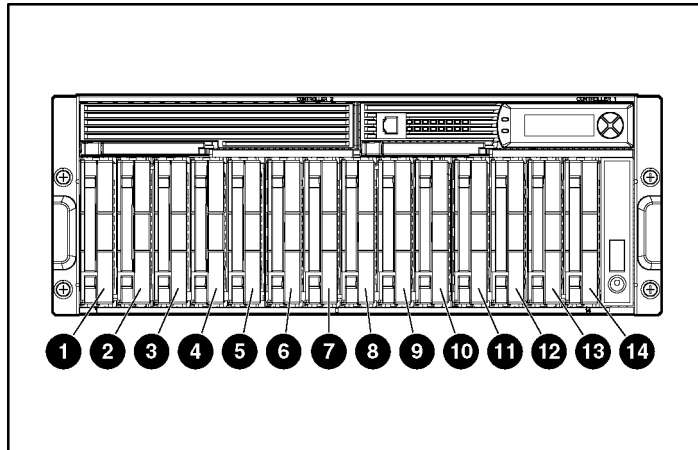
The Battery-Backed Write Cache Enabler, also known as the battery module, provides transportable data protection, increases overall controller performance, and maintains any cached data for up to 72 hours. The NiMH batteries in the battery module are continuously recharged through a trickle-charging process whenever the system power is on. Under normal operating conditions, the battery module lasts for 3 years before replacement is necessary.

**NOTE:** The data protection and the time limit also apply if a power outage occurs. When power is restored to the system, an initialization process writes the preserved data to the hard drives.

To enable faster data access from disk storage, the battery module performs two types of caching:

- Posted-write caching—the controller writes user data in the cache memory on the module rather than directly to the drives. Later, when the storage system is idle, the controller writes the data to the drive array.
- Read-ahead caching—the controller detects sequential array access, reads ahead into the next sequence of data, and stores the data in the read-ahead cache. Then, if the next read access is for the cached data, the controller immediately loads the data into system memory, avoiding the latency of a disk access.

## SCSI IDs

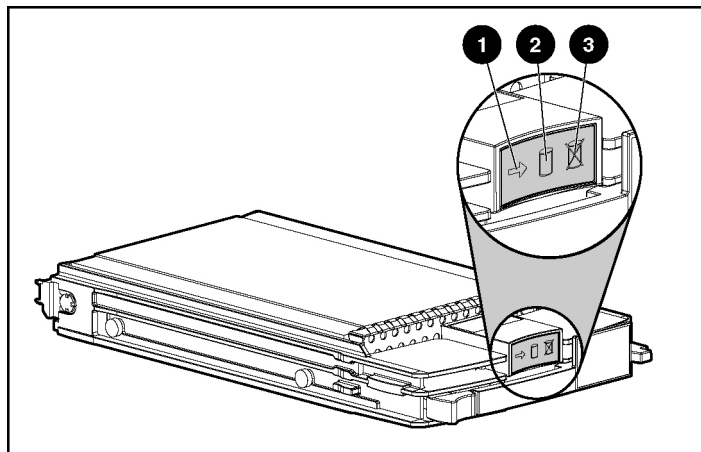


Bay	SCSI ID	Bus Port
1	0	0
2	1	0
3	2	0
4	3	0



Bay	SCSI ID	Bus Port
5	4	0
6	5	0
7	8	0
8	0	1
9	1	1
10	2	1
11	3	1
12	4	1
13	5	1
14	8	1

## Hot-Plug SCSI Hard Drive LEDs



Item	LED Description	Status
1	Activity status	On = Drive activity Flashing = High activity on the drive or drive is being configured as part of an array. Off = No drive activity

Item	LED Description	Status
2	Online status	On = Drive is part of an array and is currently working. Flashing = Drive is actively online. Off = Drive is offline.
3	Fault status	On = Drive failure Flashing = Fault-process activity Off = No fault-process activity

## Hot-Plug SCSI Hard Drive LED Combinations

Activity LED (1)	Online LED (2)	Fault LED (3)	Interpretation
On, off, or flashing	On or off	Flashing	A predictive failure alert has been received for this drive. Replace the drive as soon as possible.
On, off, or flashing	On	Off	The drive is online and is configured as part of an array. If the array is configured for fault tolerance and all other drives in the array are online, and a predictive failure alert is received or a drive capacity upgrade is in progress, you may replace the drive online.
On or flashing	Flashing	Off	<b>Do not remove the drive. Removing a drive may terminate the current operation and cause data loss.</b> The drive is rebuilding or undergoing capacity expansion.
On	Off	Off	<b>Do not remove the drive.</b> The drive is being accessed, but (1) it is not configured as part of an array; (2) it is a replacement drive and rebuild has not yet started; or (3) it is spinning up during the POST sequence.
Flashing	Flashing	Flashing	<b>Do not remove the drive. Removing a drive may cause data loss in non-fault-tolerant configurations.</b> Either (1) the drive is part of an array being selected by an array configuration utility; (2) Drive Identification has been selected in HP SIM; or (3) drive firmware is being updated.
Off	Off	On	The drive has failed and has been placed offline. You may replace the drive.

Activity LED (1)	Online LED (2)	Fault LED (3)	Interpretation
Off	Off	Off	<p>Either (1) the drive is not configured as part of an array; (2) the drive is configured as part of an array, but it is a replacement drive that is not being accessed or being rebuilt yet; or (3) the drive is configured as an online spare.</p> <p>If the drive is connected to an array controller, you may replace the drive online.</p>



# Specifications

## In This Section

Environmental Specifications .....	<a href="#">45</a>
Dimensions and Weight.....	<a href="#">45</a>
Power Specifications .....	<a href="#">46</a>

## Environmental Specifications

Temperature range	
Operating	10°C to 35°C (50°F to 95°F)
Shipping	-40°C to 70°C (-40°F to 158°F)
Maximum wet bulb temperature	28°C (82.4°F)
<p><b>NOTE:</b> All temperature ratings shown are for sea level. An altitude derating of 1°C per 300 m (1.8°F per 1,000 ft) to 3048 m (10,000 ft) is applicable. No direct sunlight allowed.</p>	
Relative humidity (noncondensing)	
Operating	10% to 90%
Non-operating	5% to 95%
<p><b>NOTE:</b> Storage maximum humidity of 95% is based on a maximum temperature of 45°C (113°F). Altitude maximum for storage corresponds to a pressure minimum of 70 KPa.</p>	

## Dimensions and Weight

Parameter	Value
Height	17.5 cm (6.9 in)
Depth	52.1 cm (20.5 in)
Width	48.3 cm (19.0 in)

Parameter	Value
Weight (no drives installed)	22.7 kg (50 lb)

## Power Specifications

Parameter	Value
Rated input voltage	100 VAC to 240 VAC
Rated input frequency	50 Hz to 60 Hz
Rated input current	7.35 A Max
Rated input power	641 W *
BTUs per hour	2187 *
Rated steady-state power	377 W
Maximum peak power	681 W
Acoustic noise (LWAdc bels and LpAm dBA)	
Idle	<6.9 and 53
Fixed disk (random writes)	<7.3 and 54
* Input power and heat dissipation specifications are maximum values and apply to worst-case conditions at a full-rated power supply load. The power/heat dissipation for each installation varies depending on the equipment configuration.	

# Acronyms and Abbreviations

**ACU**

Array Configuration Utility

**ADG**

Advanced Data Guarding

**ADU**

Array Diagnostics Utility

**ASIC**

application specific integrated circuit

**ASR**

Automatic Server Recovery

**CPQONLIN**

NetWare Online Array Configuration Utility

**DDR**

double data rate

**DMA**

direct memory access

**ECC**

error checking and correcting

**EMU**

environmental monitoring unit

**HBA**

host bus adapter

**I2C**

inter-integrated circuit

**IEC**

International Electrotechnical Commission

**KVM**

keyboard, video, and mouse

**LCD**

liquid crystal display

**LED**

light-emitting diode

**LVD**

low-voltage differential

**NEMA**

National Electrical Manufacturers Association



**NFPA**

National Fire Protection Association

**NIC**

network interface controller

**NLM**

NetWare Loadable Module

**NVRAM**

non-volatile memory

**ORCA**

Option ROM Configuration for Arrays

**PDU**

power distribution unit

**POST**

Power-On Self-Test

**RIS**

reserve information sector

**ROM**

read-only memory

**SA**

Smart Array

**SE**

single-ended

**SIM**

Systems Insight Manager

**SMART**

self-monitoring analysis and reporting technology

**SSP**

selective storage presentation

**TMRA**

recommended ambient operating temperature

**UPS**

uninterruptible power system

**VHDCI**

very high density cable interconnect

# Index

## 2

2-Port Shared Storage Module 18, 33, 34

## 4

4-Port Shared Storage Module 18, 35, 36

## A

active redundancy LED 38  
 active/standby LED 38  
 ACU (Array Configuration Utility) 26  
 ADU (Array Diagnostics Utility) 27  
 Array Configuration Utility (ACU) 26

## B

Battery-Backed Write Cache Enabler 15, 39  
 bezel, removing 13  
 blanks 31  
 blower assembly 31, 32  
 busy status LED 38  
 buttons 29, 37

## C

cache activity LED 38  
 component identification 29  
 configuration utilities 23  
 connectors 31, 33, 35  
 controller display, LCD 29, 37  
 controller LEDs 38

## D

diagnostic tools 23  
 DMA activity LED 38  
 drive bays 29, 40

drive failure LED 38  
 drive LEDs 38, 41

## E

electrostatic discharge 7  
 EMU heartbeat LED 30  
 enclosure LEDs 30  
 environmental requirements 45  
 environmental specifications 45

## F

fans 31  
 fault LED 38  
 firmware upgrades 24  
 front panel components 29  
 front panel LEDs 30

## H

hard drive blanks 10  
 hard drive LEDs 41, 42  
 hard drive, replacing 11  
 hard drives 11, 41, 42  
 host port notification LED 38  
 hot-plug power supply 17  
 HP Insight Diagnostics 23  
 HP ProLiant Essentials Foundation Pack 23

## I

idle heartbeat LED 38  
 illustrated parts catalog 5  
 Insight Diagnostics 23

## L

LCD 37  
 LED, power button 30  
 LEDs, controller 38  
 LEDs, hard drive 41  
 logical I/O activity LED 38

**M**

Management Agents 24  
management tools 23

**O**

Online ROM Flash Component Utility 25

**P**

part numbers 5  
physical specifications 45  
power button/LED board 20  
power connectors, external 31  
Power On/Standby button 9, 29  
power supplies 17  
power supply LEDs 32  
power supply output 46  
powering down 9

**R**

RAID configuration 26  
rear panel LEDs 32  
removal and replacement procedures 7  
ROM, updating 24, 25

**S**

safety considerations 7  
SCSI bus activity LED 38  
SCSI IDs 40  
serial number 21  
Shared Storage Module 18, 32  
spare part numbers 5  
specifications 45  
specifications, server 45  
static electricity 7  
Survey Utility 24  
system power LED 30  
Systems Insight Manager 23

**T**

temperature requirements 45  
tools 23

**U**

updating 24  
utilities 23, 24, 25, 26, 27

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