

# Hitachi AMS 2000 Family Storage System Service Guide

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## Glossary





# Preface

Congratulations on purchasing a new Hitachi AMS 2000 Family Storage System.

This guide can assist you in maintaining a Hitachi AMS 2000 Family Storage System.

This preface includes the following information:

- [Intended audience](#)
- [Product version](#)
- [Release notes and readme](#)
- [Document revision level](#)
- [Changes in this revision](#)
- [Document organization](#)
- [Document conventions](#)
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**NOTE:** The AMS 2500 model is included in this manual for reference only. Hitachi Data Systems self-service policy does not include customer installation or maintenance for model AMS 2500, except for firmware upgrades and disk drives in the expansion unit.

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## Intended audience

This document is intended for system administrators, Hitachi Data Systems representatives, and Authorized Service Providers who install, configure, and operate Hitachi Adaptable Modular System (AMS) 2000 family storage systems.

## Product version

This document applies to Hitachi AMS 2000 Family firmware version 0890/A or later.

## Release notes and readme

Read the release notes and readme file before installing and using this product. They may contain requirements or restrictions that are not fully described in this document and/or updates or corrections to this document.

## Document revision level

This section provides a history of the revision changes to this document.

Revision	Date	Description
MK-97DF8009EN-00	October 2008	Initial Release.
MK-97DF8009EN-01	October 2008	Revision 1, supersedes and replaces MK-97DF8009EN-00.
MK-97DF8009EN-02	November 2008	Revision 2, supersedes and replaces MK-97DF8009EN-01.
MK-97DF8009EN-03	February 2009	Revision 3, supersedes and replaces MK-97DF8009EN-02.
MK-97DF8009EN-04	April 2009	Revision 4, supersedes and replaces MK-97DF8009EN-03.
MK-97DF8009EN-05	June 2009	Revision 5, supersedes and replaces MK-97DF8009EN-04.
MK-97DF8009EN-06	August 2009	Revision 6, supersedes and replaces MK-97DF8009EN-05.
MK-97DF8009EN-07	November 2009	Revision 7, supersedes and replaces MK-97DF8009EN-06.
MK-97DF8009EN-08	December 2009	Revision 8, supersedes and replaces MK-97DF8009EN-07.
MK-97DF8009EN-09	January 2010	Revision 9, supersedes and replaces MK-97DF8009EN-08.
MK-97DF8009EN-10	April 2010	Revision 10, supersedes and replaces MK-97DF8009EN-09.
MK-97DF8009EN-11	August 2010	Revision 11, supersedes and replaces MK-97DF8009EN-10.
MK-97DF8009EN-12	November 2010	Revision 12, supersedes and replaces MK-97DF8009EN-11.
MK-97DF8009EN-13	December 2010	Revision 13, supersedes and replaces MK-97DF8009EN-12.
MK-97DF8009EN-14	February 2011	Revision 14, supersedes and replaces MK-97DF8009EN-13.
MK-97DF8009EN-15	May 2011	Revision 15, supersedes and replaces MK-97DF8009EN-14.
MK-97DF8009EN-16	July 2011	Revision 16, supersedes and replaces MK-97DF8009EN-15.
MK-97DF8009EN-17	August 2011	Revision 17, supersedes and replaces MK-97DF8009EN-16.

## Changes in this revision

- Added Canister unit of 3,000GB drive to [Table 3-6 on page 3-11](#).
- Changed safety labels. See [Safety and warning labels](#).







## Document organization




Thumbnail descriptions of the chapters are provided in the following table. Click the [chapter title](#) in the first column to go to that chapter. The first page of every chapter or appendix contains links to the contents.

Chapter/Appendix Title	Description
<a href="#">Chapter 1, Introduction</a>	This chapter describes the hardware components and controls of the AMS 2100/2300.
<a href="#">Chapter 2, Identifying failed parts</a>	This chapter describes how to verify a failed part and how to order a failed part.
<a href="#">Chapter 3, Replaceable parts</a>	This chapter describes the replaceable parts for the Hitachi AMS 2000 Family Storage System.
<a href="#">Chapter 4, Replacing parts</a>	This chapter explains the steps to remove and install parts in an Hitachi AMS 2000 Family Storage System.
<a href="#">Chapter 5, Maintenance</a>	This chapter contains information about replacing components on a periodic basis to prevent array failures and to maintain optimum performance.
<a href="#">Chapter 6, Troubleshooting</a>	This chapter describes how to configure an Hitachi AMS 2000 Family Storage System.
<a href="#">Chapter 7, Errors</a>	This chapter provides information about the errors and error messages that can be displayed by the Hitachi AMS 2000 Family Storage System software.
<a href="#">Glossary</a>	Defines the acronyms and special terms used in this document.

## Document conventions

This document uses the following symbols to draw attention to important safety and operational information.

Symbol	Meaning	Description
	Tip	Tips provide helpful information, guidelines, or suggestions for performing tasks more effectively.
	Note	Notes emphasize or supplement important points of the main text.
	Caution	Cautions indicate that failure to take a specified action could result in damage to the software or hardware.
	WARNING	Warnings indicate that failure to take a specified action could result in loss of data or serious damage to the hardware.
	DANGER	The Danger symbol warns users of possible injury or death if instructions are not followed.
	ELECTRIC SHOCK HAZARD!	This symbol warns users of electric shock hazard. Failure to take appropriate precautions such as not opening or touching hazardous areas of the equipment could result in injury or death.

Symbol	Meaning	Description
	Electrostatic Sensitive	The ESD symbol warns users that the equipment is sensitive to electrostatic discharge (ESD) and could be damaged if users do not take appropriate precautions such as using an anti-static wrist strap when touching or handling the equipment.
	Burn Hazard	HOT SURFACE! Turn off power and allow to cool before touching.
	Sharp Edges or Corners	WARNING! Sharp edges or corners. Avoid touching or wear gloves

The following typographic conventions are used in this document.

Convention	Description
<b>Bold</b>	Indicates text on a window, other than the window title, including menus, menu options, buttons, fields, and labels. Example: Click <b>OK</b> .
<i>Italic</i>	Indicates a variable, which is a placeholder for actual text provided by the user or system. Example: copy <i>source-file target-file</i> Angled brackets (< >) are also used to indicate variables.
screen/code	Indicates text that is displayed on screen or entered by the user. Example: # <code>pairdisplay -g oradb</code>
< > angled brackets	Indicates a variable, which is a placeholder for actual text provided by the user or system. Example: # <code>pairdisplay -g &lt;group&gt;</code>  Italic font is also used to indicate variables.
[ ] square brackets	Indicates optional values. Example: [ a   b ] indicates that you can choose a, b, or nothing.
{ } braces	Indicates required or expected values. Example: { a   b } indicates that you must choose either a or b.
vertical bar	Indicates that you have a choice between two or more options or arguments. Examples: [ a   b ] indicates that you can choose a, b, or nothing. { a   b } indicates that you must choose either a or b.
underline	Indicates the default value. Example: [ <u>a</u>   b ]

## Convention for storage capacity values

Physical storage capacity values (e.g., disk drive capacity) are calculated based on the following values:

Physical capacity unit	Value
1 KB	1,000 bytes
1 MB	1,000 KB or 1,000 <sup>2</sup> bytes
1 GB	1,000 MB or 1,000 <sup>3</sup> bytes
1 TB	1,000 GB or 1,000 <sup>4</sup> bytes
1 PB	1,000 TB or 1,000 <sup>5</sup> bytes
1 EB	1,000 PB or 1,000 <sup>6</sup> bytes

Logical storage capacity values (e.g., logical device capacity) are calculated based on the following values:

Logical capacity unit	Value
1 block	512 bytes
1 KB	1,024 ( $2^{10}$ ) bytes
1 MB	1,024 KB or $1024^2$ bytes
1 GB	1,024 MB or $1024^3$ bytes
1 TB	1,024 GB or $1024^4$ bytes
1 PB	1,024 TB or $1024^5$ bytes
1 EB	1,024 PB or $1024^6$ bytes

## Related documents

The AMS 2000 Family user documentation is available on the Hitachi Data Systems Portal: <https://portal.hds.com>. Please check this site for the most current documentation, including important updates that may have been made after the release of the product.

This documentation set consists of the following documents.

### Release notes


- Adaptable Modular Storage System Release Notes
- Storage Navigator Modular 2 Release Notes



Please read the release notes before installing and/or using this product. They may contain requirements and/or restrictions not fully described in this document, along with updates and/or corrections to this document.

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### Installation and getting started

The following documents provide instructions for installing an AMS 2000 Family storage system. They include rack information, safety information, site-preparation instructions, getting-started guides for experienced users, and host connectivity information. The symbol  identifies documents that contain initial configuration information about Hitachi AMS 2000 Family storage systems.

 **AMS2100/2300 Getting Started Guide**, MK-98DF8152

Provides quick-start instructions for getting an AMS 2100 or AMS 2300 storage system up and running as quickly as possible.

 **AMS2500 Getting Started Guide**, MK-97DF8032

Provides quick-start instructions for getting an AMS 2500 storage system up and running as quickly as possible.

**AMS 2000 Family Site Preparation Guide**, MK-98DF8149

Contains site planning and pre-installation information for AMS 2000 Family storage systems, expansion units, and high-density expansion units. This document also covers safety precautions, rack information, and product specifications.

**AMS 2000 Family Fibre Channel Host Installation Guide,**  
MK-08DF8189

Describes how to prepare Hitachi AMS 2000 Family Fibre Channel storage systems for use with host servers running supported operating systems.

**AMS 2000 Family iSCSI Host Installation Guide,** MK-08DF8188

Describes how to prepare Hitachi AMS 2000 Family iSCSI storage systems for use with host servers running supported operating systems.

### **Storage and replication features**

The following documents describe how to use Storage Navigator Modular 2 (Navigator 2) to perform storage and replication activities.

**Storage Navigator 2 Advanced Settings User's Guide,** MK-97DF8039

Contains advanced information about launching and using Navigator 2 in various operating systems, IP addresses and port numbers, server certificates and private keys, boot and restore options, outputting configuration information to a file, and collecting diagnostic information.

**Storage Navigator Modular 2 User's Guide,** MK-99DF8208

Describes how to use Navigator 2 to configure and manage storage on an AMS 2000 Family storage system.

**AMS 2000 Family Dynamic Provisioning Configuration Guide,**  
MK-09DF8201

Describes how to use virtual storage capabilities to simplify storage additions and administration.

**Storage Navigator 2 Storage Features Reference Guide for AMS,**  
MK-97DF8148

Contains concepts, preparation, and specifications for Account Authentication, Audit Logging, Cache Partition Manager, Cache Residency Manager, Data Retention Utility, LUN Manager, Performance Monitor, SNMP Agent, and Modular Volume Migration.

**AMS 2000 Family Copy-on-write SnapShot User Guide,** MK-97DF8124

Describes how to create point-in-time copies of data volumes in AMS 2100, AMS 2300, and AMS 2500 storage systems, without impacting host service and performance levels. Snapshot copies are fully read/write compatible with other hosts and can be used for rapid data restores, application testing and development, data mining and warehousing, and nondisruptive backup and maintenance procedures.

**AMS 2000 Family ShadowImage In-system Replication User Guide,**  
MK-97DF8129

Describes how to perform high-speed nondisruptive local mirroring to create a copy of mission-critical data in AMS 2100, AMS 2300, and AMS 2500 storage systems. ShadowImage keeps data RAID-protected and fully recoverable, without affecting service or performance levels. Replicated data volumes can be split from host applications and used for system backups, application testing, and data mining applications while business continues to operate at full capacity.

**AMS 2000 Family TrueCopy Remote Replication User Guide,**  
MK-97DF8052

Describes how to create and maintain multiple duplicate copies of user data across multiple AMS 2000 Family storage systems to enhance your disaster recovery strategy.

**AMS 2000 Family TrueCopy Extended Distance User Guide,**  
MK-97DF8054

Describes how to perform bi-directional remote data protection that copies data over any distance without interrupting applications, and provides failover and recovery capabilities.


**AMS 2000 Data Retention Utility User's Guide,** MK-97DF8019

Describes how to lock disk volumes as read-only for a certain period of time to ensure authorized-only access and facilitate immutable, tamper-proof record retention for storage-compliant environments. After data is written, it can be retrieved and read only by authorized applications or users, and cannot be changed or deleted during the specified retention period.

## Storage Navigator Modular 2 online help

Provides topic and context-sensitive help information accessed through the Navigator 2 software.

## Hardware maintenance and operation

The following documents describe how to operate, maintain, and administer an AMS 2000 Family storage system. They also provide a wide range of technical information and specifications for the AMS 2000 Family storage systems. The symbol  identifies documents that contain initial configuration information about Hitachi AMS 2000 Family storage systems.

 **AMS 2100/2300 Storage System Hardware Guide**, MK-97DF8010

Provides detailed information about installing, configuring, and maintaining an AMS 2100/2300 storage system.

 **AMS 2500 Storage System Hardware Guide**, MK-97DF8007

Provides detailed information about installing, configuring, and maintaining an AMS 2500 storage system.

 **AMS 2000 Family Storage System Reference Guide**,  
MK-97DF8008

Contains specifications and technical information about power cables, system parameters, interfaces, logical blocks, RAID levels and configurations, and regulatory information about AMS 2100, AMS 2300, and AMS 2500 storage systems. This document also contains remote adapter specifications and regulatory information.

**AMS 2000 Family Storage System Service and Upgrade Guide**,  
MK-97DF8009 — this document

Provides information about servicing and upgrading AMS 2100, AMS 2300, and AMS 2500 storage systems.

**AMS 2000 Family Power Savings User Guide**, MK-97DF8045

Describes how to spin down volumes in selected RAID groups when they are not being accessed by business applications to decrease energy consumption and significantly reduce the cost of storing and delivering information.

## Command and Control (CCI)

The following documents describe how to install the Hitachi AMS 2000 Family Command Control Interface (CCI) and use it to perform TrueCopy and ShadowImage operations.

### **AMS 2000 Family Command Control Interface (CCI) Installation Guide**, MK-97DF8122

Describes how to install CCI software on open-system hosts.

### **AMS 2000 Family Command Control Interface (CCI) Reference Guide**, MK-97DF8121

Contains reference, troubleshooting, and maintenance information related to CCI operations on AMS 2100, AMS 2300, and AMS 2500 storage systems.

### **AMS 2000 Family Command Control Interface (CCI) User's Guide**, MK-97DF8123

Describes how to use CCI to perform TrueCopy and ShadowImage operations on AMS 2100, AMS 2300, and AMS 2500 storage systems.

## Command Line Interface (CLI)

The following documents describe how to use Hitachi Storage Navigator Modular 2 to perform management and replication activities from a command line.

### **Storage Navigator Modular 2 Command Line Interface (CLI) Unified Reference Guide**, MK-97DF8089

Describes how to interact with all Navigator 2 bundled and optional software modules by typing commands at a command line.

### **Storage Navigator 2 Command Line Interface Replication Reference Guide for AMS**, MK-97DF8153

Describes how to interact with Navigator 2 to perform replication activities by typing commands at a command line.

## Dynamic Replicator documentation

The following documents describe how to install, configure, and use Hitachi Dynamic Replicator to provide AMS Family storage systems with continuous data protection, remote replication, and application failover in a single, easy-to-deploy and manage platform.

### **Hitachi Dynamic Replicator - Scout Release Notes**, RN-99DF8211

### **Hitachi Dynamic Replicator - Scout Host Upgrade Guide**, MK-99DF8267

### **Hitachi Dynamic Replicator - Scout Host User Guide**, MK-99DF8266

## **Hitachi Dynamic Replicator - Scout Installation and Configuration Guide, MK-98DF8213**

## **Hitachi Dynamic Replicator - Scout Quick Install/Upgrade Guide, MK-98DF8222**

### **Getting help**

If you need to contact the Hitachi Data Systems support center, please provide as much information about the problem as possible, including:

- The circumstances surrounding the error or failure.
- The exact content of any messages displayed on the host system(s).
- The exact content of any messages displayed on Storage Navigator Modular 2.
- The Storage Navigator Modular 2 configuration information. This information is used by service personnel for troubleshooting purposes.

The Hitachi Data Systems customer support staff is available 24 hours a day, seven days a week. If you need technical support, please log on to the Hitachi Data Systems Portal for contact information: <https://portal.hds.com>

### **Comments**

Please send us your comments on this document: [doc.comments@hds.com](mailto:doc.comments@hds.com). Include the document title, number, and revision, and refer to specific section(s) and paragraph(s) whenever possible.

***Thank you!*** (All comments become the property of Hitachi Data Systems.)



# Safety guidelines

This section contains warnings and important safety guidelines for using a Hitachi AMS 2100/2300 Storage System. Read and understand the information in this section before removing, replacing and installing system components.

This section includes the following key topics:

- [Personal safety](#)
- [Electrical safety](#)
- [Equipment safety](#)
- [Safety and warning labels](#)

## Personal safety

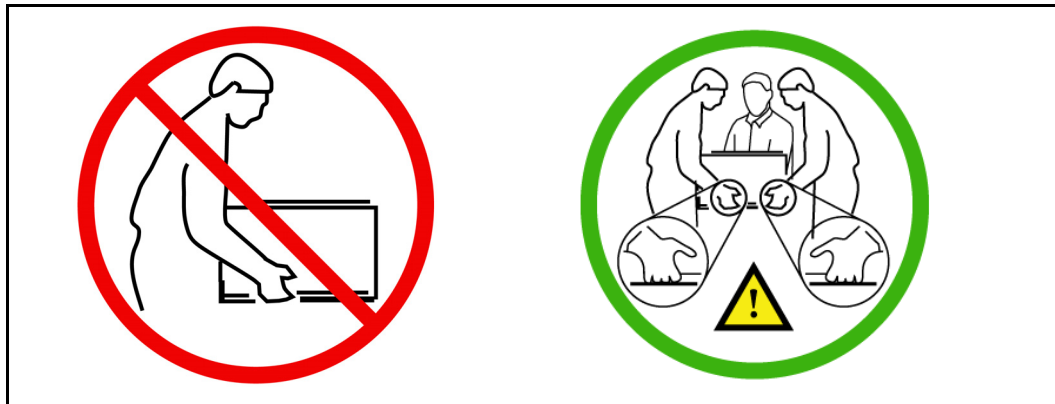
Observe the following guidelines to ensure safety. Failure to follow these guidelines could result in bodily injury or damage to the equipment.



**CAUTION! A fully populated AMS 2300 base unit weighs approximately 125 pounds (57 kg). A fully populated AMS 2500 weighs approximately 101 lbs (46 kg). Three or more people are required to lift these units. Before lifting one of these units, always turn off the power to the unit and unplug all data and power cables.**

**An expansion unit weighs 88 lbs (40Kg). Use at least two people to unpack and install an expansion unit.**

Install the base unit at the bottom of the rack. If the array is mounted at the top of the rack, the rack may become unstable and fall.



**CAUTION! Be sure to use at least three people to install the unit in a rack. Work carefully to prevent the unit from slipping or falling.**

**Be sure to install the base unit at the bottom of the rack and any expansion units above it to prevent the rack from falling. Lift the unit up to the height suitable for mounting. Adjust the position of the array so it is seated in the horizontal center of the rack. Slide the array onto the rails in the rack frame. When sliding the array onto the rails, move it gently all the way onto the rails.**

**WARNING!**

- Do not perform any action that creates a potential hazard to people or makes the equipment or rack unsafe.
  - Perform operations in accordance with the procedures in this manual.
  - Follow the safety statements in this manual and on the labels attached to the array.
  - Do not wear loose clothing that could get caught in the chassis or mounting hardware.
  - Wear safety glasses when working under conditions that are hazardous to your eyes.
  - Do not work on the equipment or disconnect cables during a thunderstorm, when wearing a wool sweater or other heavy wool clothing, or when power is applied.
  - Avoid hazards such as moist floors.
  - The hard disk drives in the array contain a class 1 laser system that does not emit a hazardous laser beam.
  - Tie up long hair before working with the equipment.
  - Do not power on any device with rotating or moving parts that are not properly covered unless instructed to do so.
-

## **ELECTRIC SHOCK HAZARD!**

- The power supplies and backup batteries can contain electricity even when the power is turned off and the units are disconnected from the electrical supply.
- Disconnect all power before installation.
- Do not disassemble the power supplies or backup batteries.
- Do not touch the electrical connectors on the rear of the power supplies or backup batteries.
- When replacing power supplies or backup batteries, make certain that the replacement units are the same model number as the units being replaced.
- Do not install or remove any ENC or power cables with the power on. The ENC cables carry a power control signal to the expansion units. (LAN and Fibre Channel cables can be installed or removed with the power on.)
- Do not use ungrounded power-extension cables.
- Do not touch any uninsulated conductor or surface that remains charged for a limited time after the external power supply to the machine is disconnected.
- When working on a machine that has a grounding terminal, make sure that the terminals are properly connected to the facility's ground.
- Do not work alone when working close to an energized part. Work with another person who can immediately turn off the power in an emergency.
- Before starting work, ensure that there are no potential electric hazards in the maintenance area such as insufficient grounding or a wet floor.
- Before starting work, note where the emergency power-off switches are located and make sure you know how to operate them.
- Cut off all power sources to the system before starting work unless you are instructed not to cut off power. Turning off the machine power supplies is usually not sufficient. When power is fed from a wall or floor outlet, unplug the power supply cord, or turn off the switch on the power distribution panel or board.
- Do not put metallic material, such as a clip or combustible material, such as paper, into the equipment from the air vent because it will cause an electric shock or fire.
- Do not use the array in a moist or dusty place because the insulation can deteriorate. An electric shock or a fire may be caused when the insulation is deteriorated.
- Before inserting a power plug, ensure that no foreign particles are on the connectors.
- When the power supply has a lockout device (see the following note), lock it up after powering off and keep the key. Attach a notice on the panel or board prohibiting the use of the switch.

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If the system power has been already turned off, verify that these conditions are satisfied.



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**NOTE:** The following is an excerpt from 29 CFR 1910.147 “The control of hazardous energy (lockout/takeout),” in the OSHA (Occupational Safety & Health Administration U.S Department of Labor USA) Regulations.

- Lockout device. A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in a safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds.
  - Energy isolating device. A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: A manually operated electrical circuit breaker; a disconnect switch, a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors, and, in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.
- 

## Handling of cables on the floor

- Route the cables so that you do not trip on them.
- Protect cables which cannot be routed within a rack and are laid on the floor including across a doorway. Use a cable duct to prevent wear on the cable, tripping over, and walking on the cables. and thus laid on the floor or cables which cross a passage with cable ducts, etc.
- Do not put heavy objects on the cables. Do not put the cables near any objects that generates heat because the cable coating can break down and could cause an electric shock, fire, or power failure.
- Do not route rack-to-rack cables in the air. Route them down the rack and under the floor if possible. Otherwise route the across the floor and use a cable duct to protect them.

## Handling of under-floor cables

Use cables that have enough length so that the cables can be laid somewhat loosely on the floor under the computer room floor, and are not hanging or stretched between the racks or arrays. Tight cables can be damaged or broken if stretched beyond their specified limits, as could happen in an earthquake.

## Equipment safety

The following safety instructions are designed to help protect the array from various types of physical and electrical damage.



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### **CAUTION! Electrostatic-sensitive. Ground yourself before touching.**

To avoid damage to the array or array components due to electrostatic discharge (ESD), wear an anti-static wrist strap when handling, installing, or removing any components from the array. Connect the clip on the wrist strap to an unpainted part of the array chassis frame to safely channel any static electricity generated by your body to ground. If no wrist strap is available, ground yourself by touching an unpainted part of the array chassis frame.











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- **Moisture.** Do not store, install, or use the array in a place where moisture exists or is likely to condense on the unit.
- **Heat.** Do not install the unit in a rack which has less than the specified cooling. The AMS 2100/2300 has heat sensors which will cause the unit to shut down if the internal temperature exceeds the specifications. See the Hitachi AMS 2100/2300 Reference Guide for details.
- **Electromagnetic Interference.** When the array is operating under normal conditions, close the rack doors if the rack has them. This helps protect the array from electromagnetic interference.
- Do not perform any operations on the array other than those in this guide because unexpected failures or accidents may occur.
- Use only the power cords provided with the array because unexpected accidents or failures may occur.
- Shut off the array's power if smoke, abnormal heat generation, or an unusual odor occurs. Ignoring these conditions may cause an electrical shock, damage to the equipment, or fire.
- Avoid using the equipment for any use other than its original purpose.
- Do not put heavy material on the equipment because it can fall and injure you, or the subsystem may not operate normally.
- The array is provided with ventilating holes on external covers in order to prevent overheating. Therefore, be sure to leave at least 2 inches (5 cm) in front and rear of the array and not block the ventilation holes. Otherwise, the array may overheat and fail.
- Use specified optional parts, cables, and connectors. Otherwise, a fire or a failure of the array may be caused as well as the deterioration of the performance.
- Do not put containers that contain any type of liquids or metal articles on top of the array. If they spill and accidentally get into the array, they can cause a fire, an electric shock, or an array failure.
- When a failure occurs in the unit, refer to this manual and to the *Hitachi Hitachi AMS 2100/2300 Storage System Hardware Guide* to prevent personal injury. If the failure does not correspond to any corrective measure written in this manual, inform the maintenance engineer.

## Safety and warning labels

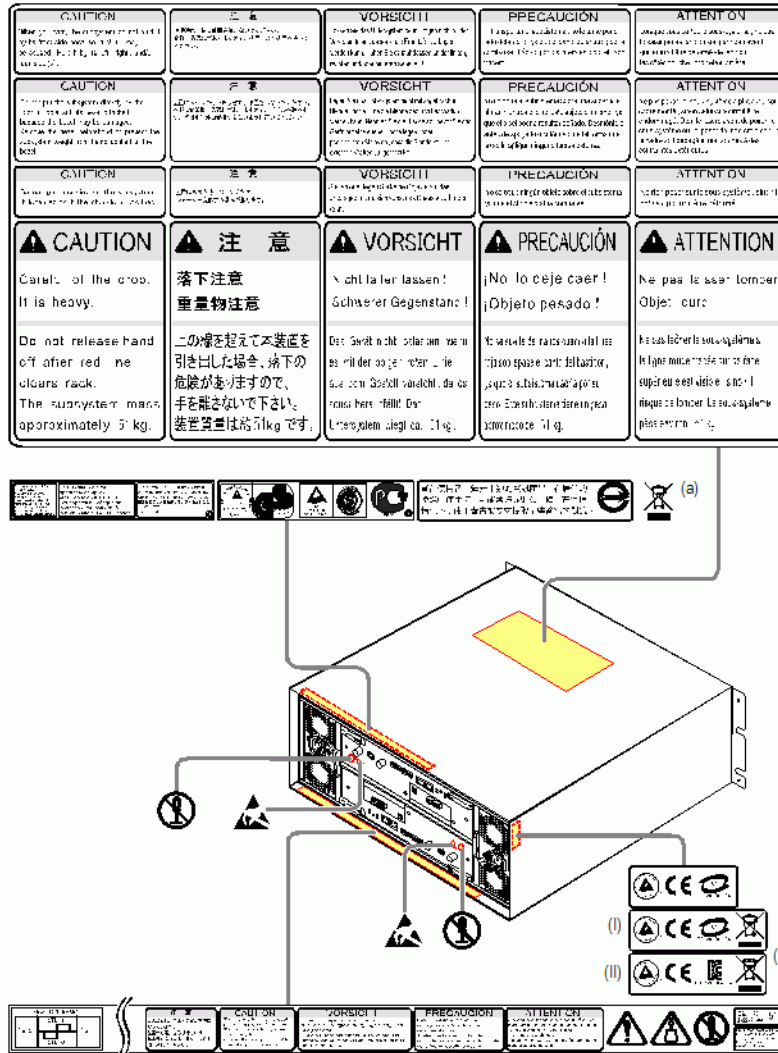
In this equipment, warning labels are pasted on areas requiring special care. Warnings written on them are primarily for service personnel. The following table shows the symbols contained in warning labels.

**Table 1: Warning Labels**


Symbol	Meaning	Description
	Caution	Cautions indicate that failure to take a specified action could result in damage to the software or hardware.
	WARNING	Warnings indicate that failure to take a specified action could result in loss of data or serious damage to the hardware.
	DANGER	The Danger symbol warns users of possible injury or death if instructions are not followed.
	ELECTRIC SHOCK HAZARD!	This symbol warns users of electric shock hazard. Failure to take appropriate precautions such as not opening or touching hazardous areas of the equipment could result in injury or death.
	Electrostatic Sensitive	The ESD symbol warns users that the equipment is sensitive to electrostatic discharge (ESD) and could be damaged if users do not take appropriate precautions such as using a grounded wrist strap when touching or handling the equipment.
	Burn Hazard	HOT SURFACE! Turn off power and allow to cool before touching.
	No Screwdrivers	Do not disassemble the equipment.
	Heavy	Handle the heavy equipment carefully.
	Caught Fingers	Be careful that your fingers do not get caught in moving parts.
	Equipment Safety	Do not put anything on top of an array that is partially out of a rack.

# Safety and warning labels - base unit

Figure 1 shows the location and content of the warning and safety labels on the base unit.

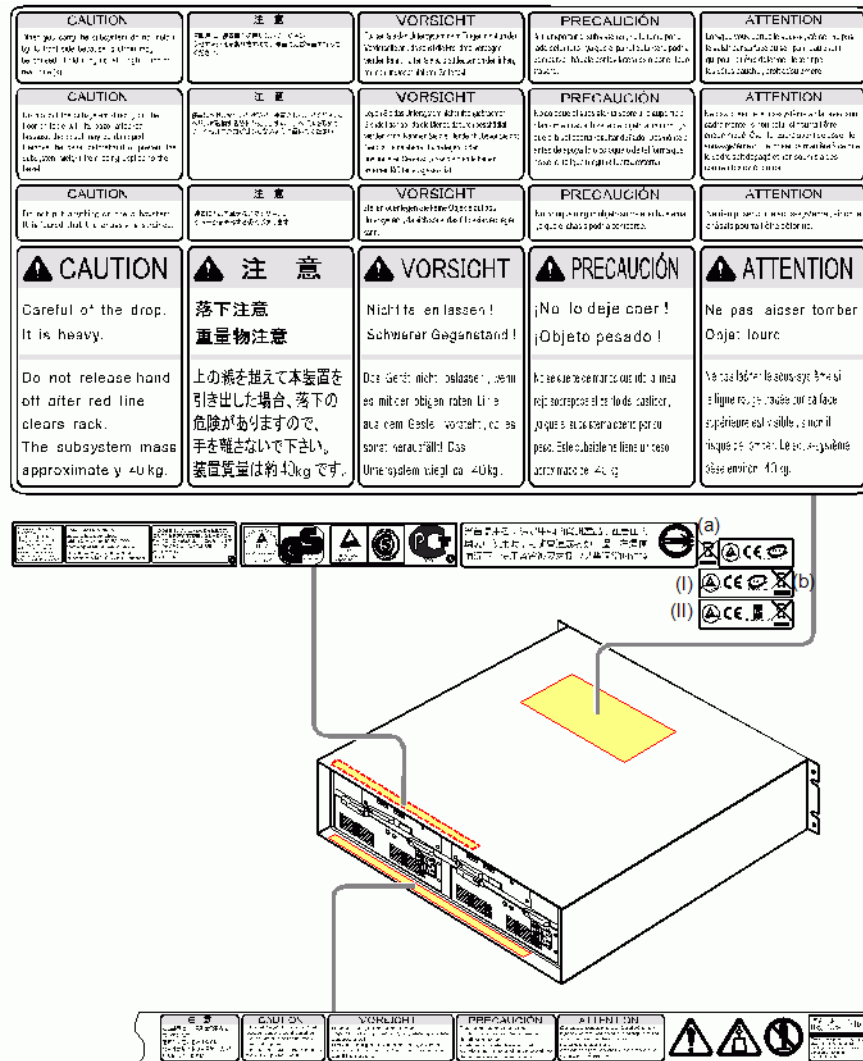


**Figure 1: Safety and Warning Labels, Base Unit**


The  label is affixed at location (a) or (b). Either (I) or (II) is affixed.

## Safety and warning labels - expansion unit

Figure 2 shows the location and content of the warning and safety labels on the expansion unit.

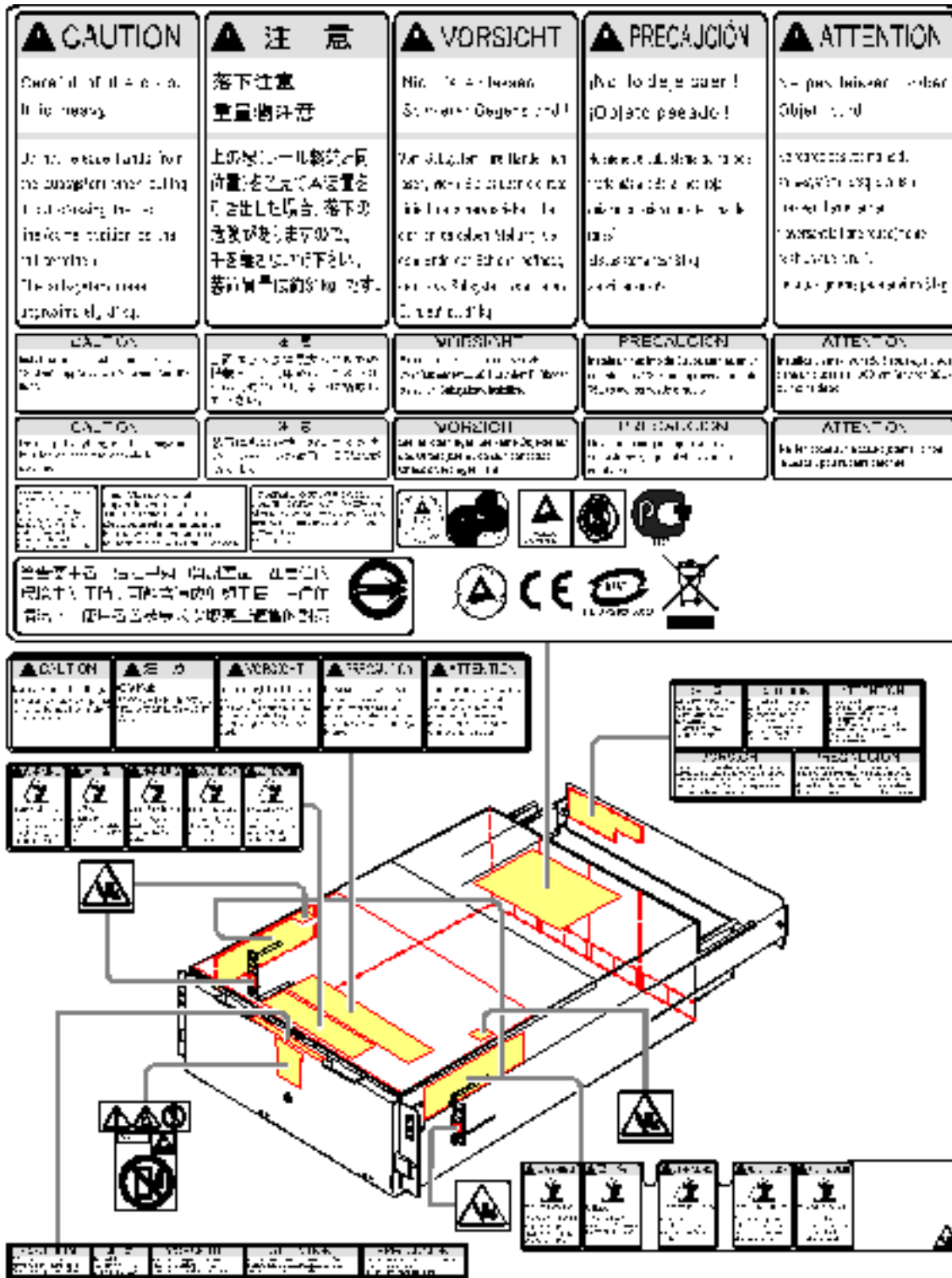


**Figure 2: Safety and Warning Labels, Expansion Unit**


The  label is affixed at location (a) or (b). Either (I) or (II) is affixed

# Warning and safety labels - high-density expansion unit

Figure 3 shows the location and content of the warning and safety labels on the high-density expansion unit.



**Figure 3: Warning and Safety Labels (High-density Expansion Unit)**

The  label is affixed at location (a) or (b).

## Safety and warning labels - modular 2U SAS expansion unit

Figure 4 shows the location and content of the warning and safety labels on the modular 2U SAS expansion unit.

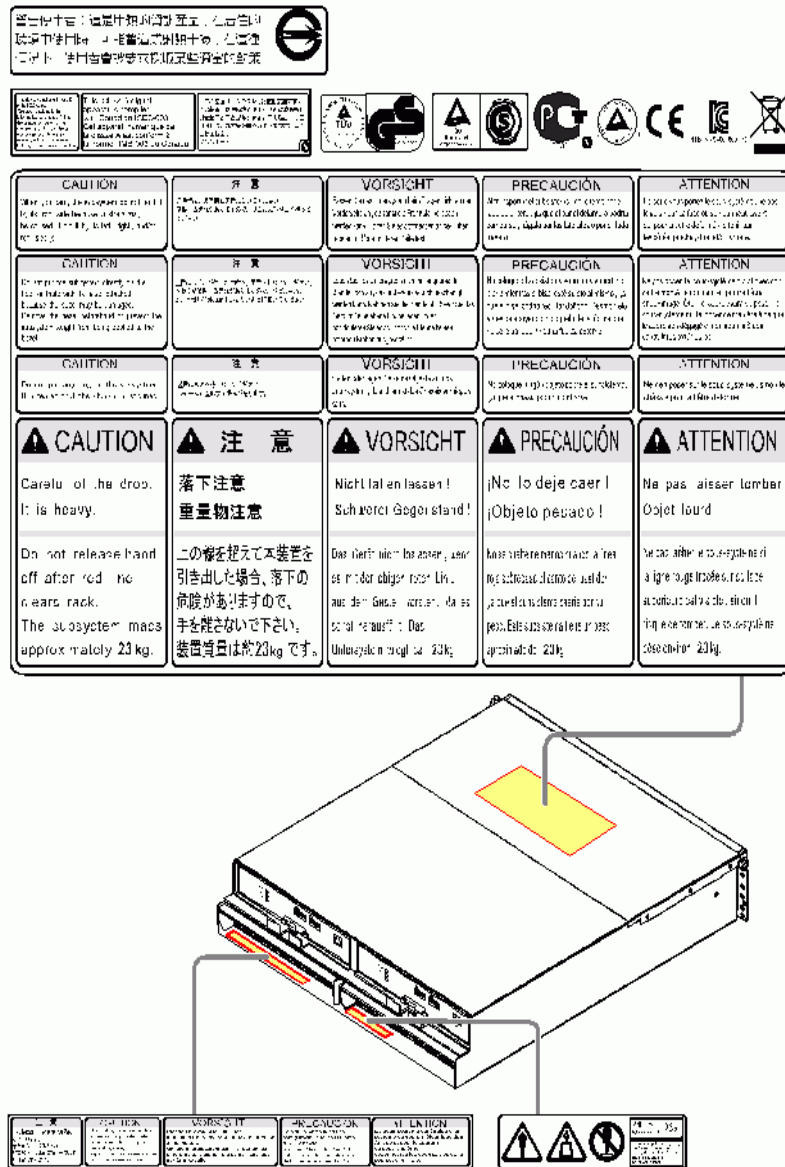


Figure 4: Warning and Safety Labels (Modular 2U SAS Expansion Unit)

# Warning and safety labels - battery expansion unit

Figure 5 shows the location and content of the warning and safety labels on the Battery Expansion Unit.

<p><b>⚠ CAUTION</b></p> <p>Careful of the drop. It is heavy.</p> <p>Do not release hand off after red line clears rack. The subsystem mass approximately 15kg.</p>	<p><b>⚠ 注意</b></p> <p>落下注意 重量物注意</p> <p>上の線を越えて本装置を引き出した場合、落下の危険がありますので、手を離さないで下さい。装置質量は約15kgです。</p>	<p><b>⚠ VORSICHT</b></p> <p>Nicht fallen lassen! Schwerer Gegenstand!</p> <p>Das Gerät nicht loslassen, wenn es mit der obigen roten Linie aus dem Gestell vorseht, da es sonst neu installiert. Das Untersystem wiegt ca. 15kg.</p>	<p><b>⚠ PRECAUCIÓN</b></p> <p>¡No lo deje caer! ¡Objeto pesado!</p> <p>No se suelte de manos cuando la línea roja sobrepase el borde del chasis, ya que el sub-sistema caería por su peso. Este sub-sistema tiene un peso aproximado de 15 kg.</p>	<p><b>⚠ ATTENTION</b></p> <p>Ne pas laisser tomber. Objet lourd.</p> <p>Ne pas lâcher le sous-système si la ligne rouge traverse sur la face supérieure est visible, sinon il risque de tomber. Le sous-système pèse environ 15 kg.</p>
<p><b>CAUTION</b></p> <p>When you raise the subsystem, do not hold it by its front side because a strain may be caused. Hold it by its left, right, and rear side.</p>	<p><b>注意</b></p> <p>本装置を吊り上げる際は、前面を握らずに、左側、右側、背面を握ります。</p>	<p><b>VORSICHT</b></p> <p>Bei der Erhebung des Systems nicht an der Frontseite greifen, da dies zu einer Verletzung durch die Belastung des Arms führen könnte. Greifen Sie stattdessen an der linken, rechten oder hinteren Seite an.</p>	<p><b>PRECAUCIÓN</b></p> <p>Al elevar el sub-sistema, no lo tome por el lado delantero, ya que el peso del brazo puede sufrir un trauma. Tómalo por los lados izquierdo, derecho o posterior.</p>	<p><b>ATTENTION</b></p> <p>Lorsque vous portez le sous-système, ne pas le saisir par sa face avant, car le poids de votre bras peut être affecté. Prenez le sous-système par les côtés gauche, droit et arrière.</p>
<p><b>CAUTION</b></p> <p>Do not put the subsystem directly on the floor table with its base on floor because the floor may be damaged. Remove the base balancers or prevent the subsystem weight from being applied to the floor.</p>	<p><b>注意</b></p> <p>本装置を床面に直接置くことは、床面に損傷を及ぼす可能性があります。床面保護板を取り除くか、装置の重量が床面に直接かからないようにしてください。</p>	<p><b>VORSICHT</b></p> <p>Legen Sie das Untersystem nicht direkt auf den Boden, da dies zu Schäden an der Bodenplatte führen könnte. Entfernen Sie die Bodenbalancer oder verhindern Sie, dass das Untersystem direkt auf den Boden aufgesetzt wird.</p>	<p><b>PRECAUCIÓN</b></p> <p>No coloque el sub-sistema sobre el suelo directamente, ya que esto podría dañar el piso. Quite los balancines de la base o evite que el peso del sub-sistema se aplique directamente al suelo.</p>	<p><b>ATTENTION</b></p> <p>Ne pas poser le sous-système directement sur le sol, car cela pourrait endommager le revêtement de sol. Retirez les patins de la base ou évitez que le poids du sous-système ne soit appliqué directement sur le sol.</p>
<p><b>CAUTION</b></p> <p>Do not put anything on the subsystem, it is feared that the chassis is strained.</p>	<p><b>注意</b></p> <p>本装置の上に物を置かないでください。シャーシが変形する可能性があります。</p>	<p><b>VORSICHT</b></p> <p>Stellen oder legen Sie keine Dinge auf das Untersystem, da andernfalls das Chassis verformt sein könnte.</p>	<p><b>PRECAUCIÓN</b></p> <p>No coloque ningún objeto sobre el sub-sistema, ya que el chasis podría deformarse.</p>	<p><b>ATTENTION</b></p> <p>Ne rien poser sur le sous-système, sinon le châssis pourrait être déformé.</p>

<p><b>⚠ CAUTION</b></p> <p>Do not release hand off after red line clears rack. The subsystem mass approximately 15kg.</p>	<p><b>⚠ 注意</b></p> <p>上の線を超えて本装置を引き出した場合、落下の危険がありますので、手を離さないで下さい。装置質量は約15kgです。</p>
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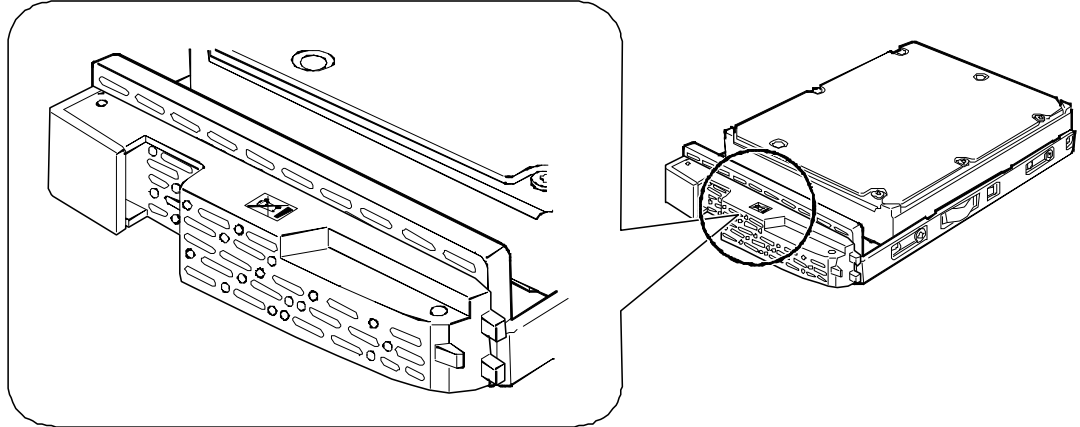
  

<p><b>NI-MH</b></p> <p>この製品はリチウムイオン二次電池（リチウムイオン電池）を使用しています。リチウムイオン電池は、過充電、過放電、短絡、火災、発熱、破裂、漏液などの危険を伴います。取り扱いには十分注意してください。</p> <p>Battery warning: Do not use this product with a lithium-ion battery, because of the risk of fire, explosion or leakage. A battery should not be recharged, overcharged, over-discharged, short-circuited, or subjected to mechanical stress. Please do not keep together as the property of the kind of battery. When using the battery, use warning flag as handle as follows. Only the low of battery warning, all other please read carefully.</p>	<p><b>⚠</b></p>
<p><b>⚠</b></p>	<p><b>⚠</b></p>

Figure 5: Warning and Safety Labels (Battery Expansion Unit)

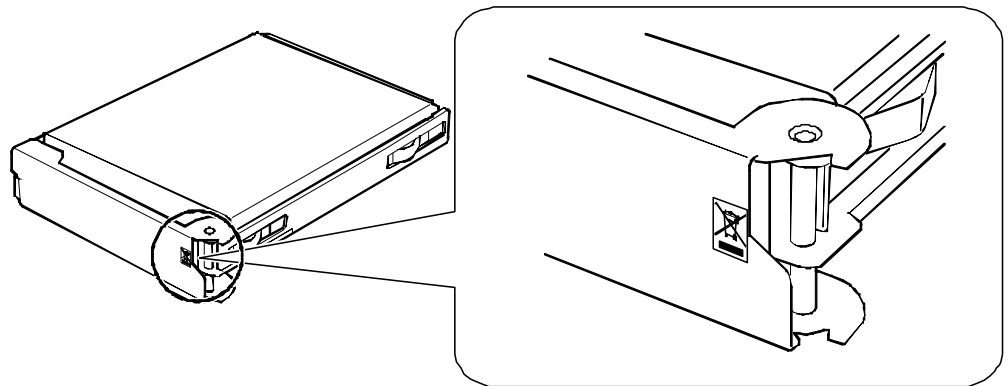
## Disk drives

Figure 6 shows the location of the label on the Base Expansion Unit disk drive.



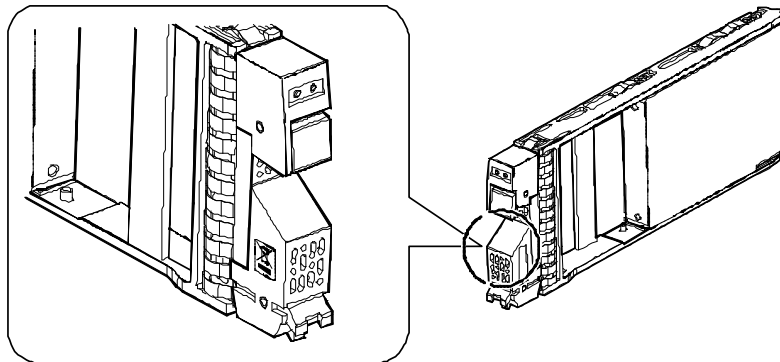
**Figure 6: Base Expansion Unit Disk Drive**

Figure 7 shows the location of the label on the High-density Expansion Unit disk drive.



**Figure 7: High-density Expansion Unit Disk Drive**

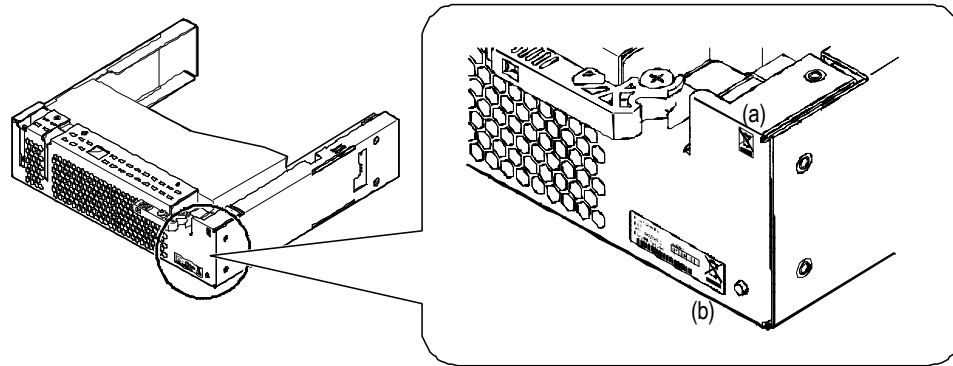
Figure 8 shows the location of the label on the Modular 2U SAS Expansion Unit disk drive.



**Figure 8: Modular 2U SAS Expansion Unit Disk Drive**

## Fan unit

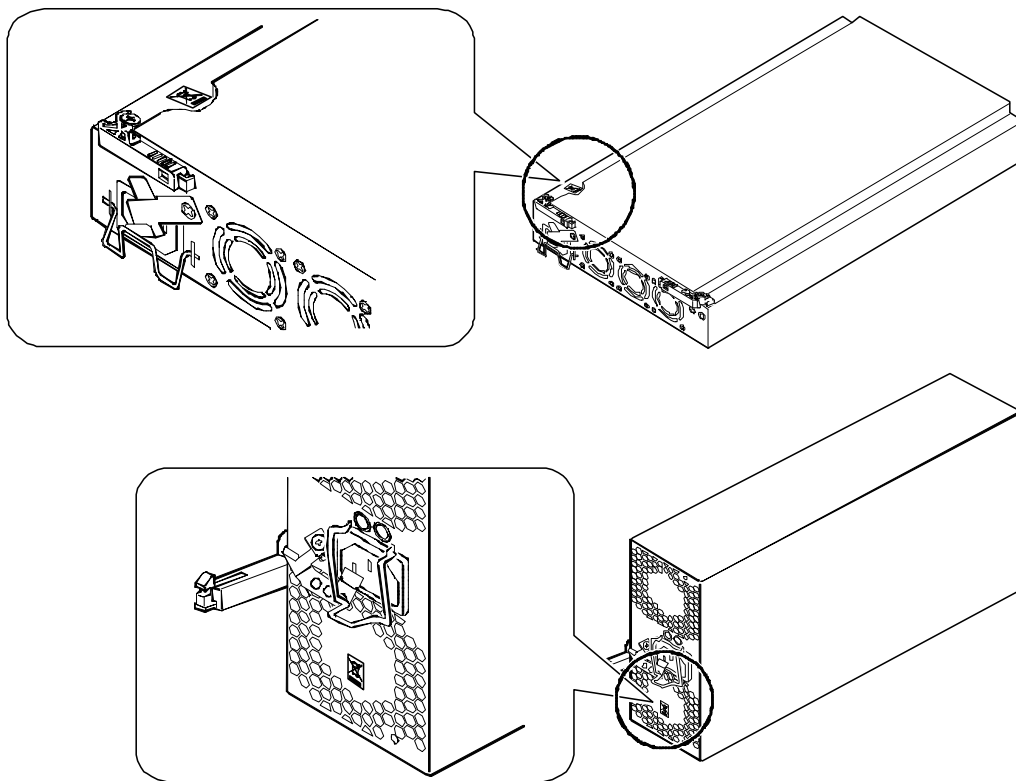
Figure 9 shows the location (a) or (b) of the labels on the Fan Unit.



**Figure 9: Fan Unit Label Locations**

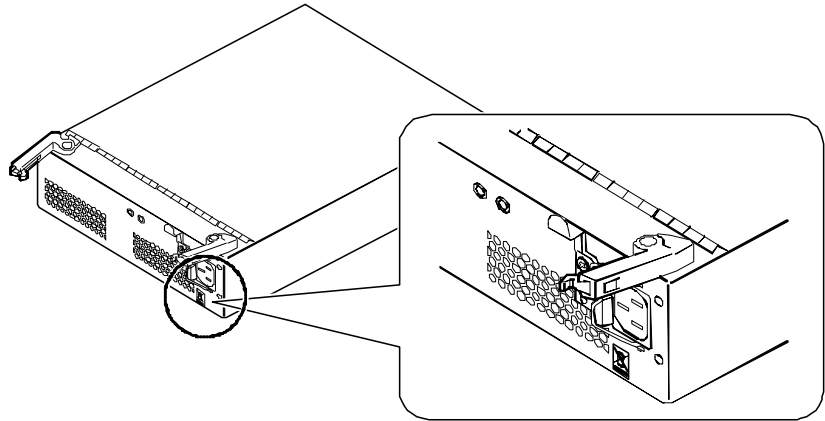
## Power supply

Figure 10 shows the location of the label on the Power Supplies for the Base Unit.



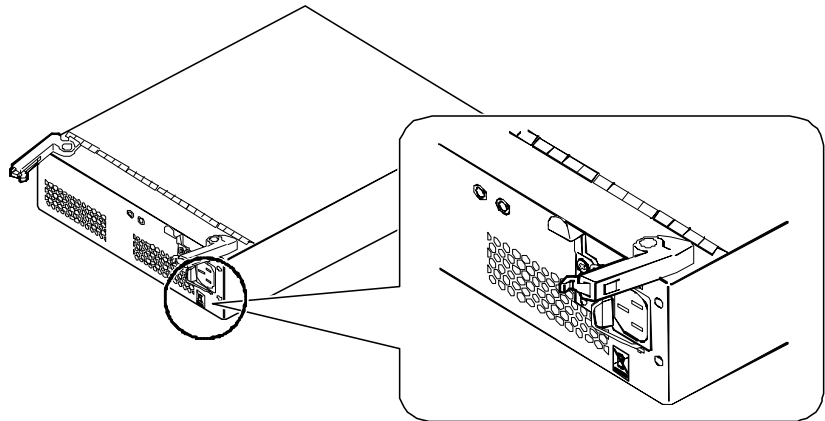
**Figure 10: Power Supply Label Location for the Base Unit**

Figure 11 shows the location of the label on the Power Supply for the Expansion Unit.



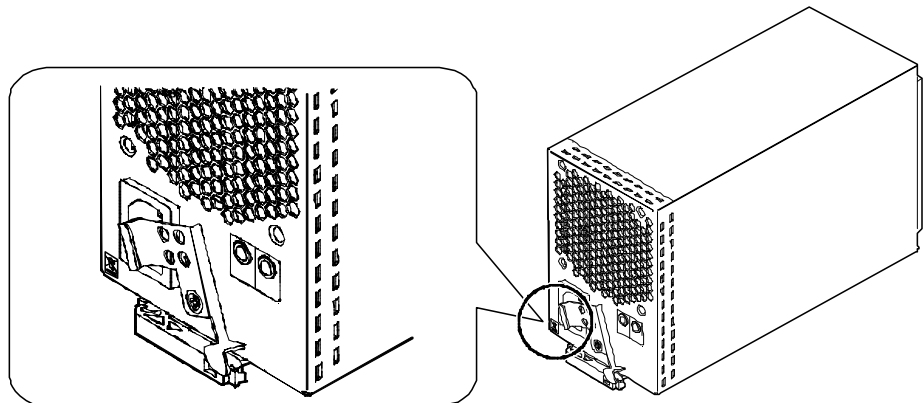
**Figure 11: Power Supply Label Location for the Expansion Unit**

Figure 12 shows the location of the label on the Power Supply for the Expansion Unit.



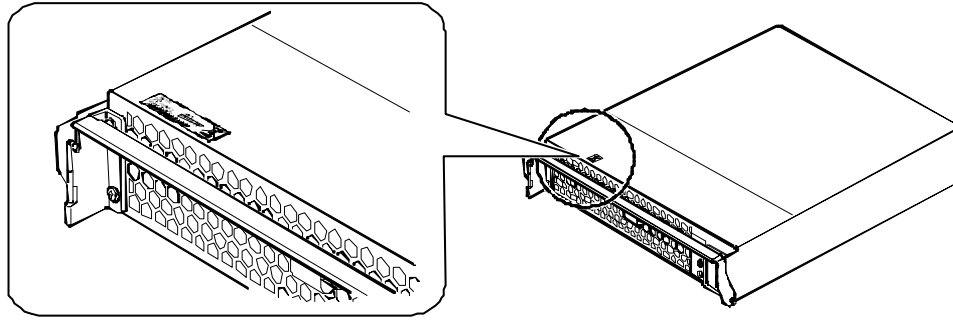
**Figure 12: Power Supply Label Location for the Expansion Unit**

Figure 13 shows the location of the label on the Power Supply for the High-density Expansion Unit.



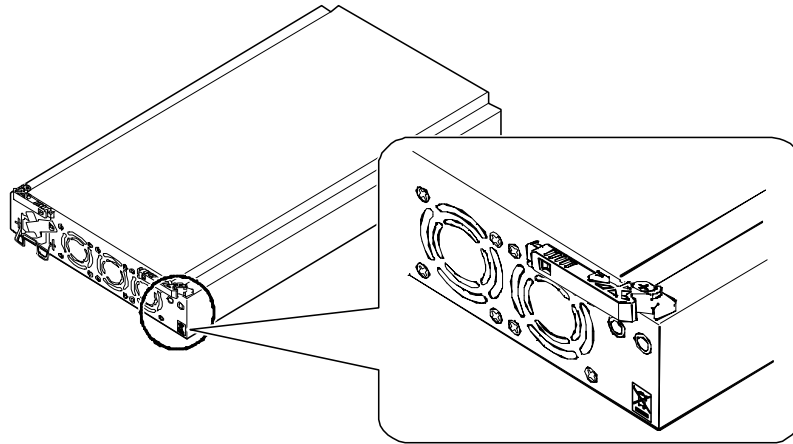
**Figure 13: Power Supply Label Location for the High-density Expansion Unit**

Figure 14 shows the location of the label on the Power Supply for the Modular 2U SAS Expansion Unit.



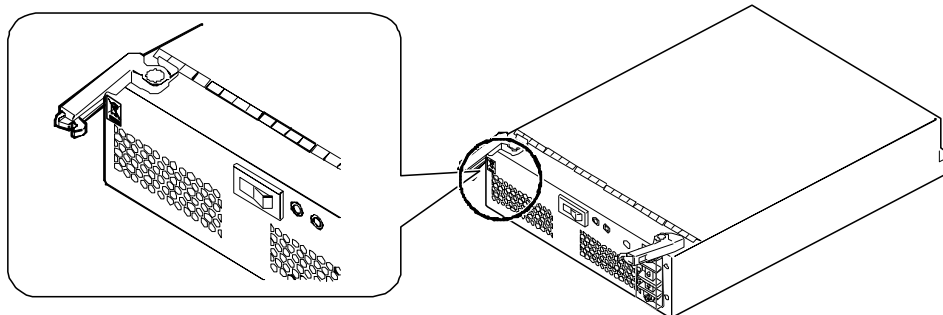
**Figure 14: Power Supply Label Location for the Modular 2U SAS Expansion Unit**

Figure 15 shows the location of the label on the DC Power Supply for the Base Unit.



**Figure 15: DC Power Supply Label Location for the Base Unit**

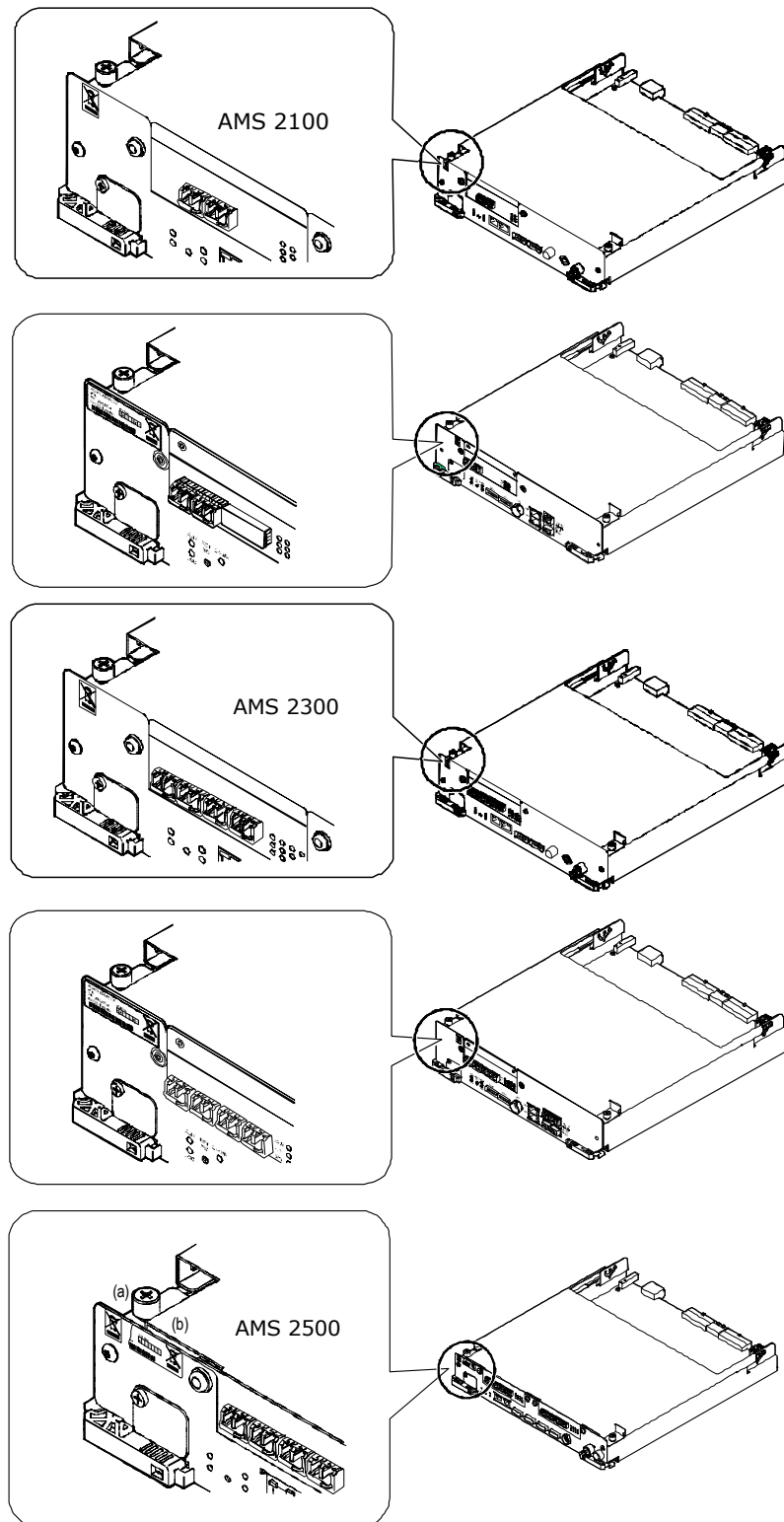
Figure 16 shows the location of the label on the DC Power Supply for the Expansion Unit.




**Figure 16: DC Power Supply Label Location for the Expansion Unit**

## Control unit

Figure 17 shows the location of the labels on the Control Unit.

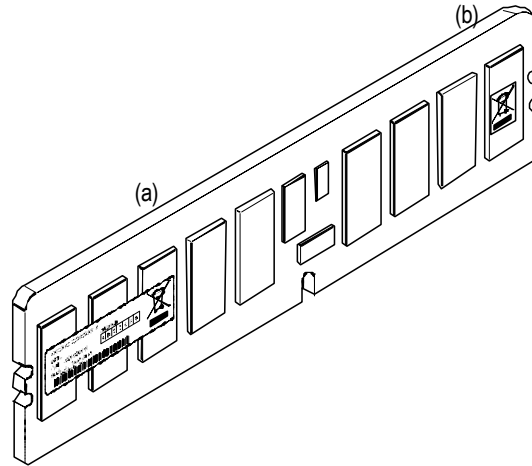


**Figure 17: Control Unit Label Location**

The  label is affixed at location (a) or (b).

## Cache memory

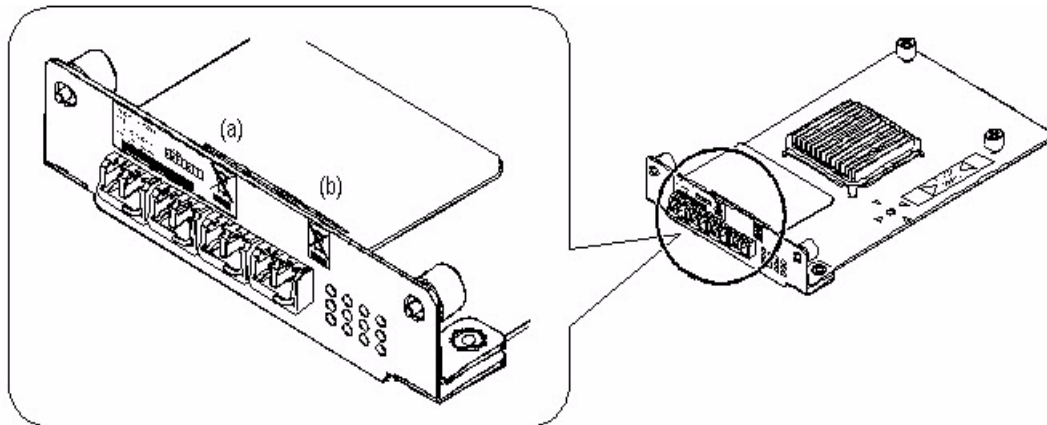
Figure 18 shows the location (a) or (b) of the labels on the Cache Memory module.



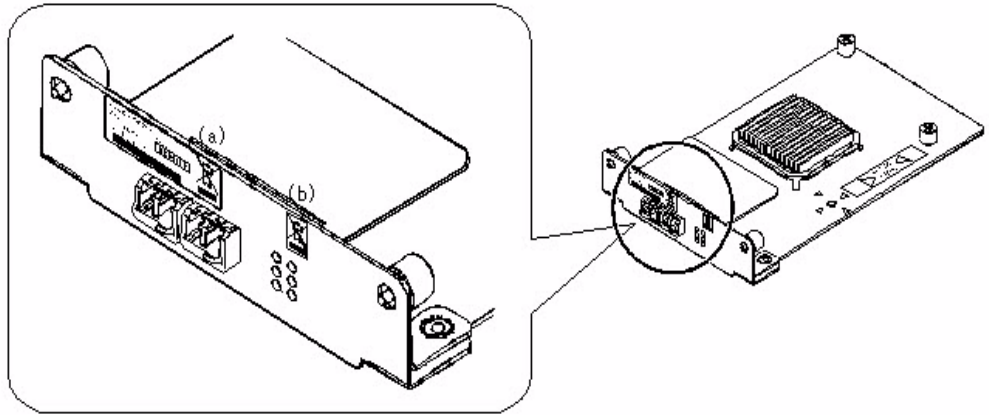
**Figure 18: Cache Memory Label Location**

## Interface board

Figure 19 and Figure 20 show the location (a) or (b) of the labels on the FC Interface Boards.

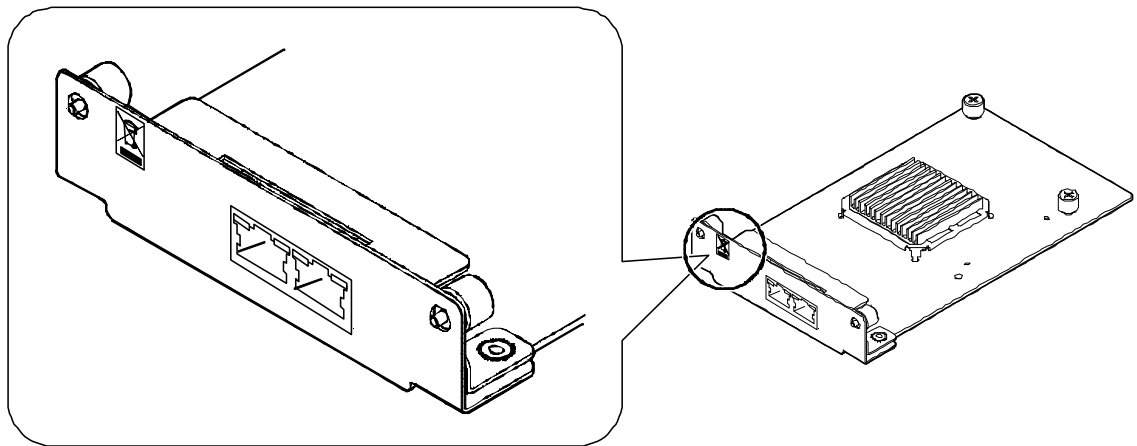


**Figure 19: Fibre Channel Interface Board (DF-F800-DKF44/ DF-F800-DKF84) Label Location**



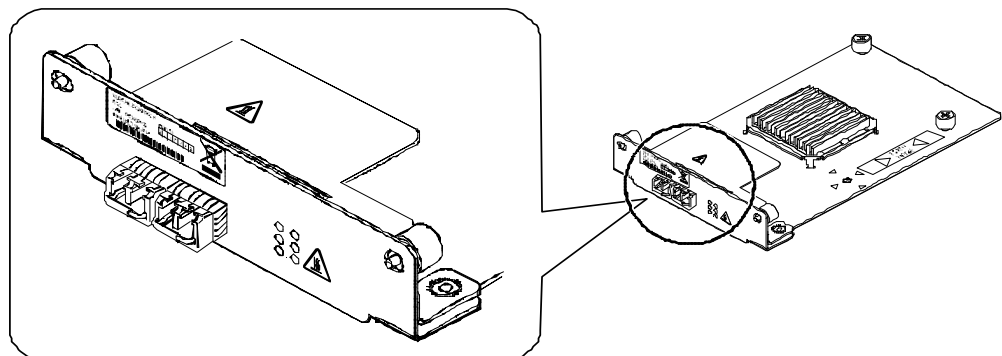
**Figure 20: Fibre Channel Interface Board (DF-F800-DKF42) Label Location**

Figure 21 shows the location of the label on the iSCSI Interface Board.



**Figure 21: iSCSI Interface Board Label Location**

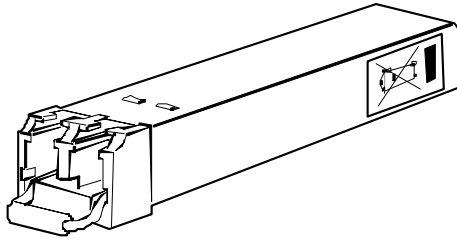
Figure 22 shows the location of the label on the 10 Gbps iSCSI Interface Board.



**Figure 22: iSCSI Interface Board Label Location**

## Host connector

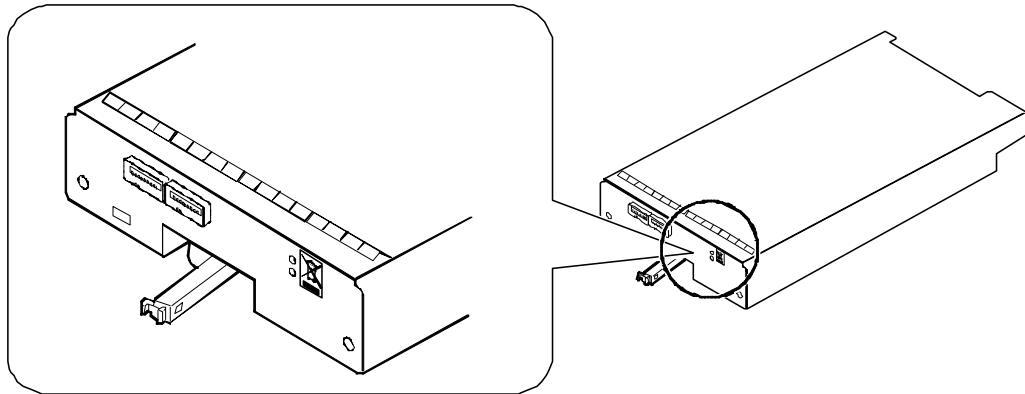
Figure 23 shows the location of the label on the Host Connector.



**Figure 23: Host Connector Label Location**

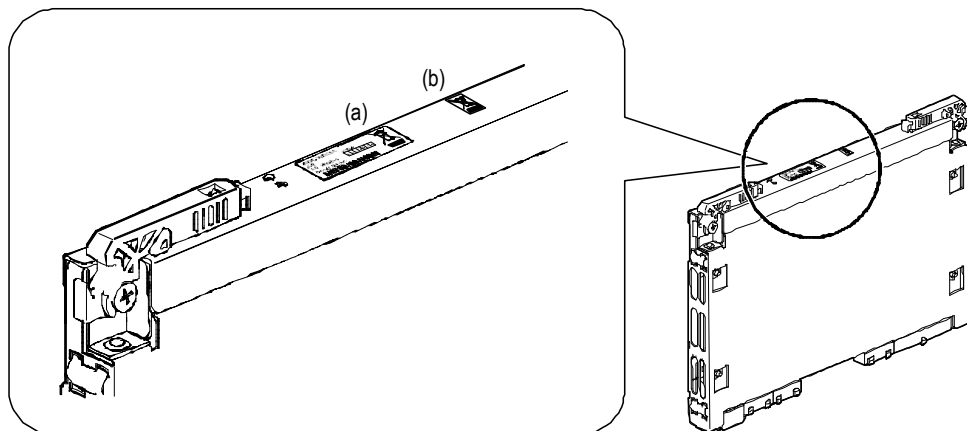
## unit

Figure 24 shows the location of the label on the ENC Unit of the Expansion Unit.



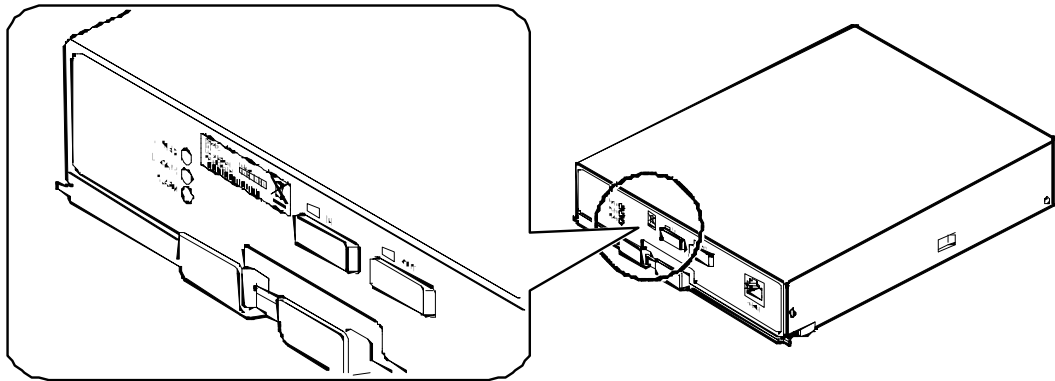
**Figure 24: Unit Label Location for the Expansion Unit**

Figure 25 shows the location of the labels (a) or (b) on the ENC Unit of the High-density Expansion Unit.



**Figure 25: Unit Label Location for the High-density Expansion Unit**

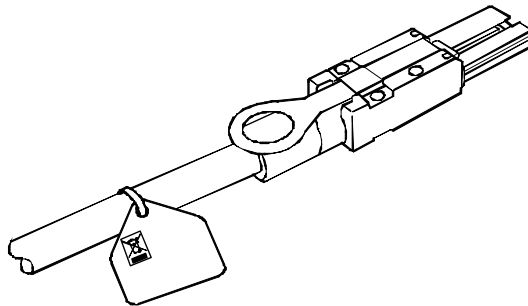
Figure 26 shows the location of the labels (a) or (b) on the ENC Unit of the Modular 2U SAS Expansion Unit.



**Figure 26: Unit Label Location for the Modular 2U SAS High-density Expansion Unit**

## **cable**

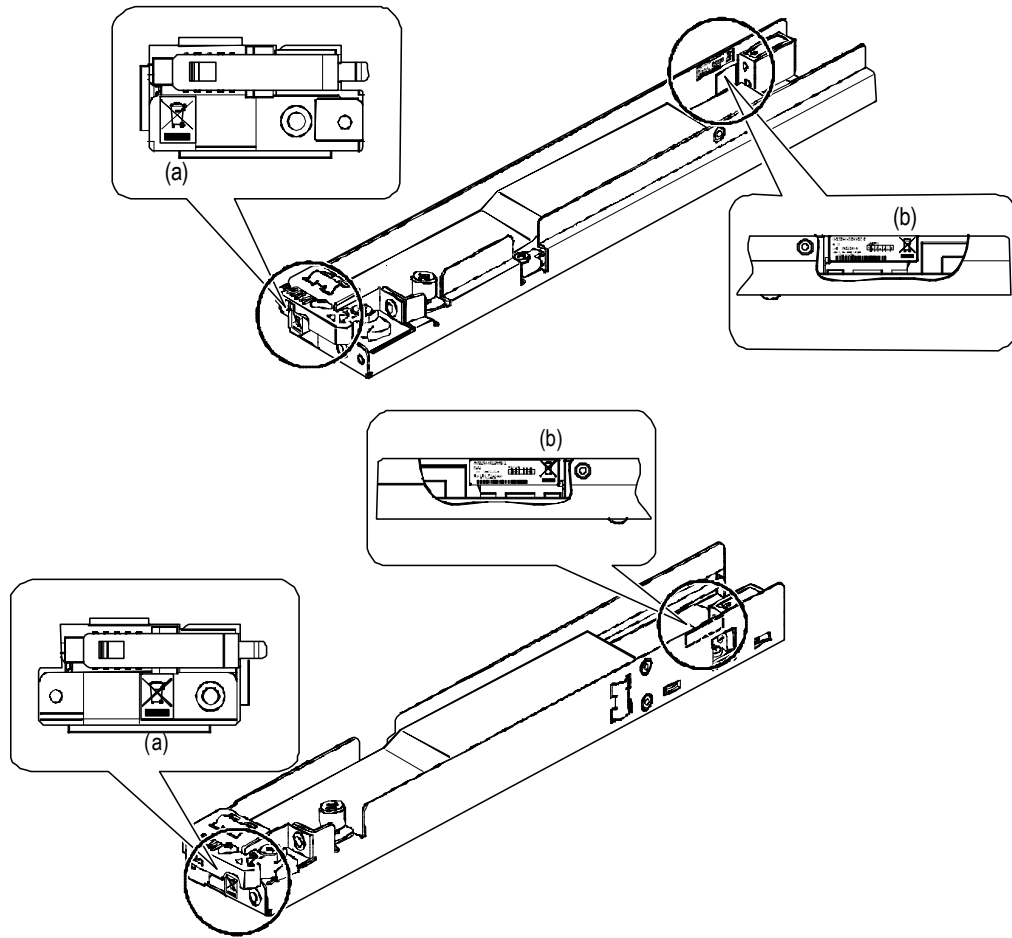
Figure 27 shows the location of the label on the ENC Cable.



**Figure 27: Cable Label Location**

## Cable holder

Figure 28 shows the locations of the labels (a) or (b) on the Cable Holders.



**Figure 28: Cable Holder Label Locations**

# Introduction

This chapter provides an overview of user maintenance and troubleshooting tasks for the Hitachi AMS 2100/2300 Storage System. This chapter covers the following key topics:

- ❑ [Overview](#)
- ❑ [User maintenance tasks](#)
- ❑ [System overview](#)
- ❑ [System components](#)
- ❑ [System controls](#)



**NOTE:** Hitachi Data Systems support policy includes customer installation and maintenance for model AMS 2100/2300 array but not for model AMS 2500 base unit, the high-density expansion unit, or the AMS 2000 Battery Expansion Unit. However, the Hitachi Data Systems Customer Assist program allows users to upgrade firmware in the AMS 2500 and add or replace disk drives in the RKAK expansion unit. See [User maintenance tasks](#) for more information.

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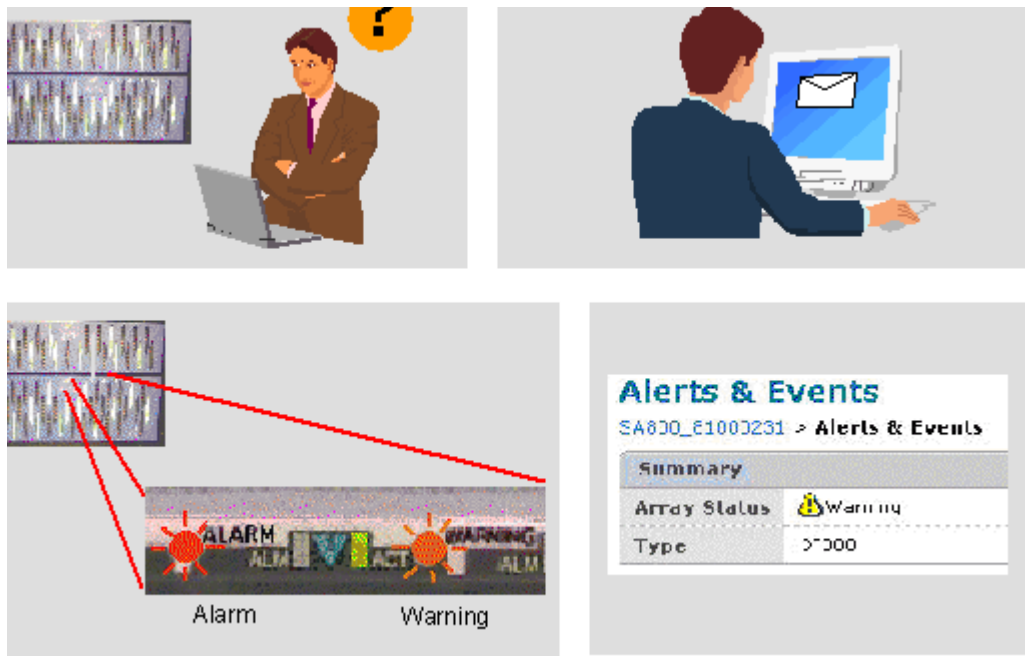
# Overview

The Hitachi Data Systems AMS 2000 storage system includes three array models:

- AMS 2100 - Smaller system provides up to 120 disk drives ranging in size from 146 GB to 2 TB. The expansion unit can use any size SAS or SATA drive. The high-density expansion unit uses either 1 or 2 TB SATA disk drives.
- AMS 2300 - Midrange system provides up to 240 disk drives, ranging in size from 146 GB to 2 TB. The expansion unit can use any size SAS or SATA drive. The high-density expansion unit uses either 1 or 2 TB SATA disk drives.
- AMS 2500 - High-end system provides up to 480 disk drives, ranging in size from 146 GB to 2 TB. The expansion unit can use any size SAS or SATA drive. The high-density expansion unit uses either 1 or 2 TB SATA disk drives.

Each array contains several LEDs that light when certain problems occur, making it easy for users to quickly find the source of these problems. The LEDs are described in this chapter. In addition, Chapter 6 (Troubleshooting) in this manual provides information to assist you to determine the causes of several possible problems, and provides solutions for each problem.

In addition, Navigator 2 generates system messages that identify parts that should be replaced and notifies users of procedures that should be performed to maintain performance. Navigator 2 can be configured to send E-mail messages to specified email addresses, notifying users of failed parts or reminding them of scheduled tasks. You can order and install the parts or perform the procedures. For more information, see [User maintenance tasks on page 1-3](#).



**Figure 1-1: Identifying a Failed Part**

## User maintenance tasks

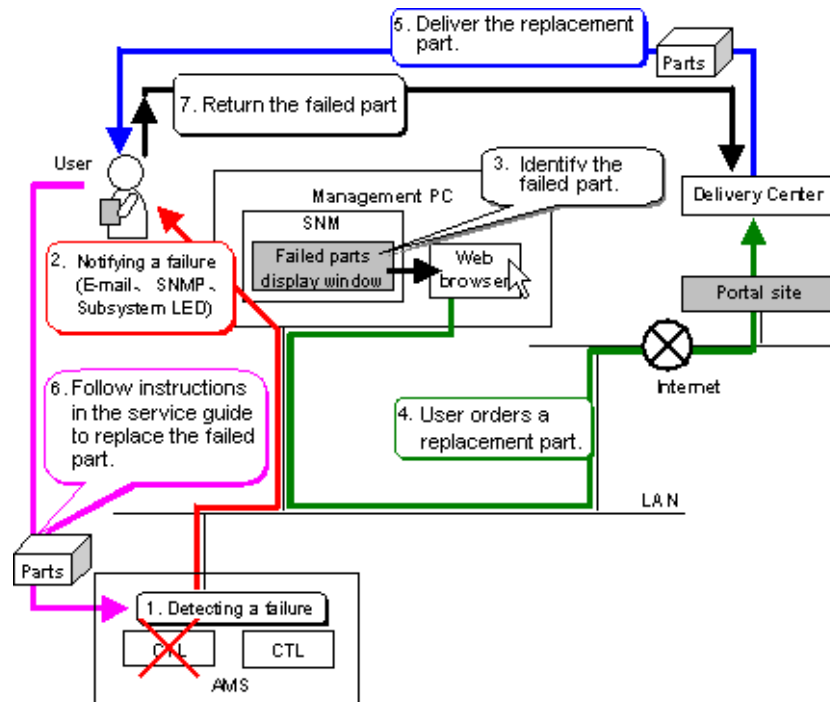
The maintenance tasks described in this manual follow the Hitachi Data Systems Customer Support program. The program provides two levels of support and defines the tasks that users can do on the various models of the AMS 2000 Family storage system.

- The Hitachi Data Systems self-service program allows users to perform all installation and configuration tasks and most maintenance tasks on the AMS 2100/2300 storage system. The self-service program does not include customer installation or maintenance for model AMS 2500, the high-density expansion unit, or the battery expansion unit.
- The Hitachi Data Systems Customer Assist program allows users to upgrade firmware in the AMS 2500 and add or replace disk drives in the RKAK expansion units in an AMS 2500 system.

## When a failure occurs

The following is an overview of the maintenance tasks you can perform when a failure occurs on your array. See [Figure 1-2](#).

1. Failure detection in the subsystem. (1)
2. Failure notification (E-mail, SNMP, Array LED). (2)
3. Determining the failed parts using the Hitachi Storage Navigator Modular 2. (3)
4. Connecting to the Web portal site from the Hitachi Storage Navigator Modular 2, and ordering the parts. See [Identifying the cause of a failure on page 2-2](#). (4)
5. Replacing the parts after the new parts arrive and checking the recovery from the failure. See [Chapter 4, Replacing parts](#). (5), (6)
6. Return the replaced parts (7).



**Figure 1-2: User Maintenance Process**

## Replaceable parts

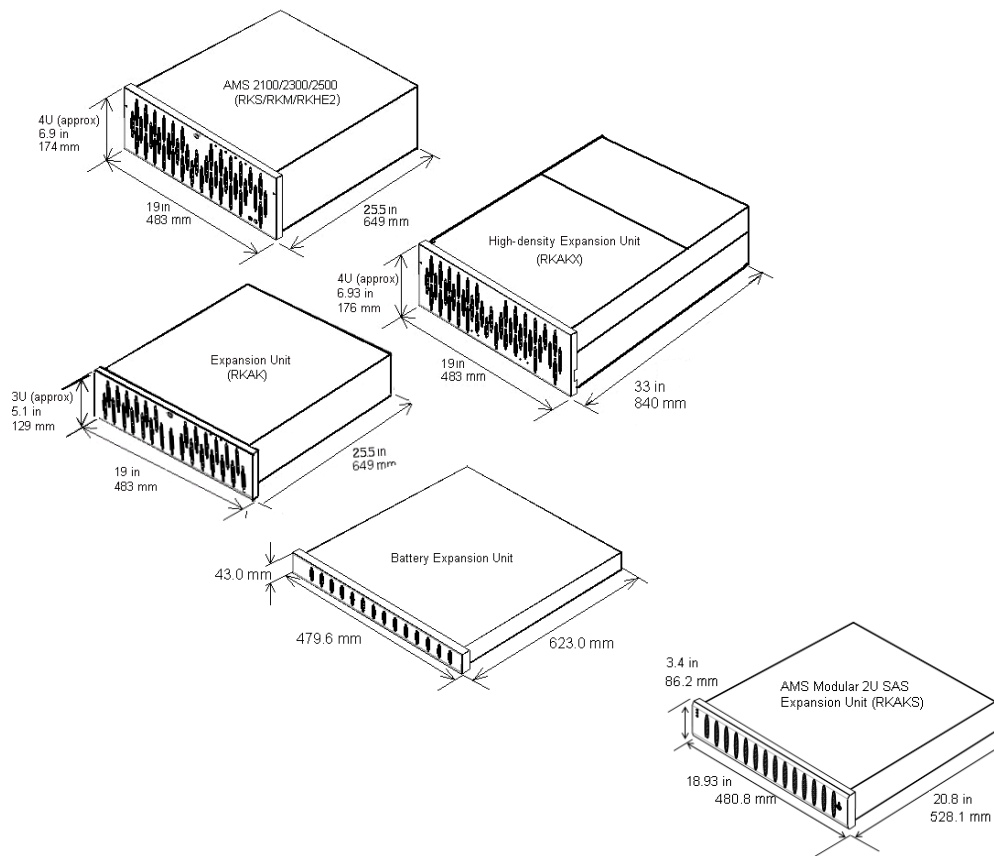
The replaceable parts for the Hitachi AMS 2100/2300 Storage System are listed and described in [Chapter 3, Replaceable parts](#).

## System overview

The AMS 2000 Family storage system includes from one to four main components, depending on the model. These components are listed in the following table and briefly described in this section.

Hitachi Data Systems Model	Hitachi Factory Designation
AMS 2100 (base unit)	DF-800-RKS (abbreviation RKS)
AMS 2300 (base unit)	DF-800-RKM (abbreviation RKM)
AMS 2500 (base unit)	DF-800-RKHE2 (abbreviation RKHE2)
Expansion Unit	DF-800-RKAK (abbreviation RKAK)
High-density Expansion Unit	DF-800-RKAKX (abbreviation RKAKX)
AMS modular 2U SAS expansion Unit	DF-800 RKAKXS (abbreviation RKAKS)
AMS2000 Battery Expansion Unit	DF-F800-N1RK (abbreviation N1RK)

**Figure 1-3** shows a basic illustration of a base unit, an expansion unit, a high-density expansion unit, an AMS modular 2U SAS expansion unit, and a battery expansion unit.



**Figure 1-3: Base Unit, Expansion Units, and Battery Expansion Unit**

## Base unit

The base unit is the primary component of an array. It is used to manage the storage in the array. [Table 1-1](#) lists the base unit models and their basic components.

**Table 1-1: Base Units**

Hitachi Data Systems Model	Hitachi Factory Designation	Main Components
AMS 2100	RKS	2 redundant power supplies, 2 controllers, 2 cache backup batteries, and from 4 to 15 disk drives.
AMS 2300	RKM	2 redundant power supplies, 2 controllers, 2 cache backup batteries, and from 4 to 15 disk drives.
AMS 2500	RKHE2	2 redundant power supplies, 2 controllers, 4 cache backup batteries, and 2 fan units. Does not contain disk drives. Can include 1 or 2 battery expansion units

## Expansion unit

An expansion unit provides additional storage space and can connect the base unit to additional expansion units or high-density expansion units. The same expansion unit is used with all base unit models. The factory designation for the standard expansion unit is RKAK.

An expansion unit contains two redundant power supplies, two ENC interface units, and from two to 15 disk drives.

The minimum and maximum number of expansion units and disk drives for each base unit are shown in [Table 1-2](#).

**Table 1-2: Expansion Unit (RKAK) Configurations**

Base Unit			Expansion Unit			
Model	Disk Drives		Units		Disk Drives	
	Min	Max	Min	Max	Min	Max
AMS 2100	4	15	0	7	2 per unit	15
AMS 2300	4	15	0	15	2 per unit	15
AMS 2500	0	0	1	32	1st unit: 4 All other units: 2	15

## High-density expansion units

A high-density expansion unit provides additional storage space and can connect the base unit to additional expansion units or high-density expansion units. The same high-density expansion unit is used with all three base unit models. The factory designation for the high-density expansion unit is RKAKX.

A high-density expansion unit that contains two storage sections. Each section contains two redundant power supplies, two redundant ENC control units, and from 0 to 24 disk drives. The maximum number of drives that can be installed in a high-density expansion unit is 48. These must all be SATA drives.

The minimum and maximum number of expansion units for each base unit are shown in [Table 1-3](#).

**Table 1-3: High-density Expansion Unit (RKAKX) Configurations**

Base Unit			Expansion Unit			
Model	Disk Drives		Units		Disk Drives	
	Min	Max	Min	Max	Min	Max
AMS 2100	4	15	0	1	2 in each section of the unit <sup>1</sup>	48 per unit
AMS 2300	4	15	0	4		
AMS 2500	0	0	1	10		

1. Minimum supported HDS configuration is two disk drives installed in slots 0 and 1 in Unit A, and two drives installed in slots 0 and 1 in Unit B.

## Modular 2U SAS expansion unit

Hitachi AMS 2100 and AMS 2300 storage systems support connection to a 2U SAS expansion unit. This unit contains two redundant power supplies, two ENC interface units, and from two to 24 small form factor (SFF) disk drives. It can connect to additional expansion units or high-density expansion units. The same expansion unit is used with both base unit models. The factory designation for the modular 2U SAS expansion unit is RKAKS.

## Battery expansion units

The AMS 2500 supports one or two battery expansion units. Each battery expansion unit contains its own charger which is powered by 100/200 VAC. A single battery can be connected to both control units. If two batteries are installed, each battery is connected separately to a different controller. See [Battery expansion unit LEDs and controls on page 1-40](#) for detailed information about this unit.

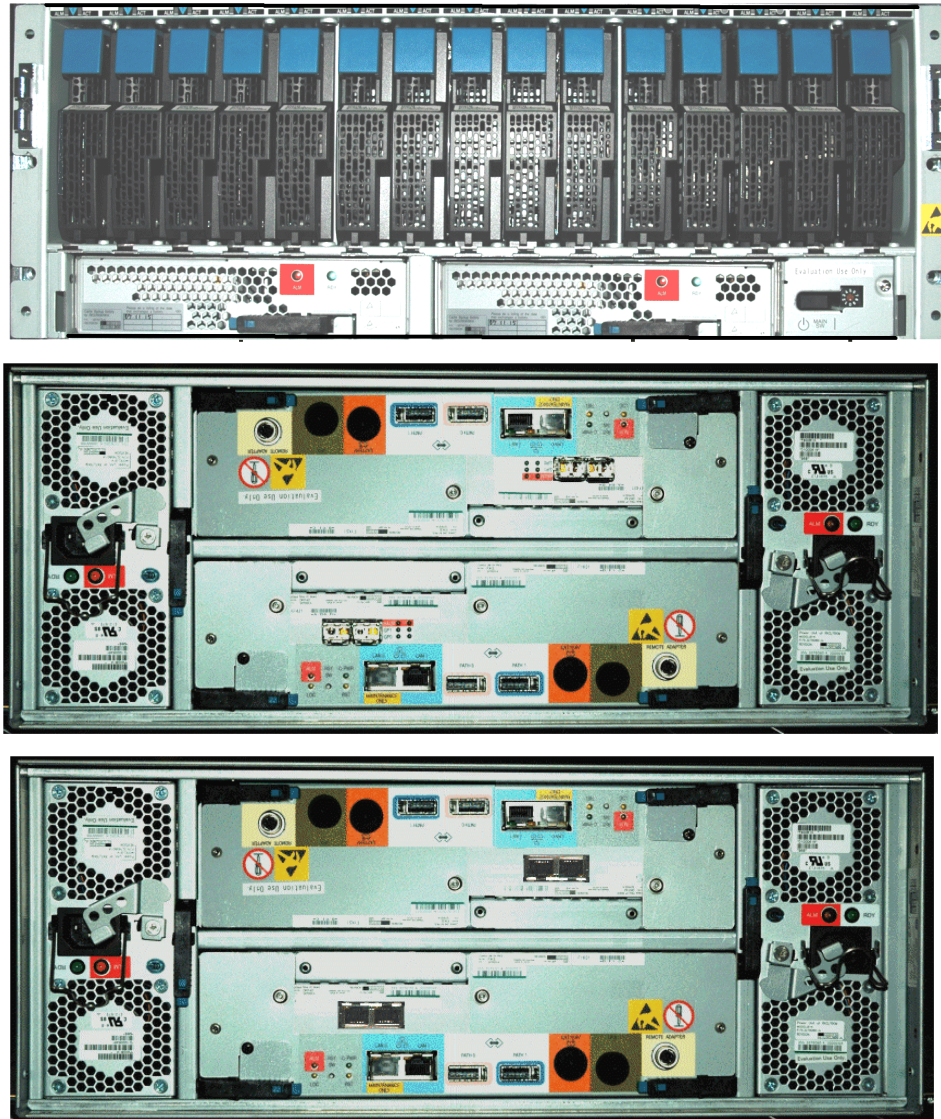
## System components

The front bezels on all three base unit models in the AMS 2000 Family (AMS 2100, AMS 2300, and AMS 2500) base units are identical. Light-Emitting Diode (LED) indicators show the unit's power, ready, warning, and alarm status. Detailed information about the status LEDs is located in [Base unit on page 1-21](#).

## AMS 2100 base unit

The Hitachi AMS 2100 Adaptable Modular Storage disk array (model RKS) (hereafter referred to as AMS 2100) includes a base unit and from 0 to 7 expansion units.

Figure 1-4 shows the front (above) and rear (below) views of the AMS 2100 base unit. The center photo shows the Fibre Channel configuration. The lower photo shows the iSCSI configuration. The front bezel has been removed in this photo.

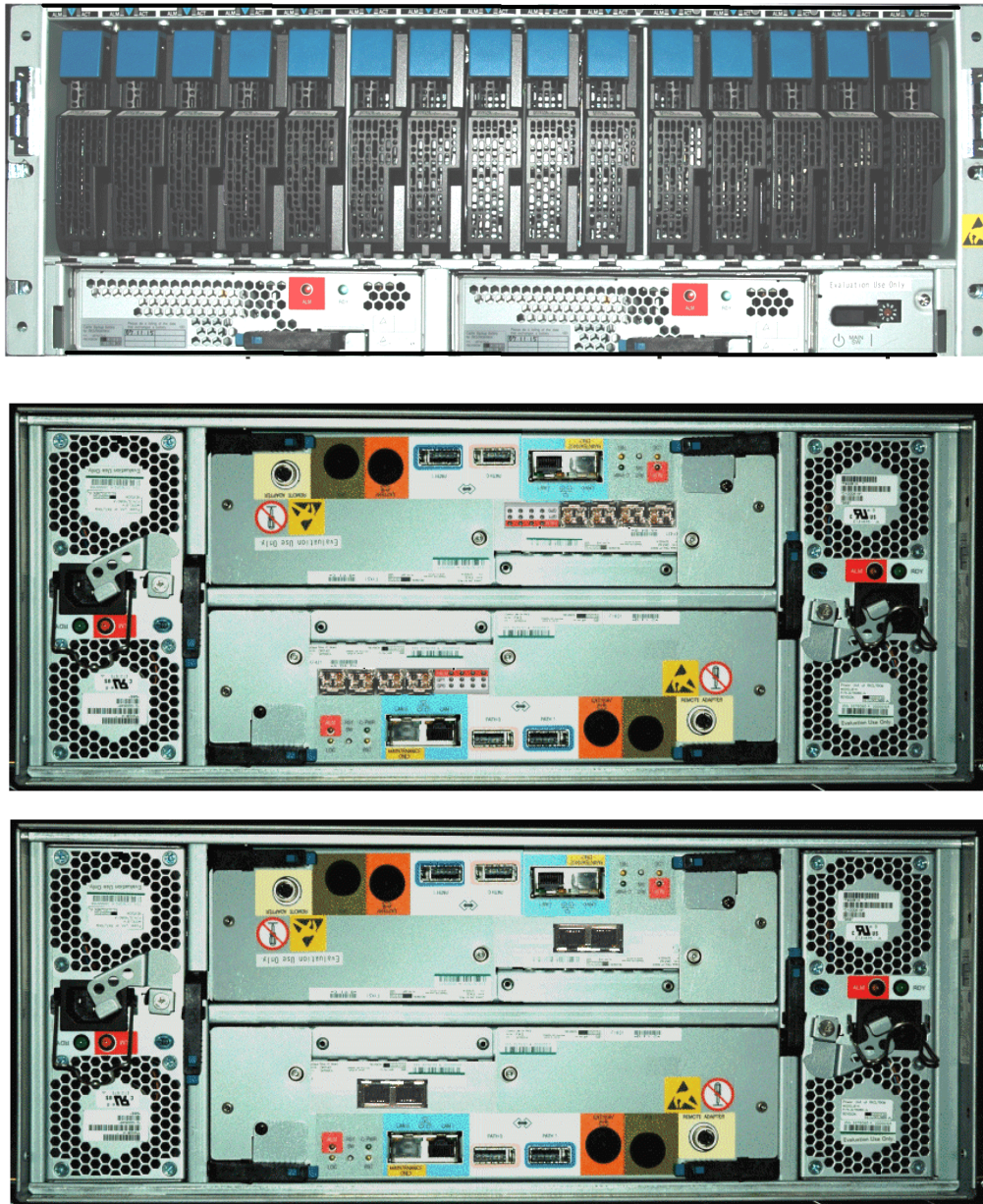


**Figure 1-4: AMS 2100 Base Unit Front and Rear Views**

## AMS 2300 base unit

The Hitachi AMS 2300 Adaptable Modular Storage disk array (model RKM) (hereafter referred to as AMS 2300) includes a base unit and from 0 to 15 expansion units.

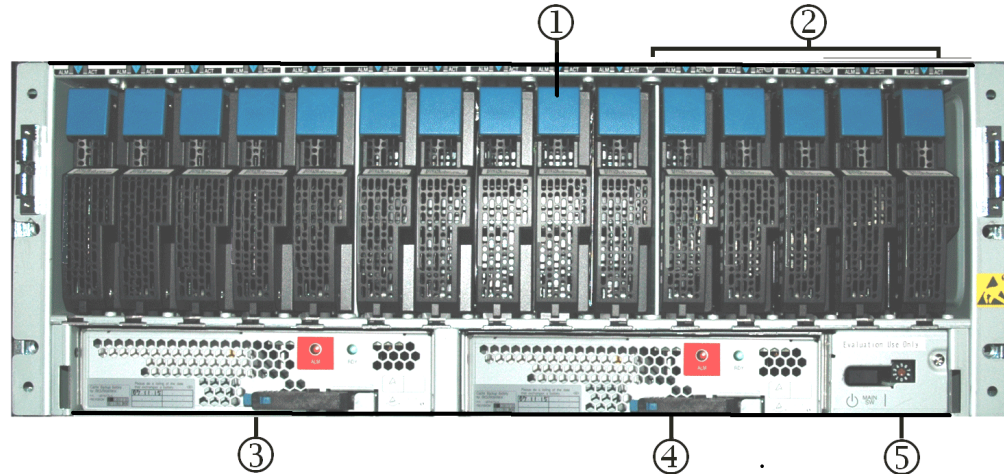
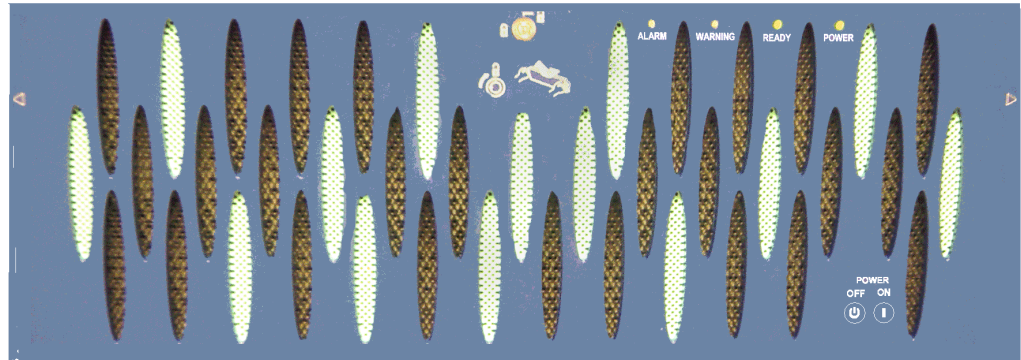
Figure 1-5 shows the front (above) and rear (below) views of the AMS 2300 base unit. The center photo shows the Fibre Channel configuration. The lower photo shows the iSCSI configuration. The front bezel has been removed in this photo.



**Figure 1-5: AMS 2300 Base Unit Front and Rear Views**

## AMS 2100/2300 base unit front panel

This section describes each of the components on the front of the base unit. [Figure 1-6](#) shows the front of a base unit with the decorative bezel installed (upper photo) and removed in the lower photo, with the components on the front of the unit exposed. Both the AMS 2100 and the AMS 2300 unit models are the same on the front.



**Figure 1-6: AMS 2100 Base Unit Front View**

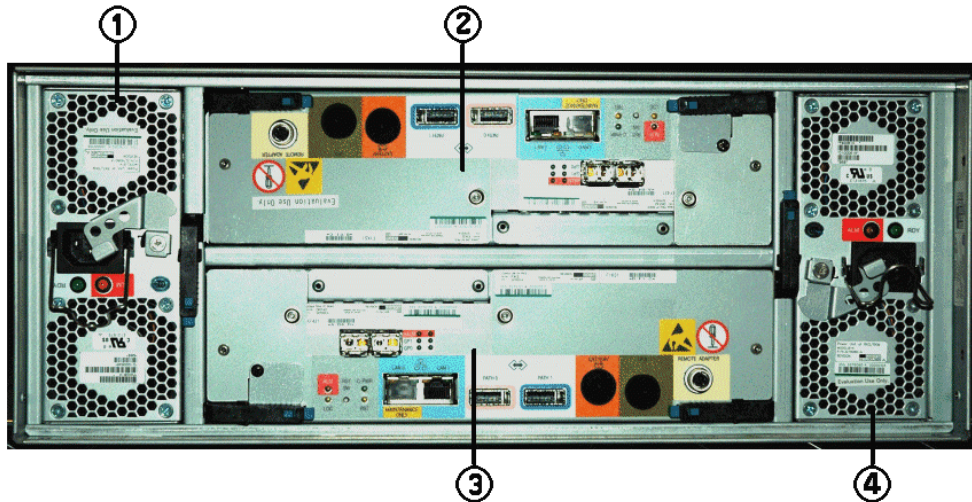
**Table 1-4: AMS 2100/2300 Base Unit Front View**

Item	Description	Item	Description
①	Disk Drives	④	2nd (optional) Cache Backup Battery
②	Base Unit Status LEDs. See <a href="#">Base unit on page 1-21</a> for details.	⑤	Switch Panel (Power and Mode switches). See <a href="#">AMS 2100 base unit on page 1-7</a> and <a href="#">Base unit switches on page 1-19</a> for details.
③	Cache Backup Battery. See <a href="#">Cache backup battery LEDs on page 1-23</a> for details.		

## AMS 2100/2300 base unit rear panel

This section describes the components on the rear panel of both the AMS 2100 and the AMS 2300. While most of the components on the rear panels of the AMS 2100 and AMS 2300 are the same, some components in the base units are different.

Figure 1-7 shows the key hardware components on the rear panel of an AMS 2100 base unit. Except for the number of Fibre channel host connectors on the controllers, the AMS 2100 rear panel is identical to the AMS 2300. The two base units in each model array are identical and can be installed in either slot. The base units for the AMS 2100 and the AMS 2300 are described separately in this chapter.



**Figure 1-7: AMS 2100 Base Unit Rear Panel Components**

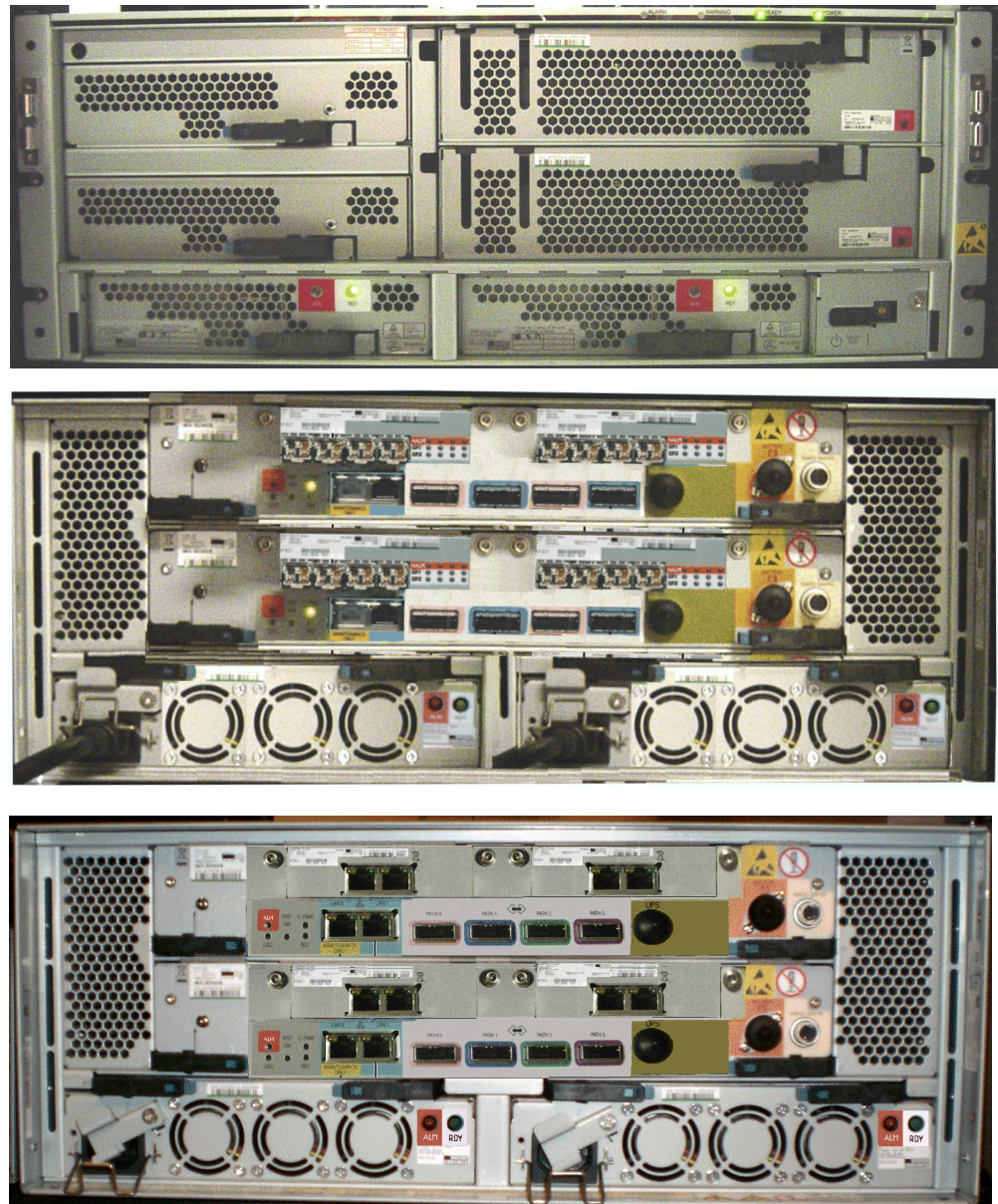
**Table 1-5: AMS 2100 Base Unit Rear Panel Components**

Item	Description	Item	Description
①	Power Supply 0 See <a href="#">Base unit power supply status LEDs on page 1-30</a> for details.	③	Controller 0
②	Controller 1 See <a href="#">Control unit LEDs, connectors, and switches - AMS 2100/2300 on page 1-24</a> for details.	④	Power Supply 1

## AMS 2500 base unit

The Hitachi AMS 2500 Adaptable Modular Storage disk array (factory designation RKHE2, and hereafter referred to as AMS 2500) includes a base unit and from 1 to 15 expansion units.

Figure 1-8 shows the front (above) and rear (below) views of the AMS 2500 base unit. The center photo shows the Fibre Channel configuration. The lower photo shows the iSCSI configuration. The front bezel has been removed in this photo.



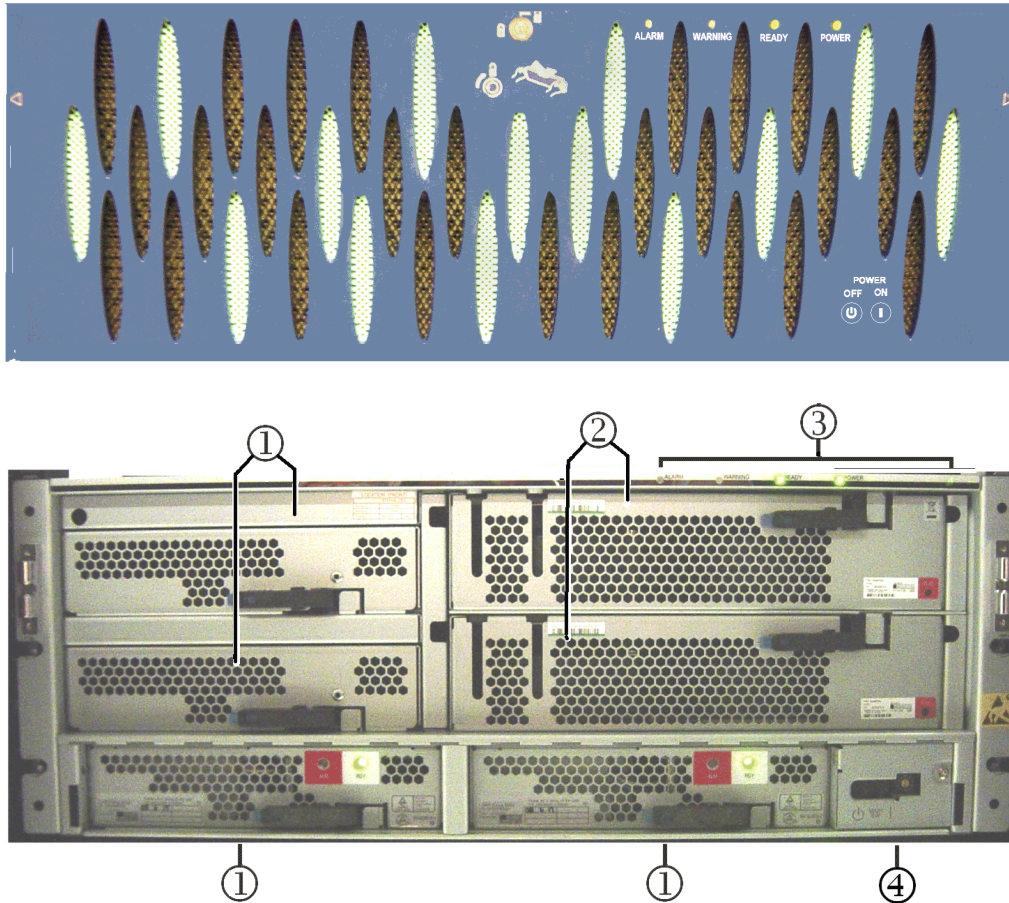
**Figure 1-8: AMS 2500 Base Unit Front and Rear Views**



**NOTE:** The AMS 2500 model is included in this manual for reference only. Hitachi Data Systems support policy does not include customer installation or maintenance for model AMS 2500, except for firmware upgrades and disk drives in the expansion units.

## AMS 2500 base unit front panel

This section describes each of the components on the front of the base unit. [Figure 1-9](#) shows the front of a base unit with the decorative bezel installed (upper photo) and removed in the lower photo, with the components on the front of the unit exposed.



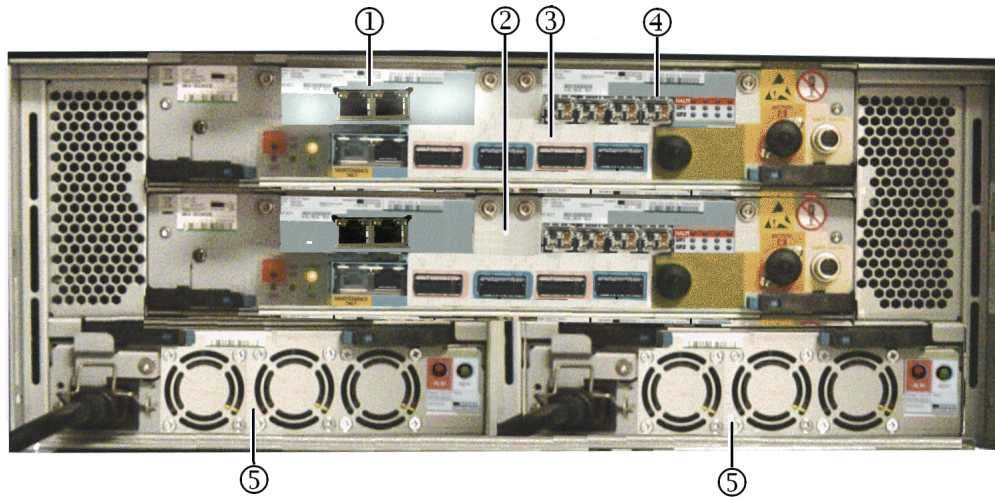
**Figure 1-9: AMS 2500 Base Unit Front View**

**Table 1-6: AMS 2500 Base Unit Front View**

Item	Description	Item	Description
①	Cache Backup Batteries. See <a href="#">Cache backup battery LEDs on page 1-23</a> for details.	③	Base Unit Status LEDs See <a href="#">Base unit on page 1-21</a> for details.
②	Fan Units	④	Switch Panel (Power and Mode switches). See <a href="#">AMS 2100 base unit on page 1-7</a> and <a href="#">Base unit switches on page 1-19</a> for details.

## AMS 2500 base unit rear panel

Figure 1-10 shows the key hardware components on the rear panel of a multi-protocol AMS 2500 base unit. The control units are configured with both iSCSI and Fibre Channel host ports.



**Figure 1-10: AMS 2500 Base Unit Rear Panel Components**

**Table 1-7: AMS 2500 Base Unit Rear Panel Components**

Item	Part Name	Description
①	iSCSI Host Ports	iSCSI RJ45 Host Connector (1 Gbps)
② ③	Control Unit	Controller for AMS 2500 Includes Fibre Channel and or iSCSI interface boards and either 2 GB or 4 GB cache memory unit (RAM) See <a href="#">AMS 2500 Control Unit Connectors and LEDs</a> on page 1-26.
④	Fibre Channel Host Ports	Host Connector (4 Gbps) See <a href="#">Fibre channel host connectors</a> on page 1-28.
⑤	Power Unit (RKHE2)	Power supply

## Expansion unit

The expansion unit (model RKAK) is used with all three base unit models. It contains from 2 to 15 SAS or SATA disk drives, two redundant power supplies and two ENC control units. The control units manage the drives and are also used to connect the expansion unit to the base unit and to other expansion units.

[Figure 1-11](#) shows the front (above) and rear (below) views of the AMS 2100/2300 expansion unit. The front bezel has been removed in this photo.



**Figure 1-11: AMS 2000 Family Expansion Unit Front and Rear Views**

## Expansion unit front panel

[Figure 1-12](#) shows the front of an expansion unit (factory designation RKAK) with the decorative bezel installed.

The front panel of the expansion unit includes Power and Locate status LEDs that show the status of the unit and identify the unit. The installation location should provide an unobstructed view of these LEDs.

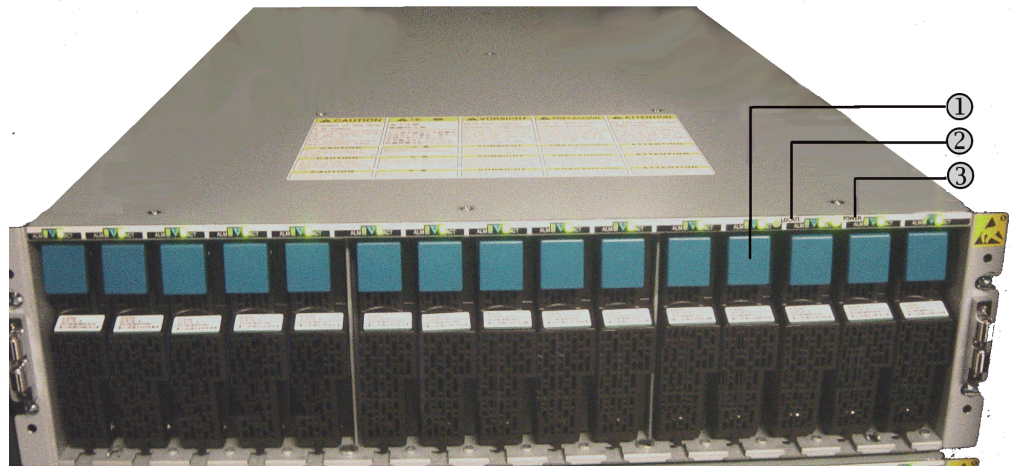
In addition, each drive slot on the expansion unit has alarm and Active LEDs that show the status of the drive that is installed in the slot that is directly below the status LEDs. As shown in [Figure 1-13 on page 1-15](#), these LEDs are visible when the front bezel is removed. A close up photo of the drive status LEDs is shown in [Figure 1-27 on page 1-31](#).

There are no switches on an expansion unit. Power is turned on and off with a control signal that is routed from the base unit via the ENC cables that are connected to the ENC unit in the expansion unit.



**Figure 1-12: Front View of an Expansion Unit**

Figure 1-13 shows the front of an expansion unit (factory designation **RKAK**) with the decorative bezel removed and the disk drives in the front of the array exposed.



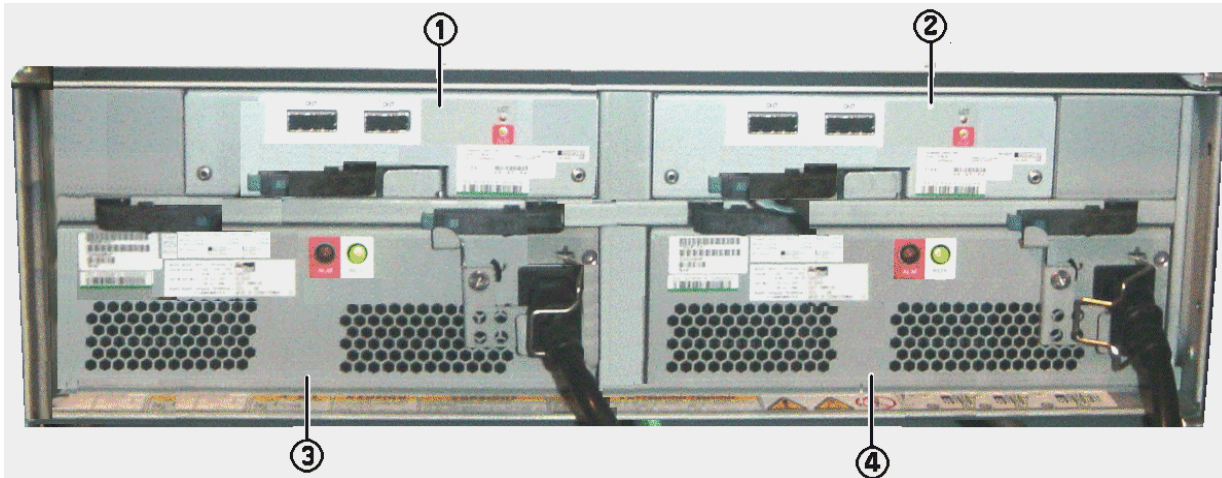
**Figure 1-13: Expansion Unit Front View, Bezel Removed**

**Table 1-8: Expansion Unit Front View, Bezel Removed**

Item	Description	Item	Description	Item	Description
①	Disk Drives, showing the status LEDs	②	Locate LED	③	Power LED

## Expansion unit rear panel

This section describes the components on the rear Panel of the expansion unit. Figure 1-14 shows the key hardware components on the rear panel of an AMS 2100/2300 expansion unit.

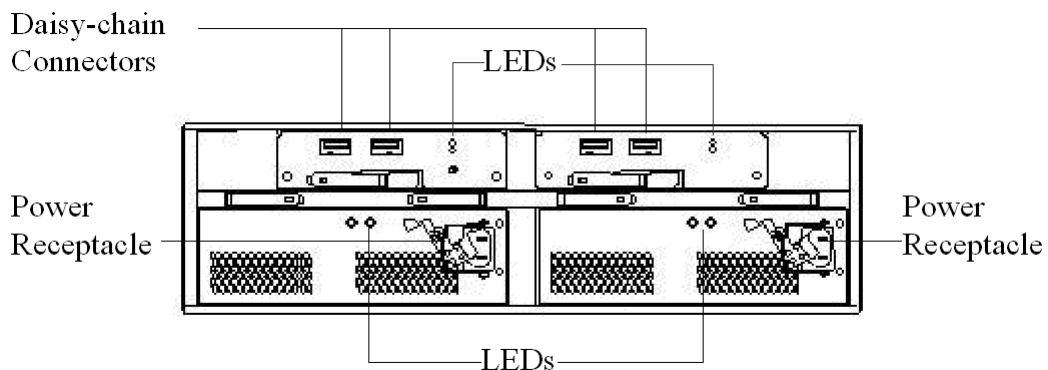


**Figure 1-14: Expansion Unit Rear Panel Components**

**Table 1-9: Expansion Unit Rear Panel Components**

Item	Description	Item	Description
①	Cable	④	Power Supply 0
②	Unit 0	⑤	Power Supply 1
③	Unit 1		

The rear of the expansion unit provides the connectors used to daisy chain expansion units in the system. See Chapter 5, Installation, in the *Hitachi AMS 2100/2300 Hardware guide*, MK-97DF8010 for details. It also provides LEDs that show the status of the expansion unit and the power supplies that provide power to the expansion unit. Expanded views of the expansion unit and detailed descriptions are located on the following pages.

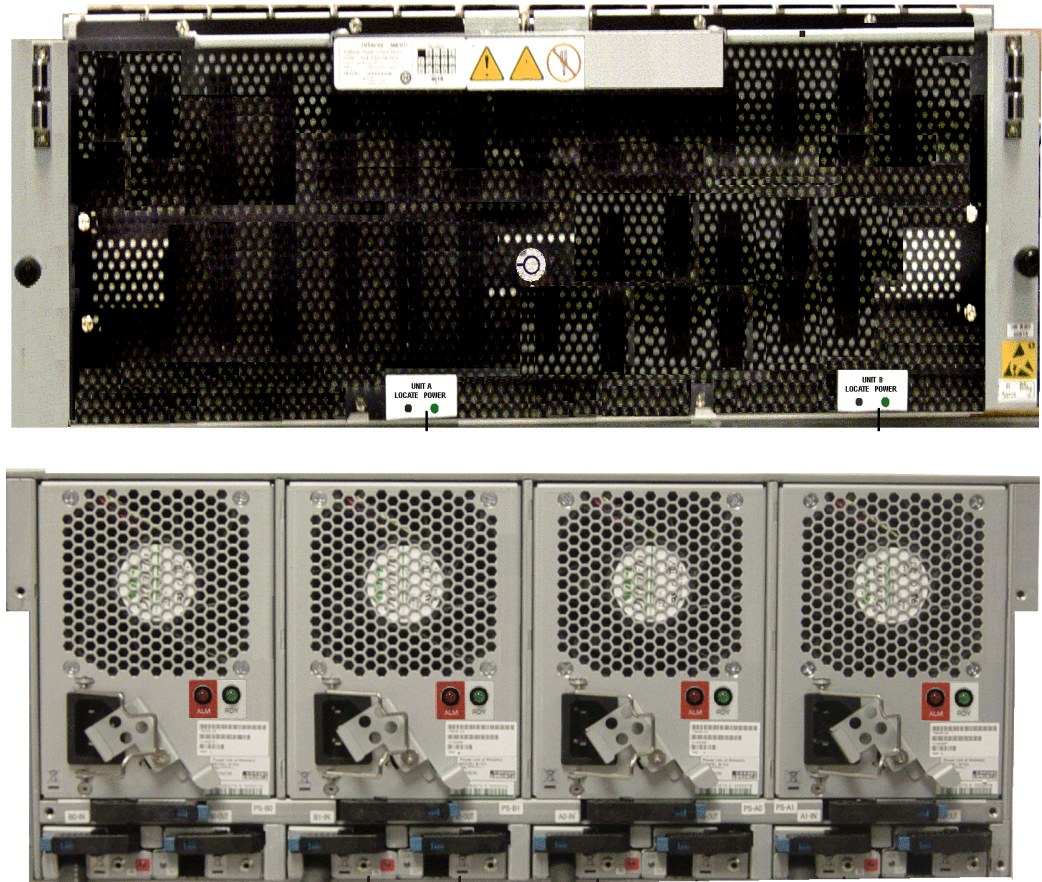


**Figure 1-15: Rear View of the Expansion Unit**

## High-density expansion unit

The AMS 2000 High-density Storage Expansion Unit (called high-density expansion unit) contains from 0 to 48 SATA disk drives, two pairs of redundant power supplies, and four ENC control units (cards). The control units manage the drives and are also used to connect the expansion unit to the base unit and to other expansion units.

Figure 1-16 shows the front (above) and rear (below) views of the high-density expansion unit. The front bezel has been removed in this photo.

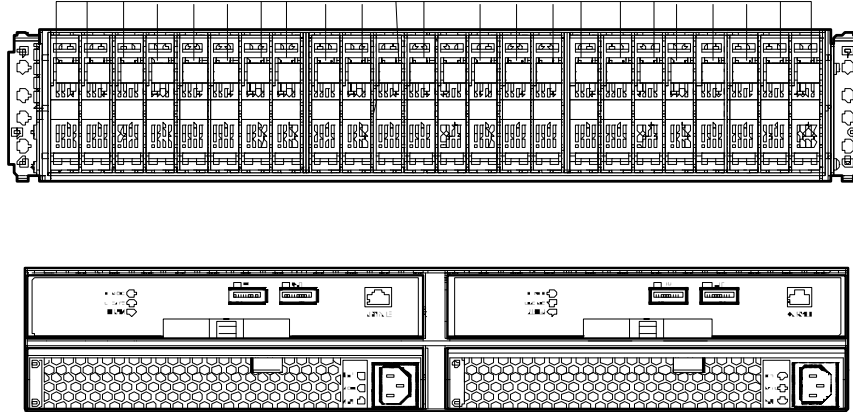


**Figure 1-16: High Capacity Expansion Unit Front and Rear Views**

## Modular 2U SAS expansion unit

The AMS Modular 2U SAS expansion unit contains two redundant power supplies, two ENC interface units, and from two to 24 SFF disk drives.

Figure 1-17 shows the front (above) and rear (below) views of the AMS Modular 2U SAS expansion unit.



**Figure 1-17: Modular 2U SAS Expansion Unit Front and Rear Views**

## System controls

This section describes the switches, connectors, and LEDs on the AMS 2100/2300 and the AMS 2500.

### Switches

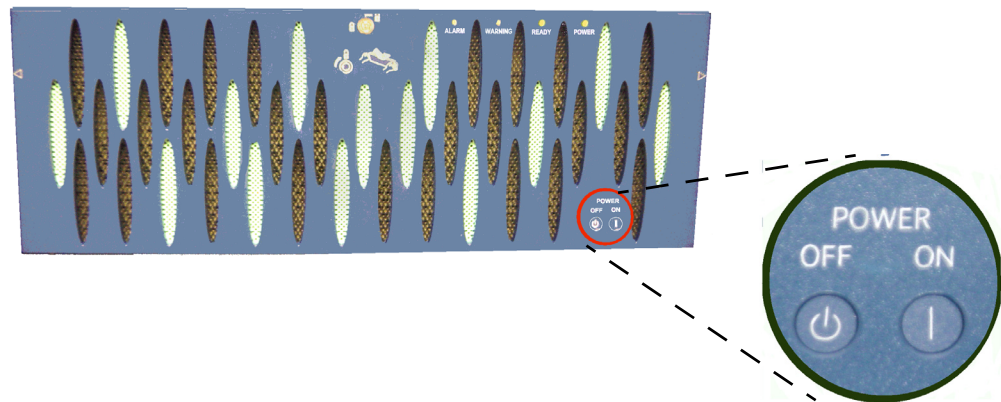
The base and expansion units include the following switches.

#### Base unit switches

This section describes the locations and functions of the switches in the base unit.

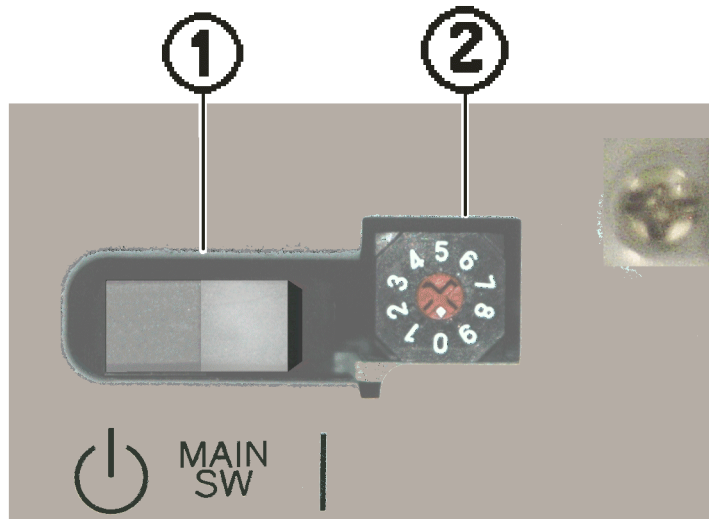
#### Base unit switches - front (all models)

The power switch for turning the controllers and drives in a base unit on or off is also located on the front of the unit. Facing the front of the base unit, this switch is located at the lower right corner. Pressing on the right button pushes the right side of the rocker switch and turns the power on. Pressing on the left button presses on the left side of the rocker switch and turns the power off.



**Figure 1-18: Base Unit Switches - Front**

[Figure 1-19](#) shows the base unit with the front bezel removed. The base unit switch panel is located at the lower right corner of the front of the array. The panel contains a power on-off switch and a mode switch, and is described in [Table 1-10](#).



**Figure 1-19: Base Unit Switch Panel**

**Table 1-10: Base Unit Switch Panel**

Item	Description
①	<p><b>Power Switch</b></p> <p>As shown in <a href="#">Figure 1-19</a>, the power ON/OFF switch is labeled <b>MAIN SW</b>.</p> <ul style="list-style-type: none"> <li>To turn the array power ON, press the right side of the switch (labeled  ).</li> <li>To turn the array power OFF, press the left side of the switch.</li> </ul>
②	<p><b>Mode Switch</b></p> <p>This sets the Uninterruptable Power Supply (UPS) mode to either Local Mode or one of three remote modes. Leave this switch in the local mode (0) position.<sup>1</sup></p>

1. Do not change the setting because it may change the normal operation of the unit.



**NOTE:** When you turn the power on, the array will automatically run a power on self test (POST). During this time, the Power LED will be on and the Ready light will be blinking. The POST takes approximately four minutes under normal circumstances. When the POST is complete and the unit is ready for operation, the Ready light changes from blinking to steady ON.

**Important!** Read chapter 6, Power On and Off Procedures in the *Hitachi AMS 2100/2300 Storage System Hardware Guide* or the *Hitachi AMS 2500 Storage System Hardware Guide* before turning the power on or off.

### Base unit switches - rear (all models)

The rear panel of all three base units contains two control units. The control units each contain one reset button. When pressed, the reset button resets the control unit and performs a full dump. See the following sections for the locations of the reset button.

- Control unit LEDs, connectors, and switches - [AMS 2100/2300 on page 1-24](#)
- Control unit LEDs, connectors, and switches - [AMS 2500 on page 1-26](#)

## Expansion unit switches

There are no switches on the expansion unit or high-density expansion unit.

## Battery expansion unit switches

There are no switches on the battery expansion unit.

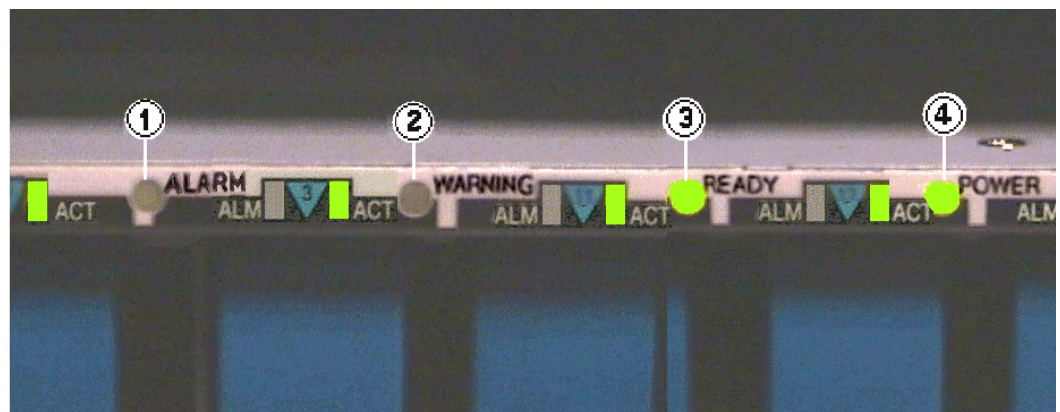
## Connectors and LEDs

This section illustrates and describes the locations and functions of the connectors and LEDs on the base and expansion units.

### Base unit

#### Front panel status LEDs

The upper right edge of the front of the AMS 2100/2300 base unit has four LEDs that indicate the status of the array. Also built into the chassis are two status LEDs for each disk drive. In addition, the Cache Backup battery has two status LEDs. [Figure 1-20](#) and [Table 1-11](#) describe the front panel status LEDs and their functions.



**Figure 1-20: Base Unit Status LEDs (front panel)**

**Table 1-11: Base Unit Status LEDs (front panel)**

Item	Name/Color	Status	Description
<b>Base Unit Overall Status LEDs</b>			
①	<b>Alarm</b> <b>RED</b>		The Alarm LED shows when an AMS 2100/2300 array has encountered a serious error.
		<b>OFF</b>	Normal operation
		<b>ON</b>	A serious error has occurred in the array. Please contact Hitachi Data Systems Technical Support. See the Getting Help section in the Preface of this manual.
		<b>Slow Blink</b> (1 blink/sec)	A serious failure has occurred. Please contact Hitachi Data Systems Technical Support. See the Getting Help section in the Preface of this manual.

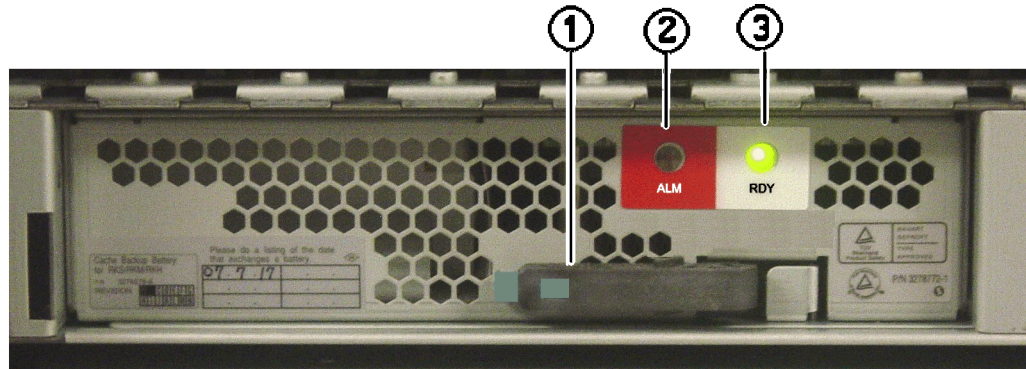
**Table 1-11: Base Unit Status LEDs (front panel)**

Item	Name/Color	Status	Description
②	<b>Warning</b> <b>ORANGE</b>		The orange <b>Warning</b> LED shows when the base unit is operating normally, has encountered a nonserious error, or is upgrading the firmware.
		<b>OFF</b>	Normal operation
		<b>ON or Slow Blink</b> (1 blink/sec)	Nonserious error. The base unit can continue to operate. See the Alerts & Events window in Navigator 2 for information about the error.
		<b>Fast Blink</b> (8 blinks/sec)	The firmware is being updated (do not turn off the array).
③	<b>Ready</b> <b>GREEN</b>	<b>ON</b>	Normal operation. The array is fully operational.
		<b>Slow Blink</b>	Firmware download is complete. The array is fully operational.
		<b>Fast Blink</b>	Firmware is downloading (Do not turn off the array).
④	<b>Power</b> <b>GREEN</b>	<b>ON</b>	The base unit is turned on and receiving power.
		<b>OFF</b>	The base unit is not turned on.
<b>AMS 2100/2300 only - Disk Drive Status LEDs (see photo on <a href="#">page 1-31</a>)</b>			
①	<b>ALArM LED</b> <b>RED</b>	<b>ON</b>	Lights when the drive has a serious error.
		<b>OFF</b>	Normal Status
②	<b>ACTive LED</b> <b>GREEN</b>	<b>ON or Flashing</b>	Lights or flashes when the drive is operating and is being read from or written to. It indicates that the disk drive is operational.
		<b>OFF</b>	No data is being transferred.
<b>Cache Backup Battery (see photo on <a href="#">page 1-23</a>)</b>			
②	<b>Alarm LED</b> <b>RED</b>	<b>ON</b>	Indicates that the battery has failed.
		<b>OFF</b>	Indicates that the battery status is normal.
③	<b>Ready LED</b> <b>GREEN</b> indicates battery condition	<b>ON</b>	Normal status
		<b>Slow Blink</b>	(1 blink per second): The battery is not fully charged.
		<b>Off or Fast Blink</b>	(8 blinks per second): Abnormal status

## Cache backup battery LEDs

The AMS 2100/2300/2500 base unit includes two cache backup batteries standard. The AMS 2500 includes two additional slots for optional cache backup batteries. Refer to [Figure 1-6 on page 1-9](#). Two fully charged batteries can preserve the data in the cache for 30 to 48 hours, depending on the amount of data in the cache.

[Figure 1-21](#) shows the cache backup battery. The front panel on the battery contains an Alarm LED and a Ready LED. The battery includes a lock lever that keeps the battery securely installed in the array and is used to remove the battery when needed.



**Figure 1-21: Cache Backup Battery**

**Table 1-12: Cache Backup Battery**

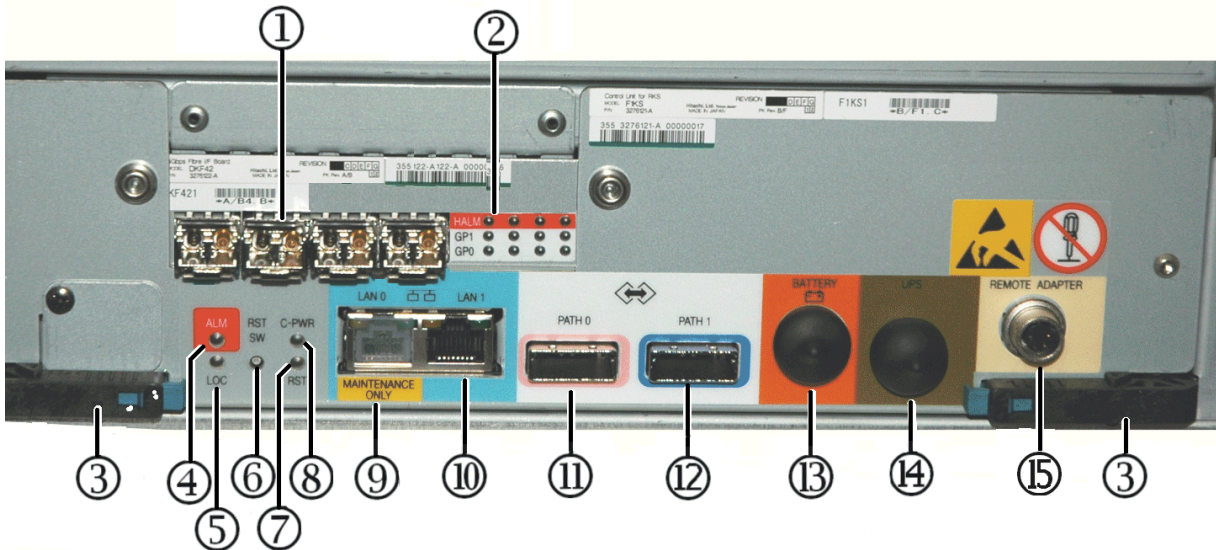
Item	Description	Status
①	Lock Lever	When the lock lever is closed and the blue button is fully extended, the battery is secured to the array.
②	<b>Alarm LED</b> <b>RED</b>	<ul style="list-style-type: none"> <li>When on, indicates that the battery has failed.</li> <li>When off, indicates that the battery status is normal.</li> </ul>
③	<b>Ready LED</b> <b>GREEN</b>	This LED indicates the condition of the battery. <ul style="list-style-type: none"> <li>On: normal status</li> <li>Low-speed blinking (1 blink per second): The battery is not fully charged.</li> <li>Off or high-speed blinking (8 blinks per second): Abnormal status</li> </ul>

## Rear panel LEDs and connectors - AMS 2100/2300

The rear panel of the AMS 2100/2300 base unit has several LEDs that indicate the status of the power supplies and control units. These LEDs are explained as part of the descriptions of the [Control unit LEDs, connectors, and switches - AMS 2100/2300 on page 1-24](#), and the [Base unit power supply status LEDs on page 1-30](#).

## Control unit LEDs, connectors, and switches - AMS 2100/2300

Figure 1-22 shows the lower control unit of an AMS 2300 /RKM base unit. The upper control unit is identical, but is installed in the base unit upside down.



**Figure 1-22: Control Unit Connectors and LEDs (AMS 2300)**

**Table 1-13: Control Unit Connectors and LEDs (AMS 2300)**

Item	Description	Item	Description	Item	Description
①	Fibre channel host connectors (4 per controller)	⑦	Reset LED (Orange) Blinks while the base unit is resetting	⑪	Connector Path 0 IN
②	Fibre Channel Activity LEDs (2 sets)	⑧	C- Power LED (Green) When on, indicates that cache memory is backed up.	⑫	Connector Path 1 IN
③	Lock Lever (2 places)	⑨	10/100 Ethernet management port	⑬	Battery Expansion Unit Connector
④	Alarm LED (Red) Indicates that the control unit has failed.			⑭	Uninterruptible Power Supply Connector
⑤	LOC LED (Orange) See LOC LED on page 1-25	⑩	ACT LED (yellow) indicates data is being transferred. LINK LED (green) When ON, indicates that the link status is normal.	⑮	Remote Adapter connector
⑥	Reset Button Resets the control unit and performs a full dump.				

## LOC LED

The LOC LED indicates various controller conditions depending on the speed and number of blinks. See [Table 1-14](#).

When adding a unit with the power turned on, the LED indicates that a unit has been added (this is not an error).

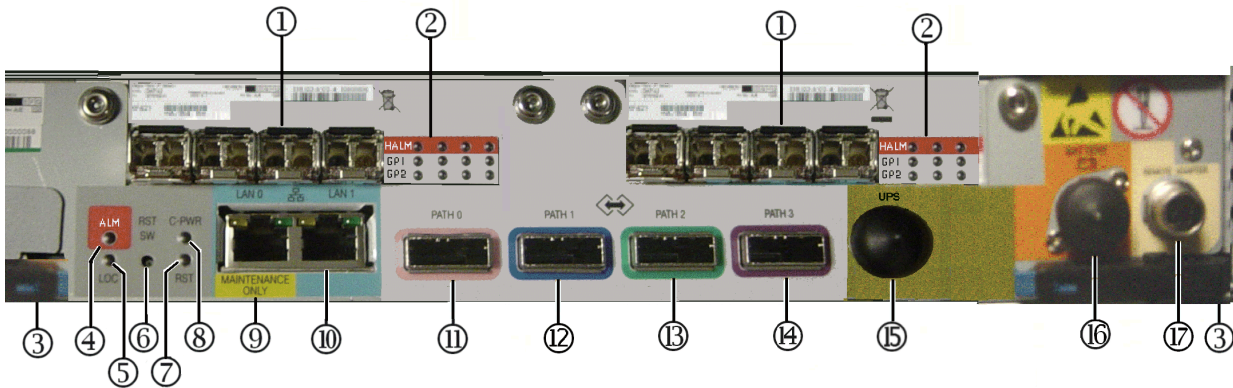
**Table 1-14: LOC LED**

<b>Number of blinks</b>	<b>Description</b>
6 (slow)	Voltage on the control unit is abnormal. (Reset of the control unit is not canceled)
1 (fast) <sup>1</sup>	SRAM error.
2 (fast)	hard error.
3 (fast)	Firmware error in flash memory.
ON	Boot section error in the ENC firmware, a RAM error, or ENC hard configuration error.

1. When blinking fast, the LED is on for 400 ms and off for 200 ms for each fast blink. After the number of fast blinks has completed, the LED ID goes off for one second.

## Control unit LEDs, connectors, and switches - AMS 2500

Figure 1-23 shows the control unit of an AMS 2500/RKHE2 base unit. The upper control unit is identical, but is installed in the base unit upside down.



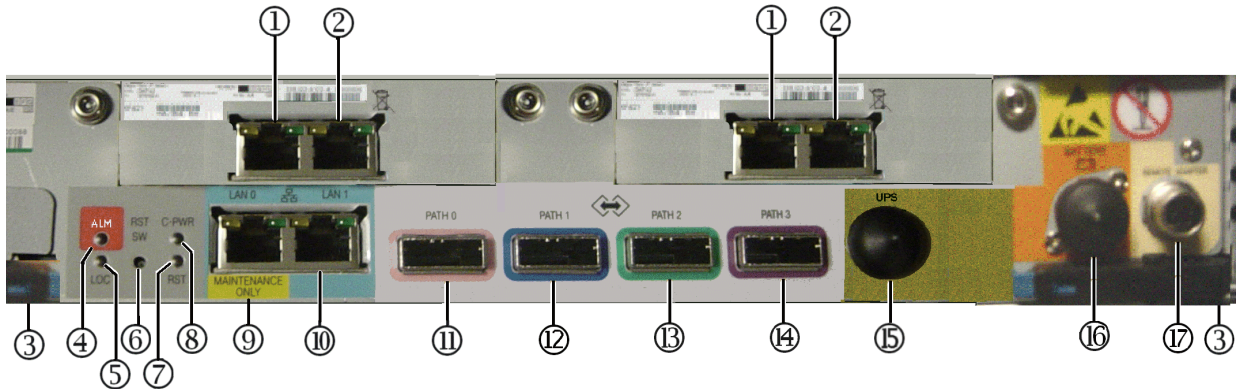
**Figure 1-23: AMS 2500 Control Unit Connectors and LEDs**

**Table 1-15: AMS 2500 Control Unit Connectors and LEDs**

Item	Description	Item	Description	Item	Description
①	Fibre channel host connectors (8 per controller)	⑥	RST (Reset) Button Resets the control unit and performs a full dump.	⑫	Connector Path 1 to ENC unit IN
②	Fibre Channel HALM (Host Alarm) - indicates that the host connector is abnormal. GP0 LED/GP1 LEDs (green) - indicate that the interface is normal.	⑦	Reset LED (orange) Blinks while the control unit is resetting	⑬	Connector Path 2 to ENC unit IN
		⑧	C- Power LED (green) When on, indicates that cache memory is backed up.	⑭	Connector Path 3 to ENC unit IN
③	Lock Lever (2 places)	⑨	<b>Maintenance Port (LAN 0)</b> <ul style="list-style-type: none"> <li>• ACT LED (yellow) indicates data is being transferred.</li> <li>• LINK LED (green) When ON, indicates that the link status is normal.</li> </ul>	⑮	Uninterruptible Power Supply Connector
④	Alarm LED (red) Indicates that the control unit has failed.	⑩	<b>10/100 Ethernet management port (LAN 1)</b> <ul style="list-style-type: none"> <li>• ACT LED (yellow) indicates data is being transferred.</li> <li>• LINK LED (green) When ON, indicates that the link status is normal.</li> </ul>	⑯	Battery Expansion Unit Connector
⑤	LOC LED (orange) See <a href="#">page 1-25</a>	⑪	Connector Path 0 to ENC unit IN	⑰	Remote Adapter connector

## AMS 2500 iSCSI control unit

The iSCSI AMS 2500 control unit is shown in [Figure 1-24](#). The only difference between this control unit and the Fibre Channel control unit is the interface board and external ports.



**Figure 1-24: AMS 2500 iSCSI Control Unit Connectors and LEDs**

**Table 1-16: AMS 2500 iSCSI Control Unit Connectors and LEDs**

Item	Description	Item	Description	Item	Description
①	iSCSI RJ45 Port #0 See item 9 in this table for ACT and Link LED descriptions	⑦	Reset LED (orange) Blinks while the control unit is resetting	⑬	Connector Path 2 to ENC unit IN
②	iSCSI RJ45 Port #1 See item 9 for ACT and Link LED descriptions	⑧	C- Power LED (green) When on, indicates that cache memory is backed up.	⑭	Connector Path 3 to ENC unit IN
③	Lock Lever (2 places)	⑨	<b>Maintenance Port (LAN 0)</b> <ul style="list-style-type: none"> <li>ACT LED (yellow) indicates data is being transferred.</li> <li>LINK LED (green) When ON, indicates that the link status is normal.</li> </ul>	⑮	Uninterruptable Power Supply Connector
④	Alarm LED (red) Indicates that the control unit has failed.	⑩	<b>10/100 Ethernet management port (LAN 1)</b> <ul style="list-style-type: none"> <li>ACT LED (yellow) indicates data is being transferred.</li> <li>LINK LED (green) When ON, indicates that the link status is normal.</li> </ul>	⑯	Battery Expansion Unit Connector
⑤	LOC LED (orange) See <a href="#">page 1-25</a>	⑪	Connector Path 0 to ENC unit IN	⑰	Remote Adapter connector
⑥	RST (Reset) Button Resets the control unit and performs a full dump.	⑫	Connector Path 1 to ENC unit IN		

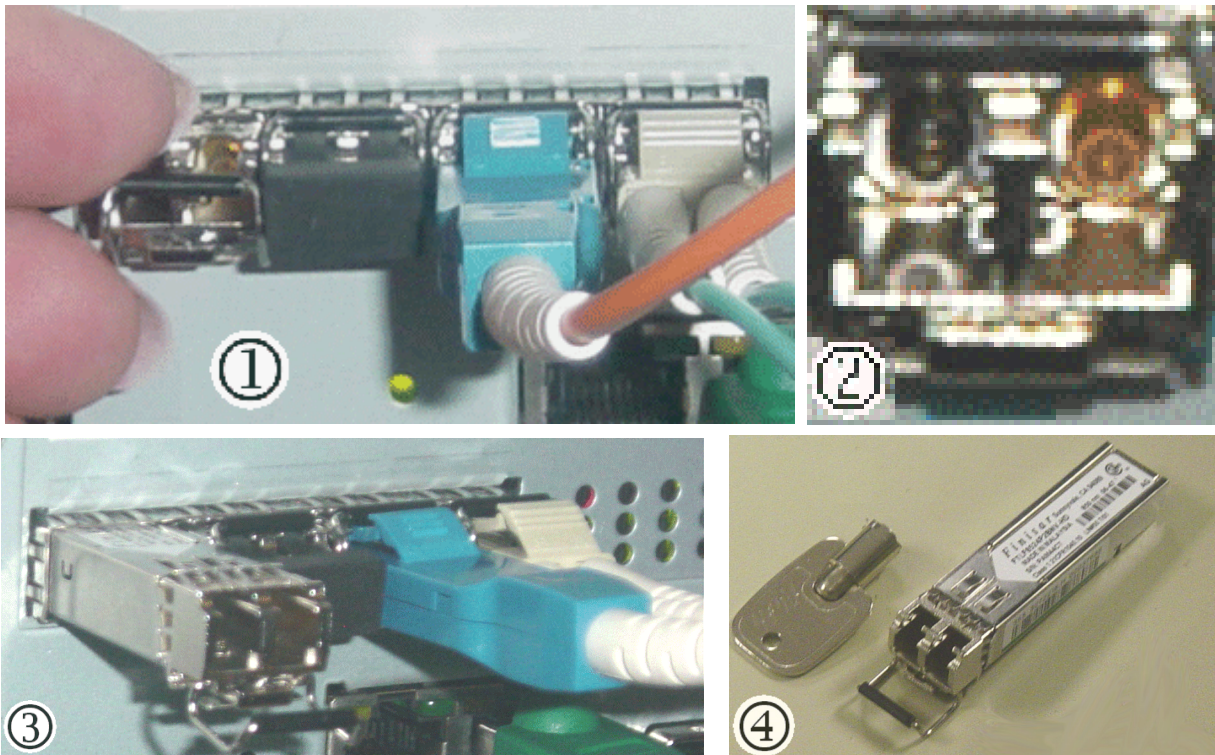
## Fibre channel host connectors

Each of the two AMS 2100 control units has two fibre channel data ports (total of 4 ports per array). Each of the two AMS 2300 control units has four fibre channel data ports (total of 8 ports per array). Each data port is part of a removable/replaceable optical transceiver called a Host Connector.

Figure 1-25 shows the four Fibre Channel data ports / Host Connectors on an AMS 2300 control unit.

- Photograph ① shows the leftmost host connector with the lock opened and the unit ready for removal. The second connector is shown capped, as all of the host connectors are when the array is shipped. The third and fourth ports are shown connected. Note that two types of fibre channel cables and connectors are used in this photo.
- Photograph ② shows a close up view of the two connectors in each data port.
- Photograph ③ shows a host connector partially removed from the array.
- Photograph ④ shows a host connector completely removed from the array. The front bezel key is included in the photo to show the relative size of a host connector.

See the Hitachi AMS 2100/2300 Service Guide for information on removing and replacing a host connector.



**Figure 1-25: Fibre Channel Host Connectors**

## 10/100 Ethernet management port

Each AMS 2100/2300 controller has one 10/100BaseT Ethernet management port that is used to configure the controller using the Navigator 2 configuration software. Configuration can be performed using either a computer with an installed NIC card that is directly connected to the management port or by connecting the management port to your Local Area Network (LAN).

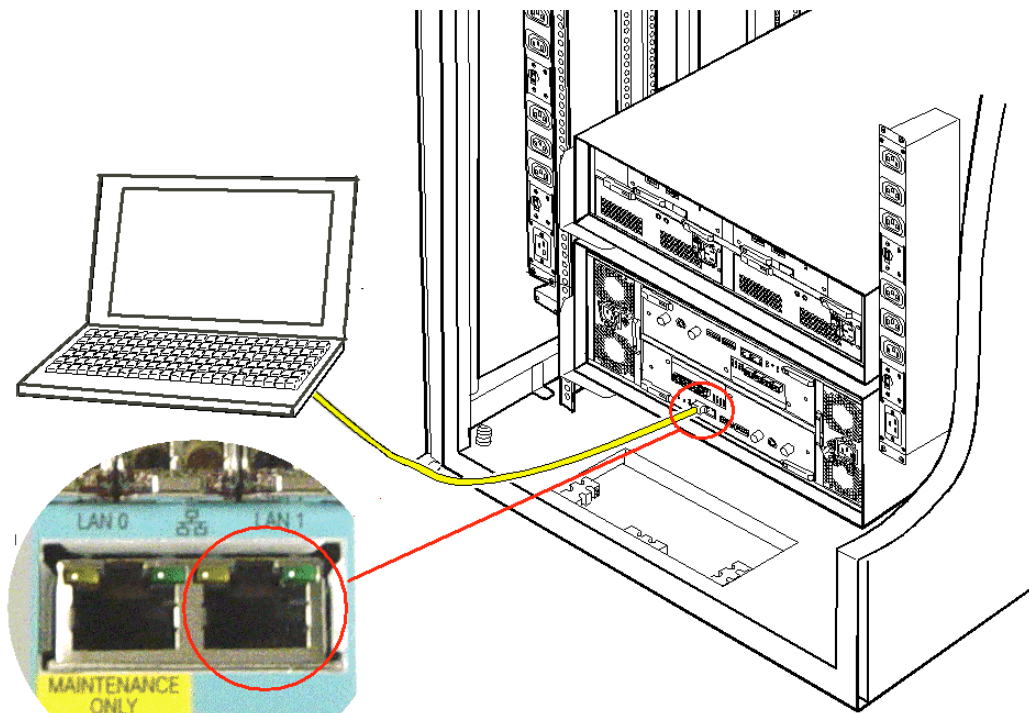
Using the management console, you can configure and manage an AMS 2000 Family array using the Navigator 2 software on the supplied CD. You can also use the storage features described under Features and Benefits on page 1-7 in the *Hitachi AMS 2100/2300 Storage System Hardware Guide* to interact with an AMS 2100/2300 array. The same features are described on page 1-8 in the *Hitachi AMS 2500 Storage System Hardware Guide* and also work with an AMS 2500 array.

The management port accepts either a cross-over cable for direct connections to the management port or a straight-through cable if connecting to the management port through a switch. The port is a standard RJ45 connector that has an amber Port Activity LED on the left side of the port and a green Link LED on the right side. When an active LAN cable is plugged into the port, the Link light comes on steady. The Activity LED lights when data is being transferred to or from the port.



**NOTE:** If you use Navigator 2 to configure an AMS 2000 Family array to send email alerts, be sure the management port can communicate via Ethernet with your mail server. For more information, refer to the Navigator 2 online help.

Figure 1-26 shows an example of how a laptop might be connected to an AMS 2100/2300 base unit that is installed in a rack.

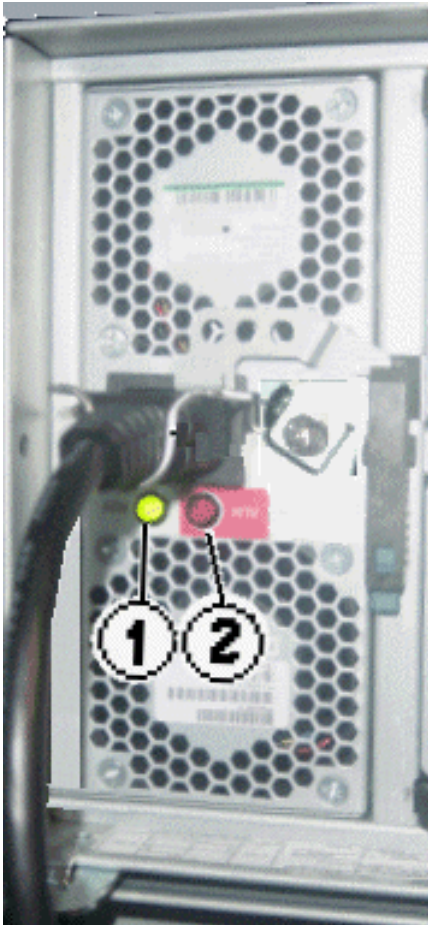
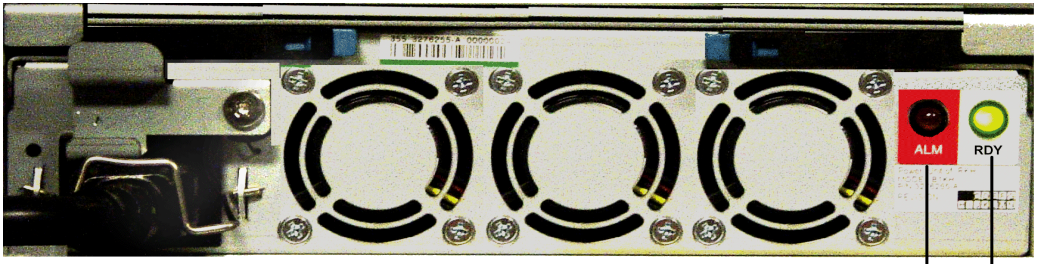


**Figure 1-26: Connecting a Laptop to a Management Port**

## Base unit power supply status LEDs

Each power supply has two LEDs on the panel near the power receptacle. These LEDs indicate the operational status of the power supply, as shown in [Table 1-17](#).

**Table 1-17: Base Unit Power Supply LEDs**

AMS 2100/2300	Item	Description
	①	Ready LED (green). on each power supply blinks when the corresponding power receptacle is connected to a working AC outlet, even if an AMS 2100/2300 array is not turned on; otherwise, the LED is OFF.
	②	Alarm LED (red). This LED indicates that the power supply has failed. Although the other power supply can supply sufficient power and cooling for the array, Hitachi Data Systems recommends that you replace the failed power supply as soon as possible. See the Hitachi AMS 2100/2300 Service Guide for instructions.
<b>AMS 2500</b>		
		

## Base unit power receptacles

Each power supply contains a power receptacle that must be connected to a working AC power source using the supplied AC power cable.



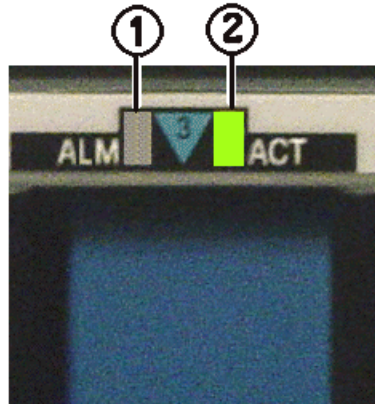
**NOTE:** Hitachi Data Systems recommends that each power supply in the base unit be connected to a different AC source in the rack. If one source fails, the other source continues to supply power to the other power supply. This keeps the array running until power is restored to the failed source.

## Disk drive status LEDs

The AMS 2100/2300 base units and expansion unit each have two LEDs that are built into the unit chassis above each disk drive slot. These LEDs, shown in [Figure 1-27](#), indicate the status of the drive that is installed in the slot below them.



**NOTE:** The AMS 2500 base unit does not contain disk drives.



**Figure 1-27: Disk Drive Status LEDs**

**Table 1-18: Disk Drive Status LEDs**

Item	Description	Item	Description
①	<b>ALarM LED ((RED)</b> Lights when the drive has a serious error in the disk drive, and the disk drive is unusable.	②	<b>ACTive LED (GREEN)</b> Lights or flashes when the drive is operating and is being read from or written to. It indicates that the disk drive is operational.

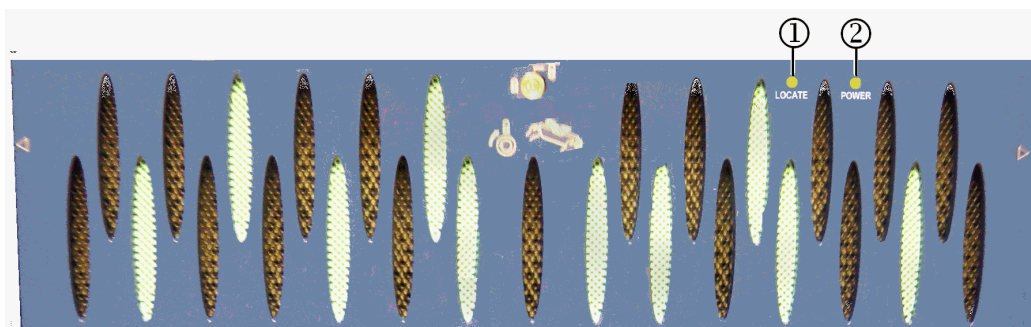
## Expansion unit

### Front panel status LEDs

The front panel of the expansion unit includes Power and Locate status LEDs that show the status of the unit and identify the unit. The installation location should provide an unobstructed view of these LEDs.

In addition, each drive slot on the expansion unit has alarm and Active LEDs that show the status of the drive installed in the slot directly below the status LEDs. As shown in [Figure 1-13 on page 1-15](#), these LEDs are visible when the front bezel is removed. A close up photo of the drive status LEDs is shown above.

There are no switches on an expansion unit. Power is turned on and off with a control signal that is routed from the base unit via the ENC cables that are connected to the ENC unit in the expansion unit.

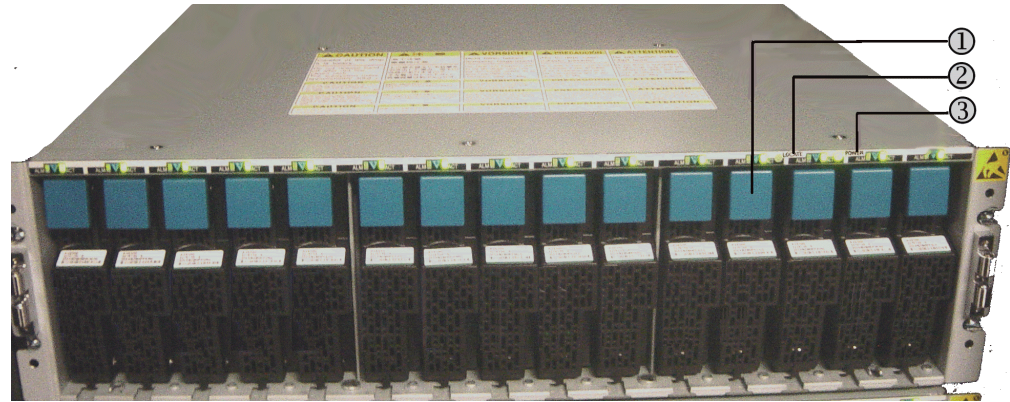


**Figure 1-28: Front View of an Expansion Unit**

**Table 1-19: Expansion Unit Front View**

Item	Description	Item	Description
①	Locate LED. <a href="#">Expansion unit status LEDs on page 1-33</a> <b>Orange</b>	②	Power LED <b>GREEN</b>

Figure 1-29 shows the front of an expansion unit (factory designation RKAK) with the front bezel removed and the disk drives in the front of the array exposed.



**Figure 1-29: Expansion Unit Front View - Bezel Removed**

**Table 1-20: Expansion Unit Front View**

Item	Description	Item	Description	Item	Description
①	Disk Drives, showing the status LEDs	②	Locate LED Expansion unit status LEDs on page 1-33	③	Power LED



**NOTE:** The status LEDs for the disk drives in the expansion unit are the same as the disk drive status LEDs the base unit. See [Disk drive status LEDs on page 1-31](#).

### Expansion unit status LEDs

The upper right edge of the front of the AMS 2100/2300 expansion unit has four LEDs that indicate the status of the array. [Figure 1-30](#) and [Table 1-21](#) describe the array status LEDs and their functions.



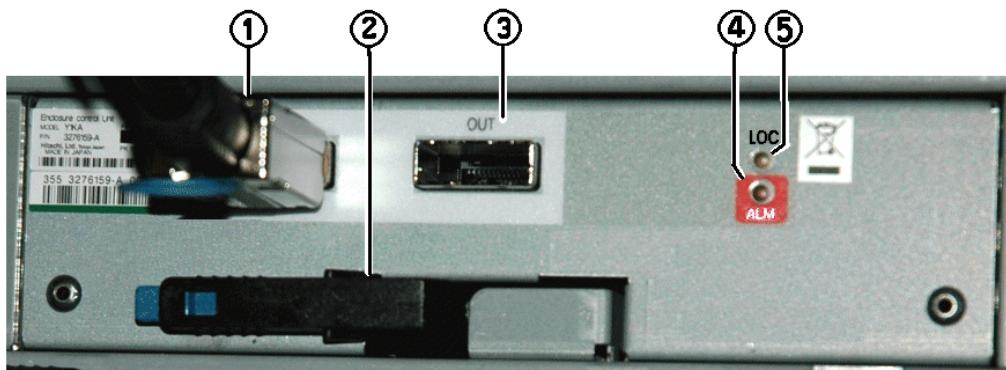
**Figure 1-30: Expansion Unit Status LEDs**

**Table 1-21: Expansion Unit Status LEDs**

Item	Name/ Color	Status	Description
①	Locate <b>ORANGE</b>	OFF	The Locate LED lights when an expansion unit has encountered a serious error. Normal operation
		ON	A serious error has occurred in the array. Please contact Hitachi Data Systems Technical Support. See the Getting Help section in the Preface of this manual.
②	Power <b>GREEN</b>	ON	The base unit is turned ON and receiving power and the power control signal is received by the expansion unit. The expansion unit is on and receiving power.
		OFF	The base unit is not turned on and/or the expansion unit is not receiving power.

**ENC unit status LEDs**

The ENC unit contains two LEDs that show the status of the unit. These are shown and explained in the following figure and tables.



**Figure 1-31: Expansion Unit ENC Unit**

**Table 1-22: Expansion Unit ENC Unit**

Item	Description	Item	Description
①	Port (IN)	④	Alarm LED <b>RED</b> This LED indicates that the ENC unit has failed.
②	Lock Lever	⑤	LOC LED <b>ORANGE</b> See <b>LOC LED</b> in the next table.
③	Port (OUT)		

**Table 1-23: LOC LED**

Number of blinks	Description
1 (fast) <sup>1</sup>	SRAM error

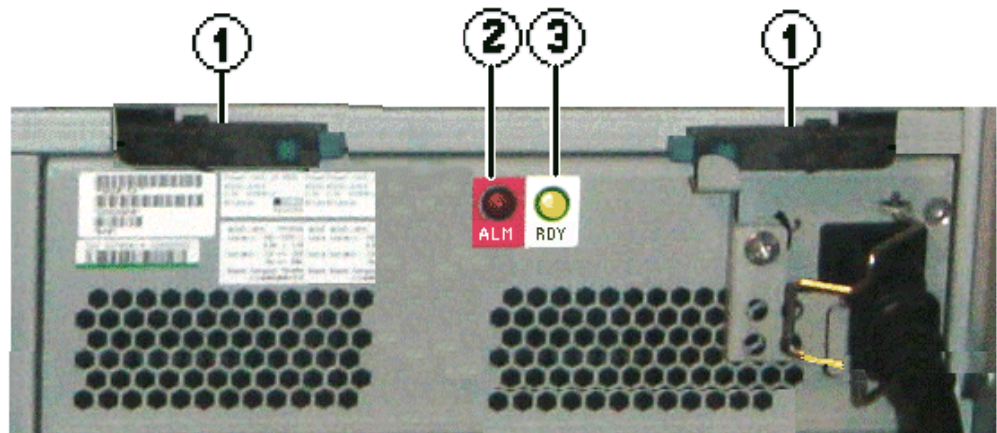
**Table 1-23: LOC LED**

Number of blinks	Description
2 (fast)	hard error (CUDG error)
3 (fast)	Firmware error in flash memory
ON	Boot section error in the ENC firmware, a RAM error, or ENC hard configuration error

1. When blinking fast, the LED is on for 400 ms and off for 200 ms for each fast blink. After the number of fast blinks has completed, the LED ID goes off for one second.

### Power supply status LEDs

Each expansion unit power supply has two LEDs on the panel near the power receptacle. These LEDs indicate the operational status of the power supply, as shown in the following figure and table.



**Figure 1-32: Expansion Unit Rear Panel**

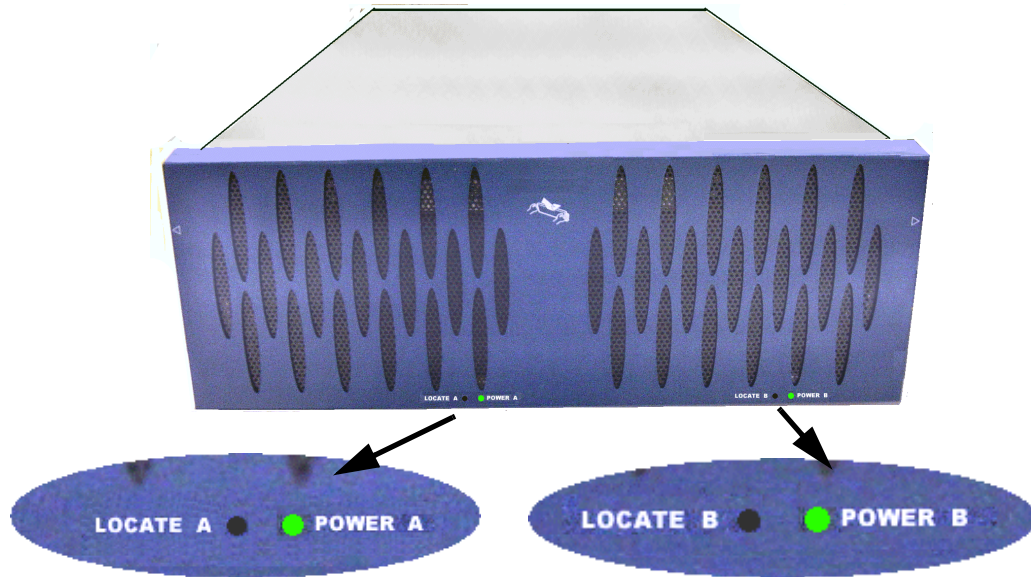
**Table 1-24: Expansion Unit Rear Panel Component Descriptions**

Item	Description
①	Lock Lever (2 places)
②	Alarm LED (red). This LED indicates that the power supply has failed. Although the other power supply can supply sufficient power and cooling for the array, Hitachi Data Systems recommends that you replace the failed power supply as soon as possible. See the Hitachi AMS 2100/2300 Service Guide for instructions.
③	Ready LED (green). on each power supply blinks when the corresponding power receptacle is connected to a working AC outlet, even if an AMS 2100/2300 array is not turned on; otherwise, the LED is OFF.

## High-density expansion unit status LEDs

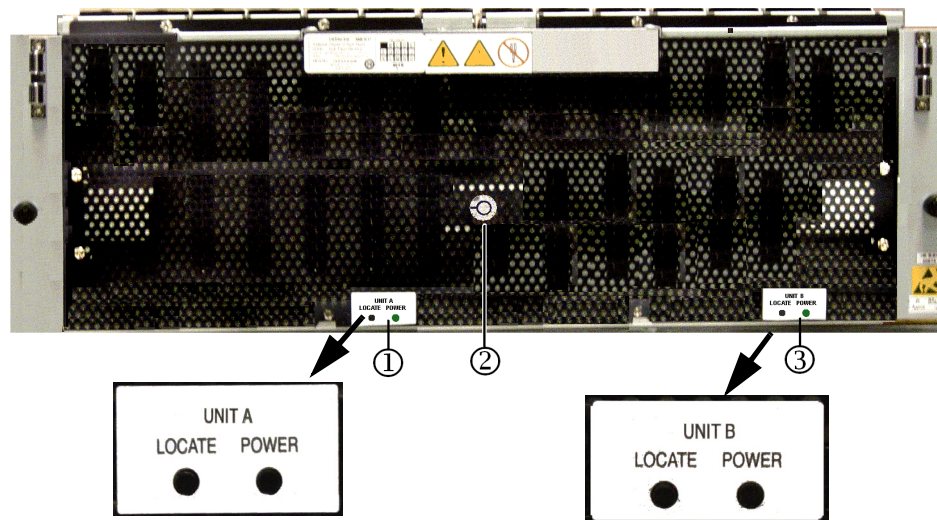
### Front panel status LEDs

The front panel of the high-density expansion unit includes two sets of Power and Locate status LEDs that show the status of each section (A and B) in the unit and identify the unit in case of a failure. The installation location should provide an unobstructed view of these LEDs.



**Figure 1-33: High-density Expansion Unit Front View**

Figure 1-34 shows the front panel of a high-density expansion unit with the front bezel removed. The Locate and Power LEDs are visible with the front bezel off as well as when it is installed.



**Figure 1-34: High-density Expansion Unit Front Panel**

**Table 1-25: High-density Expansion Unit Front Panel**

Item	Description	Item	Description	Item	Description
①	Unit A Status LEDs	②	Drive Cover Lock	③	Unit B Status LEDs

## High-density expansion unit status LEDs


Table 1-26 describes the array status LEDs and their functions.

**Table 1-26: High-density Expansion Unit Status LEDs**

Item	Name/ Color	Status	Description
①	<b>LOCATE</b> <b>ORANGE</b>	<b>OFF</b>	Normal operation
		<b>ON</b>	A serious error has occurred in the unit. Please contact Hitachi Data Systems Technical Support. See the <a href="#">Getting help</a> section in the Preface of this manual.
②	<b>POWER</b> <b>GREEN</b>	<b>ON</b>	Normal operation; the section is fully operational.
		<b>Slow Blink</b>	The firmware download is complete.
		<b>Fast Blink</b>	The firmware is downloading (do not turn off the array).

## Power supply status

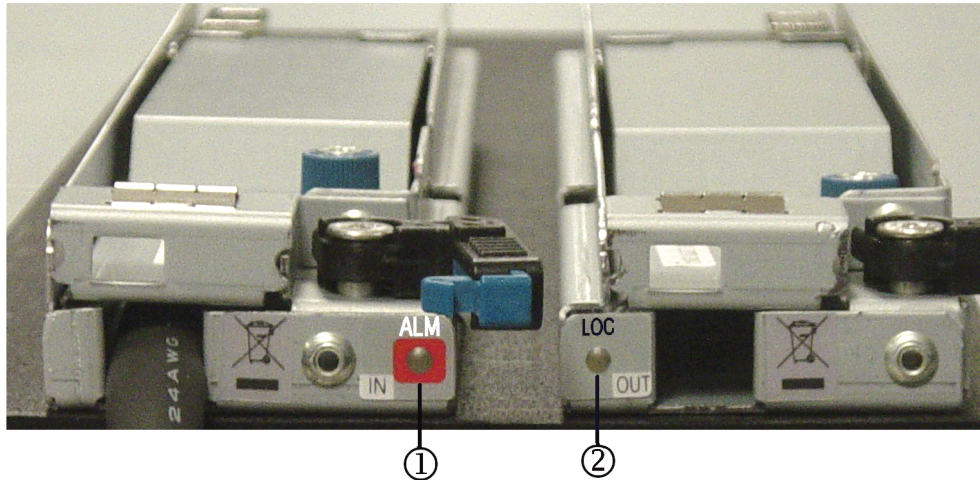
Each power supply has two LEDs on the panel near the power receptacle. These LEDs indicate the operational status of the power supply, as shown in Figure 1-35.

	Item	Description
	①	<b>Alarm LED (red).</b> This LED indicates that the power supply has failed. Although the other power supply can supply sufficient power and cooling for the array, Hitachi Data Systems recommends that you replace the failed power supply as soon as possible. Contact Hitachi Data Systems Technical Support for instructions.
	②	<b>Ready LED (green).</b> <b>OFF</b> when the power supply is not connected to power. <b>Blinks</b> when the corresponding power receptacle is connected to a working AC outlet, and is running the power on self test (POST). <b>ON</b> when the power supply is operational, even if the AMS 2100/2300 array is not turned on.

**Figure 1-35: High-density Expansion Unit Power Supply LEDs**

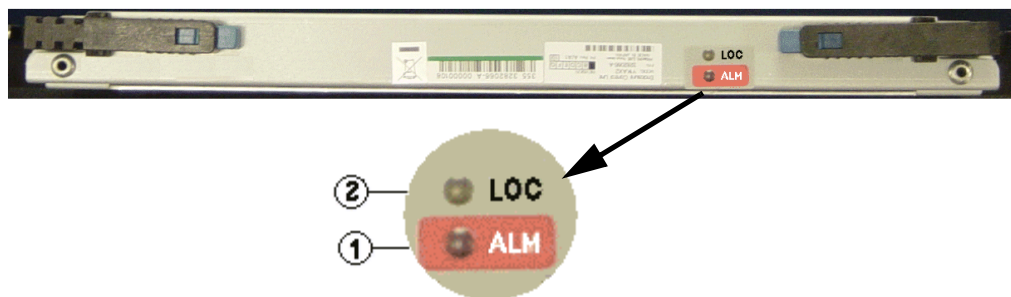
## status LEDs

The High-density Expansion Unit ENC unit connects the high-density expansion unit to the base unit and can also connect it to another high-density expansion unit. The ENC IN connector includes an ALM (alarm) LED that turns on when the ENC card to which it is connected fails. The LOC (locate) LED for the ENC unit is located on the OUT connector. These LEDs are shown in [Figure 1-36](#).



**Figure 1-36: High-density Expansion Unit ENC LEDs (Rear Panel)**

The ENC card inside the unit also has ALM and LOC LEDs on the top edge of the card. They are visible when the drive cover is removed from the high-density expansion unit, and are shown in [Figure 1-37](#). [Table 1-27](#) describes the function of these LEDs, which have exactly the same function as those on the rear panel.



**Figure 1-37: High-density Expansion Unit ENC LEDs (Card)**

**Table 1-27: High-density Expansion Unit ENC LED Functions**

Item	Description							
①	ALM (Alarm) <b>RED</b>	This LED indicates that the ENC unit has failed.						
②	<b>LOC</b> (Locate) <b>ORANGE</b>	<table border="1"> <tr> <td data-bbox="688 296 837 338"><b>OFF</b></td> <td data-bbox="837 296 1477 338">Normal operation</td> </tr> <tr> <td data-bbox="688 338 837 667"><b>Blinking</b> 6 (slow) 1 (fast)<sup>1</sup> 2 (fast) 3 (fast) 4 (fast) 6 (slow)</td> <td data-bbox="837 338 1477 667">Voltage on the control unit is abnormal. (Reset of the control unit is not canceled) SRAM error. ENC hard error. Firmware error in flash memory. CUDG error in ENC. Voltage on the control unit is abnormal. (Reset of the control unit is not canceled)</td> </tr> <tr> <td data-bbox="688 667 837 739"><b>ON</b></td> <td data-bbox="837 667 1477 739">Boot section error in the ENC firmware, a RAM error, or ENC hard configuration error.</td> </tr> </table>	<b>OFF</b>	Normal operation	<b>Blinking</b> 6 (slow) 1 (fast) <sup>1</sup> 2 (fast) 3 (fast) 4 (fast) 6 (slow)	Voltage on the control unit is abnormal. (Reset of the control unit is not canceled) SRAM error. ENC hard error. Firmware error in flash memory. CUDG error in ENC. Voltage on the control unit is abnormal. (Reset of the control unit is not canceled)	<b>ON</b>	Boot section error in the ENC firmware, a RAM error, or ENC hard configuration error.
<b>OFF</b>	Normal operation							
<b>Blinking</b> 6 (slow) 1 (fast) <sup>1</sup> 2 (fast) 3 (fast) 4 (fast) 6 (slow)	Voltage on the control unit is abnormal. (Reset of the control unit is not canceled) SRAM error. ENC hard error. Firmware error in flash memory. CUDG error in ENC. Voltage on the control unit is abnormal. (Reset of the control unit is not canceled)							
<b>ON</b>	Boot section error in the ENC firmware, a RAM error, or ENC hard configuration error.							

1. When blinking fast, the LED is on for 400 ms and off for 200 ms for each fast blink. After the blinking stops, the LED ID goes off for one second.

### High-density expansion unit top view

Figure 1-38 shows the top view of the high-density expansion unit with the drive cover removed. The disk drives and ENC cards can be seen along with the drive fillers where disk drives are not installed. These are required to prevent loss of cooling air to the drives.



**Figure 1-38: High-density Expansion Unit Top View**

**Table 1-28: High-density Expansion Unit Top View**

Item	Description	Item	Description
①	Power Supply Area	③	Disk Drive Filler (must be in all slots that do not have disk drives installed.)
②	Unit (four required)	④	Disk Drive. See Disk Drive Status LEDs following this table.

### Disk drive status LEDs

Each disk drive in the high-density expansion unit has an ALM (alarm) LED on the top edge of the drive that shows the status of the disk drive. This LED, shown in [Figure 1-39](#), indicates that the drive has failed.



**Figure 1-39: Disk Drive Alarm LED on High-Density Expansion Unit**

**Table 1-29: Disk Drive Alarm LED**

Item	Description
①	<b>Alarm LED ((RED))</b> Lights when the drive has a serious error.

With the drive cover removed, the drives and any lighted alarm LEDs are visible, as shown in [Figure 1-40](#).

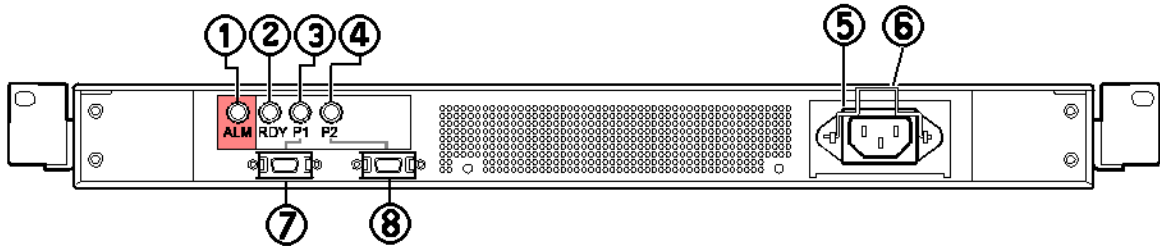


**Figure 1-40: Alarm LED Locations**

### Battery expansion unit LEDs and controls

The AMS 2500 can connect to one or two AMS 2000 Battery Expansion Units to extend the life of the data in the cache in case the power to the facility where the unit is installed fails for an extended period.

The battery expansion units contain the same batteries and have the same storage capacity as the internal batteries, but are housed in a rackmount unit that also contains a power supply to keep the battery charged. The power supply runs on 110 VAC and is plugged into the rack PDB. The front panel on the battery expansion unit contains an Alarm LED and a Ready LED. See [Figure 1-41](#) and [Table 1-30](#) for information about the battery expansion unit LEDs.



**Figure 1-41: Battery Expansion Unit LEDs and Connectors**

**Table 1-30: Battery Expansion Unit LEDs and Connectors**

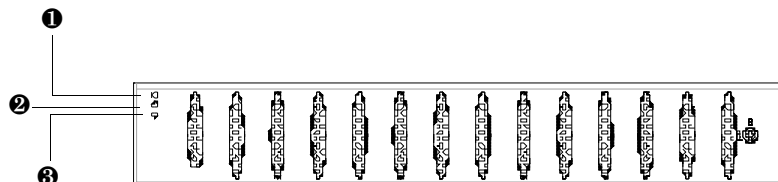
Item	Description	Status
①	<b>Alarm LED</b> red	<b>ON</b> - Lights when the battery charging or protection circuitry has failed or when the battery voltage is abnormal. <b>OFF</b> - During normal operation and when the unit is turned off. Also during backup.
②	<b>Ready LED</b> green	This LED indicates the condition of the battery. <b>ON</b> <ul style="list-style-type: none"> <li>Charge is completed.</li> <li>Supplementation charge.</li> <li>Low-speed blinking (1 second blink every two seconds): The battery is not fully charged, and is charging.</li> <li>High-speed blinking (2 blinks per second): Abnormal status</li> </ul> <b>OFF</b> - When the unit is turned off or the battery voltage is abnormal. Also when the status of the battery is abnormal. (See Alarm LED)
③	<b>Port 1 LED</b>	<b>ON</b> - Lights when the port is connected and operating normally (can be during backup)
④	<b>Port 2 LED</b> green	<b>OFF</b> <ul style="list-style-type: none"> <li>When the port is not operating (for example, after sequential shutdown)</li> <li>When the connector is not working correctly (not connected, etc.)</li> <li>During backup.</li> </ul>
⑤	<b>Power Receptacle</b>	Connects the power cable to the backup battery charger. The unit is on when the power cable is connected to the PDU.
⑥	<b>Power Cable Retainer</b>	When locked onto the power cable, prevents the power cable from being accidentally unplugged from the power receptacle.
⑦	<b>Port 0</b>	Connect the battery cable from this port to the battery expansion unit connector on control unit #0.
⑧	<b>Port 1</b>	Connect the battery cable from this port to the battery expansion unit connector on control unit #1.

## Modular 2U SAS expansion unit connectors and LEDs

### Front panel status LEDs

SFF drives are installed and removed from the front of the modular 2U SAS expansion unit. The back of the unit contains the LEDs and connectors for attaching the unit to an AMS 2100 or AMS 2300 storage system.

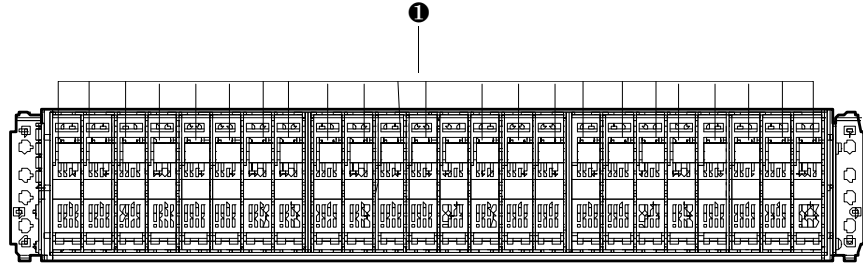
See [Figure 1-42](#), [Table 1-31](#), [Figure 1-43 on page 1-43](#), and [Table 1-32 on page 1-43](#) for information about the front panel of the modular 2U SAS expansion unit.



**Figure 1-42: Front Panel (Bezel Applied)**

**Table 1-31: Modular 2U SAS Expansion Unit Front Bezel**

Item	Description
①	POWER LED (green) <ul style="list-style-type: none"><li>• ON = expansion unit is receiving power.</li><li>• OFF = expansion unit is not receiving power.</li></ul>
②	READY LED (green) <ul style="list-style-type: none"><li>• ON = system can be operated.</li><li>• Fast blinking = internal processing is occurring, system is operational (even if the READY LED blinks).</li><li>• Slow blinking = offline download processing ended (occurs during maintenance).</li></ul>
③	LOCATE LED (orange) <ul style="list-style-type: none"><li>• ON = a failure occurred, but the expansion unit remains operational.</li></ul>



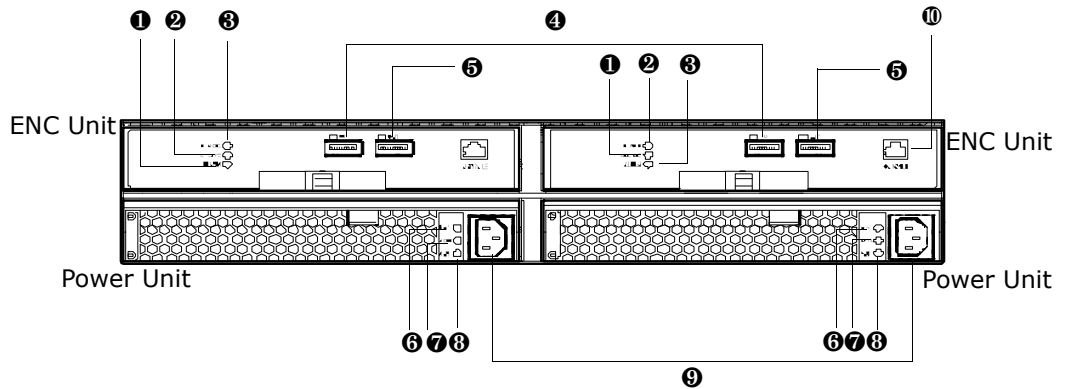
**Figure 1-43: Front Panel (Bezel Removed)**

**Table 1-32: Modular 2U SAS Expansion Unit Front Panel**

Item	Description
①	Up to 24 SFF drives

### Rear panel status LEDs

See [Figure 1-44](#) and [Table 1-33](#) for information about the rear panel of the modular 2U SAS expansion unit.



**Figure 1-44: Back Panel**

**Table 1-33: Modular 2U SAS Expansion Unit Back Panel**

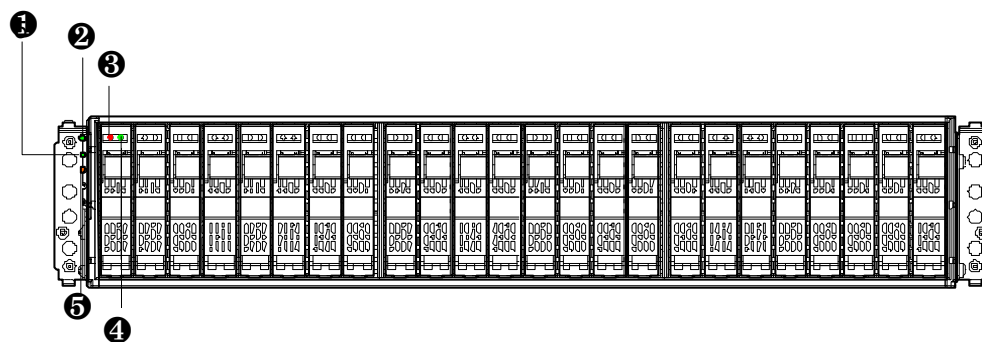
Item	Description
①	Alarm LED (red) <ul style="list-style-type: none"> <li>• ON = a failure occurred that makes the array unable to operate.</li> <li>• Slow Blinking = a serious failure has occurred while power is on. Please contact Hitachi Data Systems Technical Support. See the Getting help section in the Preface of this manual.</li> </ul>

**Table 1-33: Modular 2U SAS Expansion Unit Back Panel (Continued)**

Item	Description
②	Locate LED (orange) — lights when a modular 2U SAS expansion unit has encountered a serious error. Please contact Hitachi Data Systems Technical Support. See the Getting help section in the Preface of this manual. <ul style="list-style-type: none"> <li>• Blink one time fast = SRAM error.</li> <li>• Blink two times fast = ENC hard error.</li> <li>• Blink three times fast = firmware error in flash memory.</li> <li>• Not blinking = boot section error of ENC firmware, RAM error, or ENC hard configuration error.</li> </ul>
③	Power LED (green) <ul style="list-style-type: none"> <li>• ON = normal operation; the section is fully operational.</li> <li>• Slow Blink = firmware download is complete.</li> <li>• Fast Blink = firmware is downloading (do not turn off the array).</li> </ul>
④	IN from RKS/RKES/RKM/RKEM, RKH/RKHE/RKEH or RKAK/RKAKS/RKAKX PATH IN LED (green) appears above this connector.
⑤	OUT to RKAK/RKAKX IN PATH OUT LED (green) appears above this connector.
⑥	RDY LED (green) <ul style="list-style-type: none"> <li>• ON = DC output is normal.</li> </ul>
⑦	AC IN (green) <ul style="list-style-type: none"> <li>• ON = expansion unit is receiving power.</li> </ul>
⑧	ALM LED (red) <ul style="list-style-type: none"> <li>• ON = a failure occurred in the ENC unit, rendering it inoperable.</li> </ul>
⑨	Power receptacle (J1)
⑩	Console

### Disk drive status LEDs

Each disk drive in the modular 2U SAS expansion unit has the following LEDs.



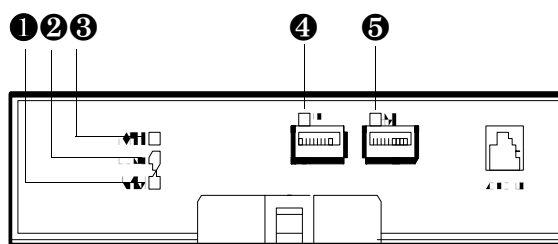
**Figure 1-45: Modular 2U SAS Expansion Tray Disk Drive LEDs**

**Table 1-34: Modular 2U SAS Expansion Tray Disk Drive LEDs**

LED	Description
①	READY LED ON = modular 2U SAS expansion unit is operational.
②	Power LED (green) ON = power is being supplied to the modular 2U SAS expansion unit.
③	HDD ALM LED (red) ON = a drive failure occurred, rendering the drive inoperable.
④	HDD ACT LED (green) ON or flashing = disk drive is operational.
⑤	LOCATE LED (orange) ON = a failure occurred, but the modular 2U SAS expansion unit remain operational.

### ENC status LEDs

The modular 2U SAS expansion unit ENC unit connects the unit to the AMS2100 or AMS 2300 base unit.



**Figure 1-46: Modular 2U SAS Expansion Tray ENC Status LEDs**

**Table 1-35: Modular 2U SAS Expansion Tray ENC Status LEDs**

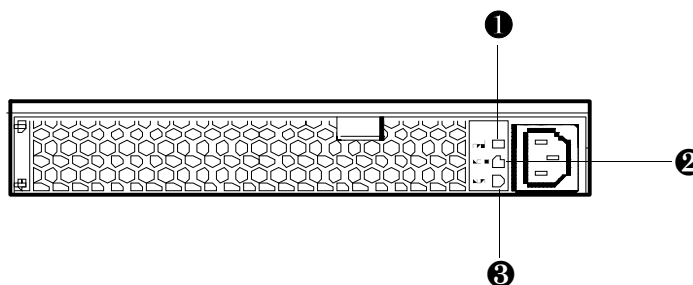
LED	Description
①	POWER LED (green) • ON = modular 2U SAS expansion tray is receiving power.
②	LOCATE LED (orange) — lights when a modular 2U SAS expansion unit ENC has encountered a serious error. Please contact Hitachi Data Systems Technical Support. See the Getting help section in the Preface of this manual. • Blink one time fast = SRAM error. • Blink two times fast = ENC hard error. • Blink three times fast = firmware error in flash memory. • Not blinking = boot section error of ENC firmware, RAM error, or ENC hard configuration error.
③	ALARM LED • ON = a failure occurred in the ENC Unit, rendering the ENC Unit inoperable.

**Table 1-35: Modular 2U SAS Expansion Tray ENC Status LEDs**

LED	Description
④	PATH 0 (IN) Side (green) <ul style="list-style-type: none"><li>• ON = IN side of the modular 2U SAS expansion tray is linked up.</li></ul>
⑤	PATH 0 (OUT) Side (green) <ul style="list-style-type: none"><li>• ON = OUT side of the modular 2U SAS expansion tray is linked up.</li></ul>

### Power supply status LEDs

The modular 2U SAS expansion unit power supply has the following LEDs.



**Figure 1-47: Modular 2U SAS Expansion Tray Power Supply Status LEDs**

**Table 1-36: Modular 2U SAS Expansion Tray Power Supply Status LEDs**

LED	Description
①	RDY LED (green) <ul style="list-style-type: none"><li>• ON = normal operation.</li></ul>
②	AC IN LED (green) <ul style="list-style-type: none"><li>• AC input to the modular 2U SAS expansion tray is operating normally.</li></ul>
③	ALM LED (red) <ul style="list-style-type: none"><li>• ON = power supply has stopped or is in an abnormal state.</li></ul>

## Identifying failed parts

This chapter describes how to verify a failed part and how to order a failed part. The following key topics are covered:

- ❑ [Identifying a failed part](#)
- ❑ [Identifying the cause of a failure](#)
- ❑ [Locating the failure](#)
- ❑ [Ordering replacement parts](#)

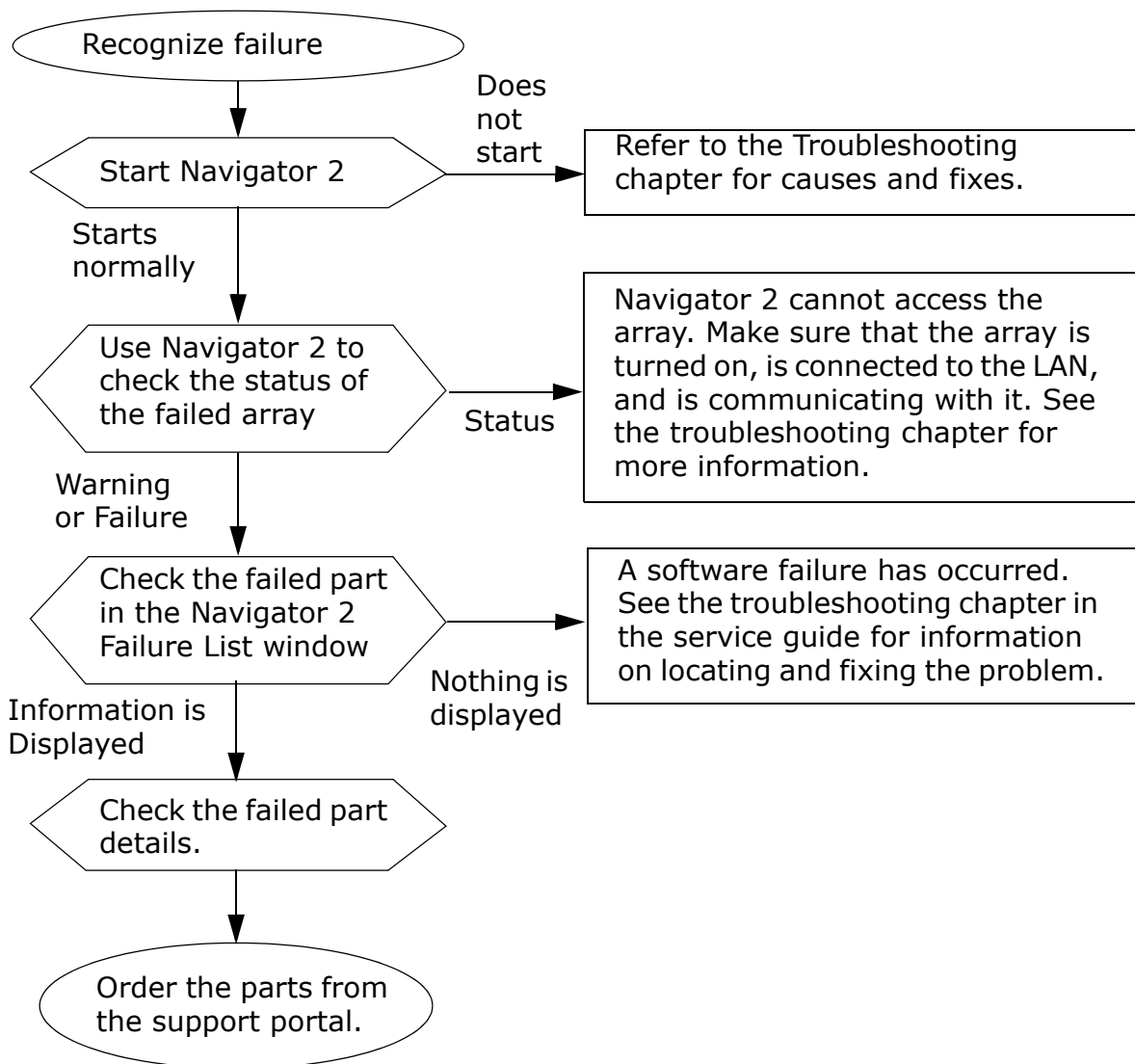
## Identifying a failed part

An AMS 2100/2300/2500 may have a failure if any of the following conditions occur:

- You are notified of a failure by email, Navigator 2, or SNMP.
- A failure is indicated by the Warning or Alarm LED on the array, or if the Ready LED continues to blink and does not light steadily.
- An abnormality such as performance deterioration is recognized by a host system connected to the array.
- When a logical unit cannot be recognized or is unstable.

## Identifying the cause of a failure

The following flowchart provides an overview of the process to locate a failed component and replace it.



**Figure 2-1: Identifying and Recovering from a Failure**

## Locating the failure

When you receive a failure notice, use the following procedure to locate the array and identify the failure.

1. Start Navigator 2.
2. On the system on which Navigator 2 is installed, start a web browser, and enter the following URL in the address field:  
**http://xxxx:23015/StorageNavigatorModular/Login**  
 where xxxx is the IP Address for the management host with Navigator 2
3. Press the ENTER key.



**NOTE:** It is possible to use a system that does not have Navigator 2 installed. After starting the web browser, enter the above URL in the address field.



**NOTE:** If Navigator 2 does not start, there may be a communication failure with the host on which Navigator 2 is running, or the host itself may not be running. Ping the management host to check communication. Restore communication as needed and then continue below.

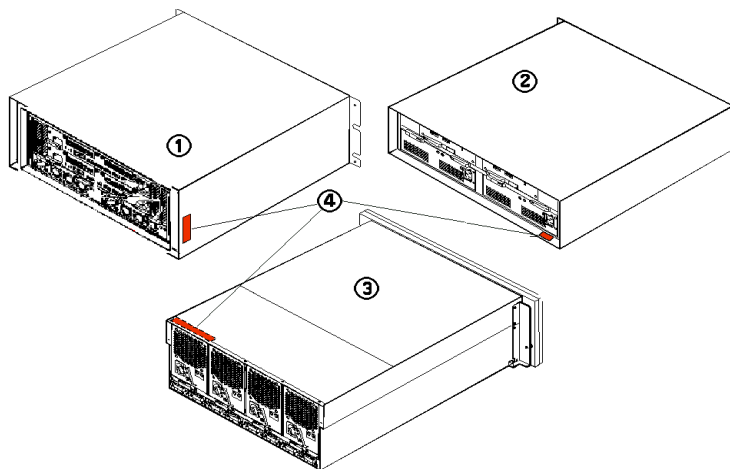
4. Check the status of the array in which the failure occurred.
  - a. Check the email or SNMP that notified you of the failure. Note the serial number of the array.

```

.....
Hardware serial number: 8100013
.....
  
```

**Figure 2-2: Checking the Mail or SNMP that Notified you of a Failure**

- b. If you have already located the array by observing warning or failure lights, obtain the serial number from the label, as shown in [Figure 2-3](#).



**Figure 2-3: Locations of Array Serial Number Labels**

**Table 2-1: Locations of Array Serial Number Labels**

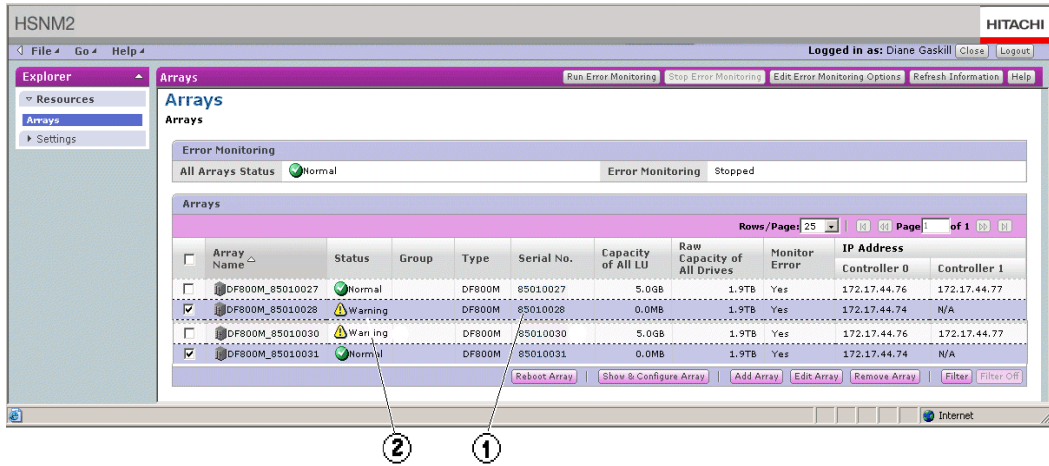
Item	Description	Item	Description	Item	Description		
①	Base Unit	②	High-density Expansion Unit	③	Expansion Unit	④	Serial Number Location

- After obtaining the serial number of the failed array, check the list of arrays in the Navigator 2 Array List window and find the serial number in the table.



**NOTE:** If Navigator 2 is already running and is not displaying the Array List window as shown in Figure 2-4, click **Arrays** in the Explorer tree to display that window.

- Check the status of the array whose serial number you have found.



**Figure 2-4: Checking the Serial number and Status of an Array**

**Table 2-2: Checking the Serial number and Status of an Array**

Item	Description	Item	Description
1	Locate the array serial number	2	Check the array status



**NOTE: Status Conditions:**

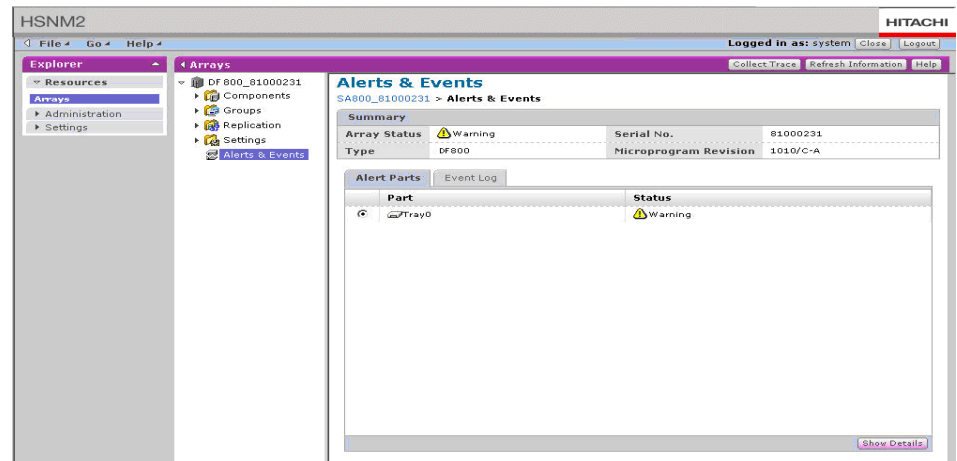
When the status is **Normal** the array is operating normally and the management node on which Navigator 2 is installed is communicating normally with the array. Check the connection between the array and the host.

When the status shows dashes (---), Navigator 2 cannot access the array. Check the array and make sure that the power is turned on and that the array is connected to the LAN. Check communication between the management host and the array. More detailed troubleshooting information is located in the Troubleshooting chapter in this manual.

## Ordering replacement parts

Click the **name** of the array. The Array Properties window and Explorer tree are displayed.

1. In the Explorer tree, click **Alerts & Events**. The Alerts & Events window is displayed. This window lists the failed components in the array.
2. Select the parts that have failed, and click **Show Details** at the lower right corner of the window. The Failed Parts dialog box is displayed.

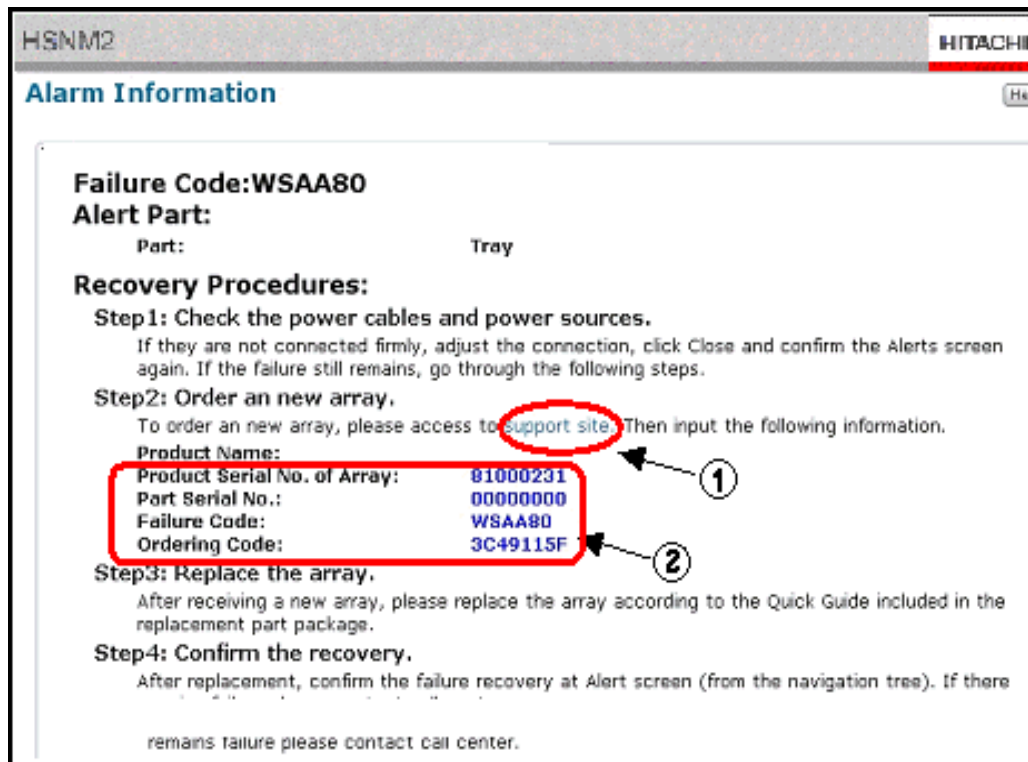


**Figure 2-5: Alerts & Events Window**

3. Check the details of the failed part. Click the support portal web site link after checking the failed part details.



**NOTE:** If the management host that has Navigator 2 installed is not connected to the Internet, note the order information, as shown in [Figure 2-6](#), and then use a system that is connected to the Internet to order parts.



**Figure 2-6: Alarm Information Window**

**Table 2-3: Alarm Information Window**

Item	Description	Item	Description
1	Click here	2	Information for order

4. Order the parts to be replaced.
  - a. Note the information as shown in the above example.
  - b. Open a web browser and go to the Hitachi Data Systems support site. Follow the support portal Web instructions.

## Replaceable parts

The replaceable parts for the Hitachi AMS 2100/2300 Storage System are described in this chapter. They can be replaced with the power turned on. This chapter covers the following key topics:

- ❑ [Overview](#)
- ❑ [Base unit](#)
- ❑ [AMS 2500 base unit parts - front](#)
- ❑ [Expansion unit](#)



**NOTE:** The AMS 2500 model is included in this manual for reference only. Hitachi Data Systems support policy does not include customer installation or maintenance for model AMS 2500, except for firmware upgrades and disk drives in the expansion units.

---

## Overview

The following parts in the Hitachi AMS 2100/2300 Storage System are replaceable. These are illustrated and described on the following pages.

**Table 3-1: Replaceable Parts Overview**

Model	Unit	Part	Notes
AMS 2100/2300	Base unit	Front Bezel Disk Drive Power Supply Backup Battery Control Unit Host Connector	Customer replaceable parts
	Expansion unit	Front Bezel Disk Drive Power Supply unit cable	Customer replaceable parts
	Hi Capacity Expansion Unit	Front Bezel Disk Drive Power Supply unit cable	No customer replaceable parts. FE only.
	Modular 2U SAS expansion unit	Front Bezel Disk Drive Power Supply unit cable	No customer replaceable parts. FE only.

**Table 3-1: Replaceable Parts Overview**

Model	Unit	Part	Notes
<b>AMS 2500</b>	AMS 2500 base unit	Front Bezel Fan Unit Power Supply Backup Battery Control Unit Host Connector	Replaceable by Hitachi Data Systems support personnel only.
	Expansion unit	Front Bezel Disk Drive Power Supply unit cable	Replaceable by Hitachi Data Systems support personnel only, except for disk drives, which are customer replaceable.
	Hi Capacity Expansion Unit	Front Bezel Disk Drive Power Supply unit cable	No customer replaceable parts. FE only.
	Modular 2U SAS expansion unit	Front Bezel Disk Drive Power Supply unit cable	No customer replaceable parts. FE only.

## Base unit

This section displays the replaceable parts on the base unit.

### AMS 2100/2300 base unit replaceable parts - front

The base unit front bezel is shown here. It is shipped with a standard key that fits the front bezel on both the base and expansion units.

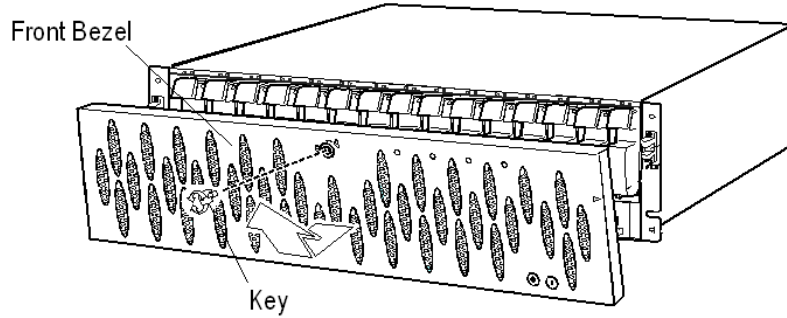
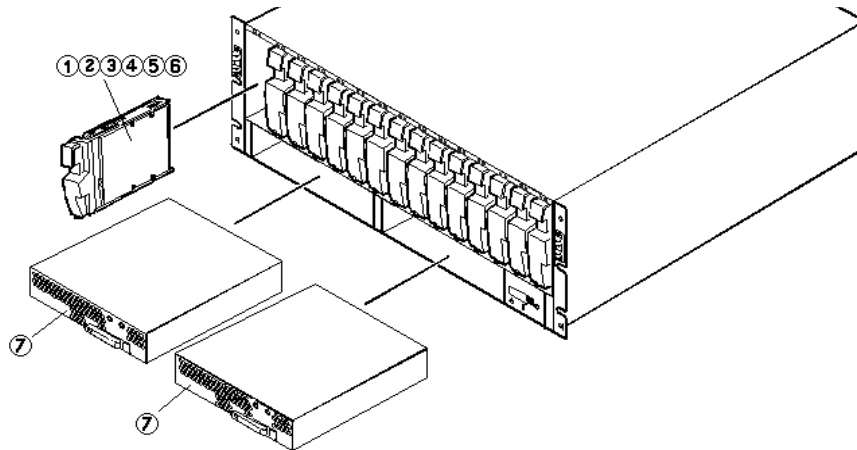


Figure 3-1 shows the base unit with the front bezel removed.



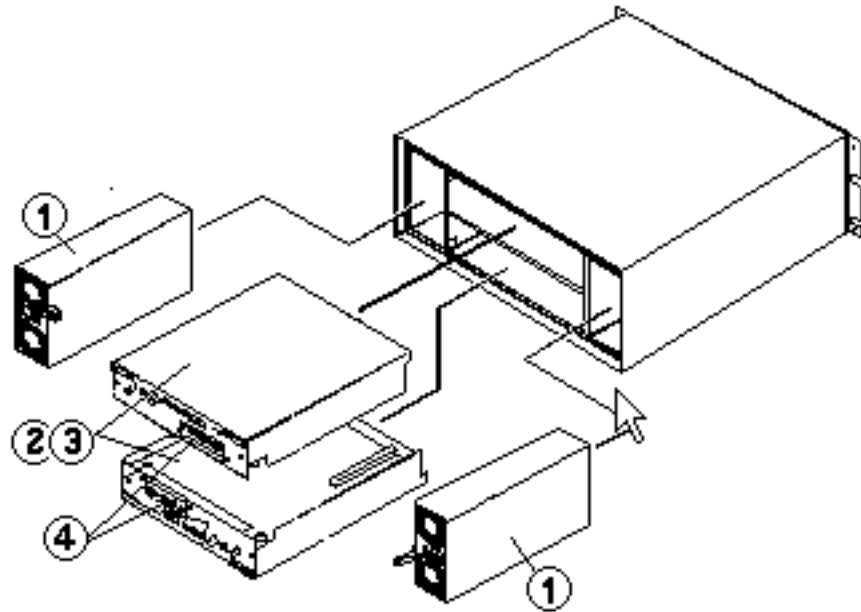
**Figure 3-1: Base Unit Replaceable Parts (Front)**

**Table 3-2: Base Unit Replaceable Parts (Front)**

No.	Part Name	Part No.	Remarks
①	Canister Unit, 146 GB Drive	3276138-A	SAS Disk Drive
	Canister Unit, 300 GB Drive	3276138-B	SAS Disk Drive
②	Canister Unit, 400 GB Drive	3276308-A	SAS Disk Drive
③	Canister Unit, 450 GB Drive	3276138-C	SAS Disk Drive
	Canister Unit, 500 GB Drive	3276139-A	SATA Disk Drive
④	Canister Unit, 600 GB Drive	3276138-D	SAS Disk Drive
⑤	Canister Unit, 600 GB Drive	3282360-A	SAS(SED) Disk Drive
	Canister Unit, 1 TB Drive	3276139-C	SATA Disk Drive
⑥	Canister Unit, 2 TB Drive	3276139-D	SATA Disk Drive
	Canister Unit, 200 GB Drive	3282195-B	Flash Drive
⑦	Canister Unit, 2000 GB Drive	3282279-A	SAS7.2K Disk Drive
	Canister Unit, 3000 GB Drive	3276139-E	SATA Disk Drive
	Cache Backup Battery (N1K)	3276079-A	Cache Backup Battery (2)

**AMS 2100/2300 base unit replaceable parts - rear**

Figure 3-2 shows the replaceable parts on the rear of the base unit.



**Figure 3-2: Base Unit Replaceable Parts (Rear)**



**Table 3-3: Base Unit Replaceable Parts (Rear)**

Item	Part Name	Part No.	Remarks
①	Power Unit (RK)	3276080-A	Power supply for AMS 2100/AMS 2300 (RKS/RKM)
②	Control Unit (SFC2)	3282005-C	Controller for AMS 2100 (RKS) Includes 4 Gbps Fibre Channel interface board and 2 GB cache memory unit (RAM)
③	Control Unit (HFC4)	3282005-A	Controller for AMS 2300 (RKM) Includes 4 Gbps Fibre Channel interface board and 2 GB cache memory unit (RAM)
④	Host Connector	3276337-A 3276337-B	Host Connector (4 Gbps) Host Connector (8 Gbps)

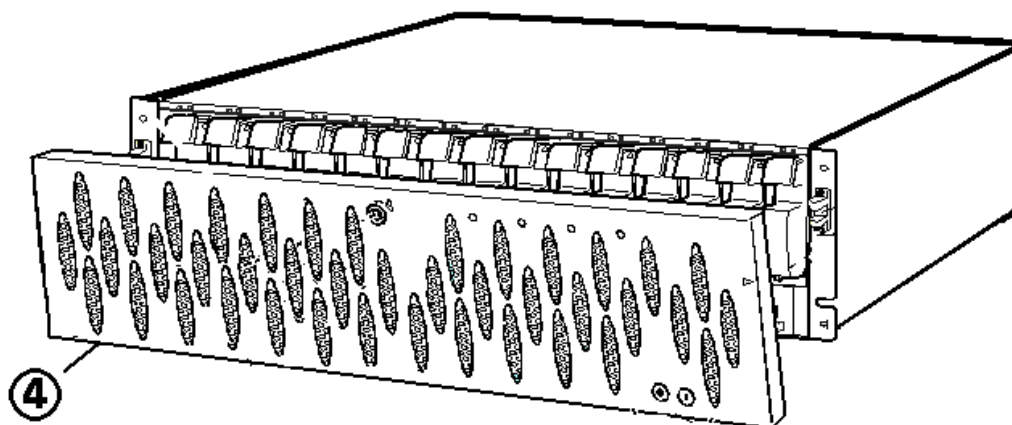
## AMS 2500 base unit

This section displays the replaceable parts on the AMS 2500 base unit.

### AMS 2500 base unit parts - front

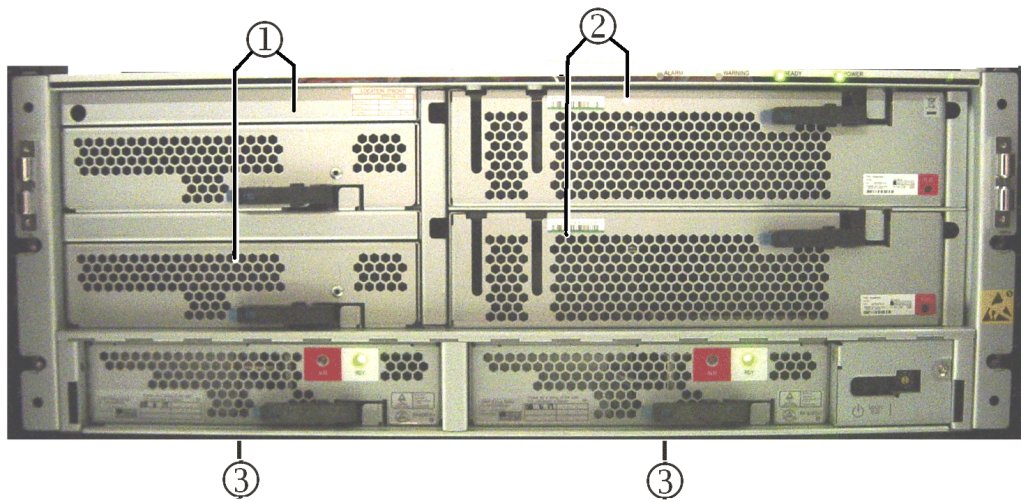
This expansion unit is serviceable only by Hitachi Data Systems authorized service representatives, and is described here for reference only.

The base unit front bezel is shown in [Figure 3-3](#). It is shipped with a standard key that fits the front bezel on both the base and expansion units.



**Figure 3-3: Base unit with the front bezel removed**

[Figure 3-4](#) shows the base unit replaceable parts.



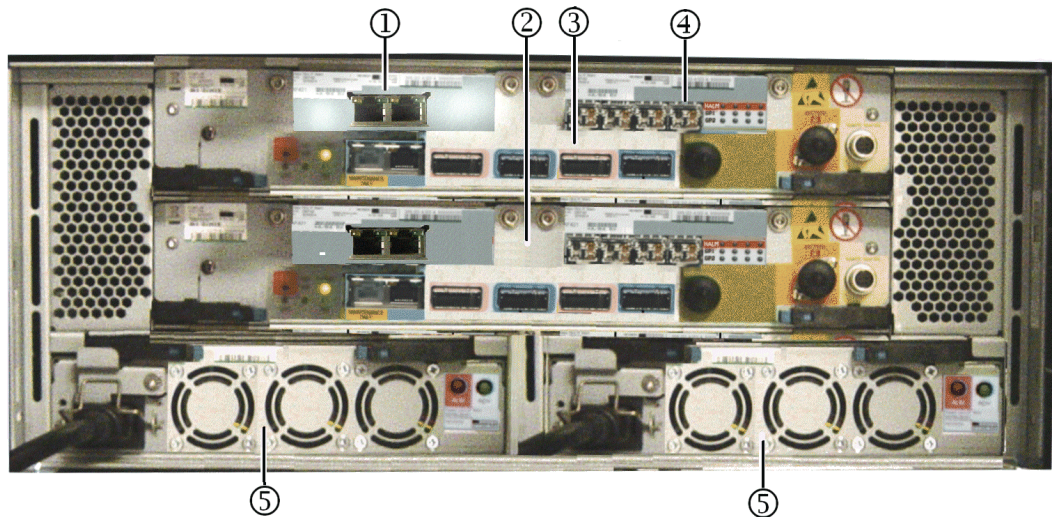
**Figure 3-4: AMS 2500 Base Unit Replaceable Parts (Front)**

**Table 3-4: AMS 2500 Base Unit Replaceable Parts (Front)**

No.	Part Name	Part No.	Remarks
①	Optional Cache Backup Battery (N1K)	3276079-A	Cache Backup Battery (2)
②	Fan Unit	3276374-A	FAN Assembly for AMS 2500 (RKHE2)
③	Cache Backup Battery (N1K)	3276079-A	Cache Backup Battery (2)
④	Front Bezel	3276156-A	Front Bezel Assembly for AMS 2500 (RK2/RKHE2)

## AMS 2500 base unit replaceable parts - rear

This section shows the replaceable parts on the rear of the base unit.



**Figure 3-5: AMS 2500 Base Unit Replaceable Parts (Rear)**

**Table 3-5: AMS 2500 Base Unit Replaceable Parts (Rear)**

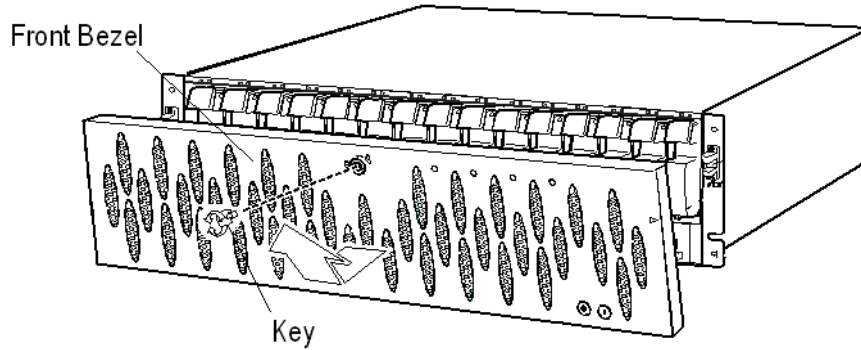
Item	Part Name	Part No.	Remarks
①	iSCSI Connector		
② ③	Control Unit	3282006-A (2 GB RAM) 3282006-B (4 GB RAM)	Controller for AMS 2500 Includes Fibre Channel interface board and either 2 GB or 4 GB cache memory unit (RAM)
④	Host Connector	3276337-A 3276337-B	Host Connector (4 Gbps) Host Connector (8 Gbps)
⑤	Power Unit	3276255-A	Power supply for AMS 2500 (RKHE2)

## Expansion unit

This section displays the replaceable parts on the expansion unit.

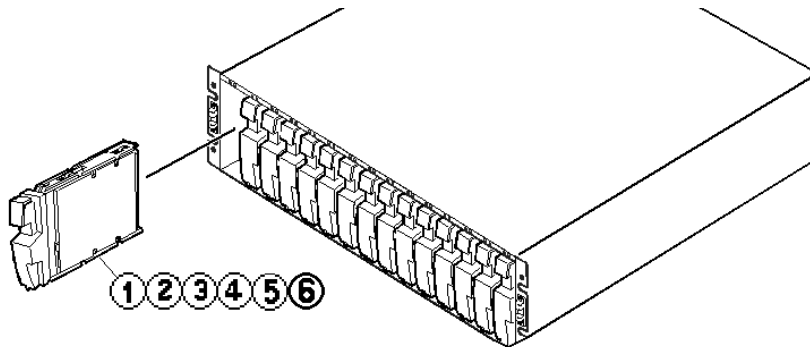
### Expansion unit replaceable parts - front

The expansion unit front bezel is shown in [Figure 3-6](#). It is shipped with a standard key that fits the front bezel on both the base and expansion units.



**Figure 3-6: Expansion Unit front bezel and key**

[Figure 3-7](#) shows the expansion unit replaceable parts.

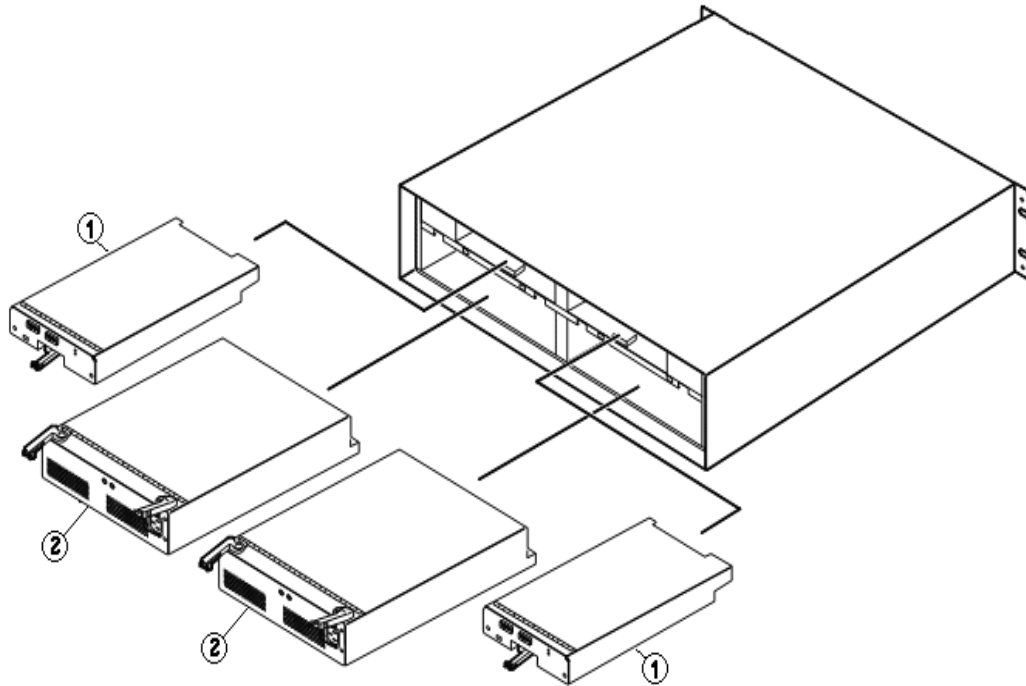


**Figure 3-7: Expansion Unit Replaceable Parts (Front)**

**Table 3-6: Expansion Unit Replaceable Parts (Front)**

<b>Item</b>	<b>Part Name</b>	<b>Part No.</b>	<b>Remarks</b>
① ② ③ ④ ⑤ ⑥	Canister Unit, 146 GB Drive	3276138-A	SAS Disk Drive
	Canister Unit, 300 GB Drive	3276138-B	SAS Disk Drive
	Canister Unit, 400 GB Drive	3276308-A	SAS Disk Drive
	Canister Unit, 450 GB Drive	3276138-C	SAS Disk Drive
	Canister Unit, 500 GB Drive	3276139-A	SATA Disk Drive
	Canister Unit, 600 GB Drive	3276138-D	SAS Disk Drive
	Canister Unit, 600 GB Drive	3282360-A	SAS(SED) Disk Drive
	Canister Unit, 1 TB Drive	3276139-C	SATA Disk Drive
	Canister Unit, 2 TB Drive	3276139-D	SATA Disk Drive
	Canister Unit, 200 GB Drive	3282195-B	Flash Disk Drive
	Canister Unit, 2000 GB Drive	3282279-A	SAS7.2K Disk Drive
	Canister Unit, 3000 GB Drive	3276139-E	SATA Disk Drive

## Expansion unit replaceable parts - rear



**Figure 3-8: Expansion Unit Replaceable Parts (Rear)**

**Table 3-7: Expansion Unit Replaceable Parts (Rear)**

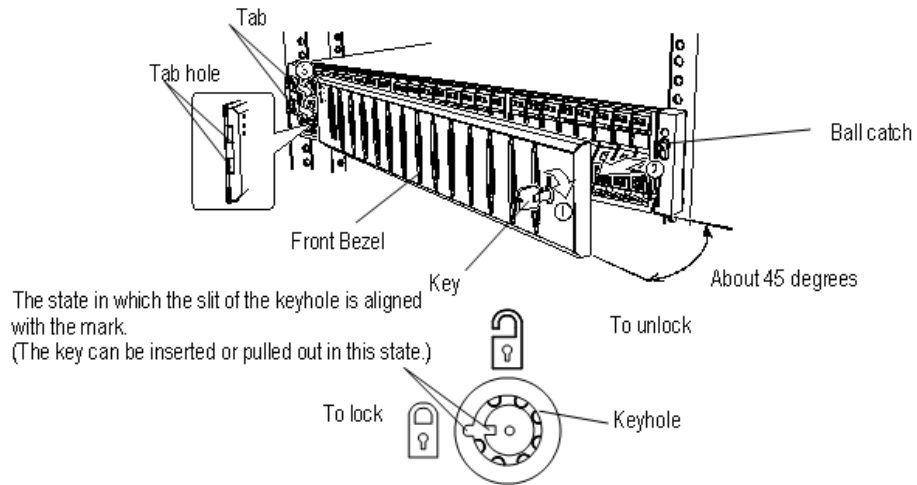
Item	Part Name	Part No.	Remarks
①	Enclosure Control Unit	3276159-A	Controller for expansion unit
②	Power Supply	3276081-A	Replaceable power supply for RKAK expansion unit

## Modular 2U SAS expansion unit

This section displays the replaceable parts on the modular 2U SAS expansion unit.

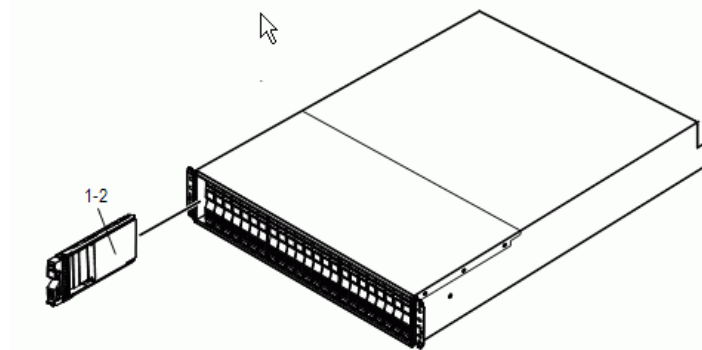
### Modular 2U SAS expansion unit replaceable parts - front

The modular 2U SAS expansion unit front bezel is shown in [Figure 3-9](#). It is shipped with a standard key that fits this unit only.



**Figure 3-9: Modular 2U SAS Expansion Unit Front Bezel and Key**

[Figure 3-10](#) shows the replaceable parts on the front of the modular 2U SAS expansion unit.



**Figure 3-10: Modular 2U SAS Expansion Unit Replaceable Parts (Front)**

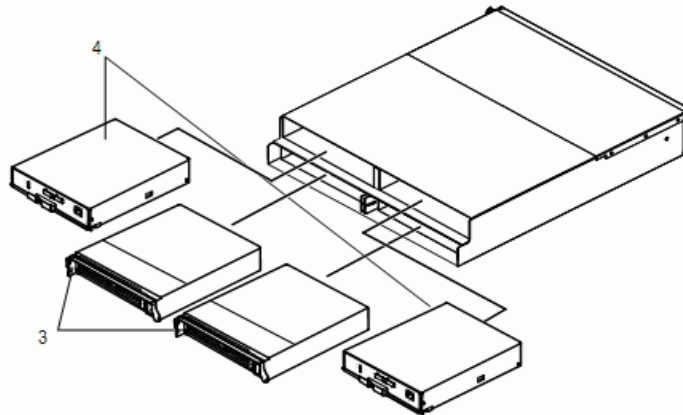
**Table 3-8: Modular 2U SAS Expansion Unit Replaceable Parts (Front)**

Item	Part Name	Part No.	Remarks
1	Canister Unit of 300GB Drive	3282389-C	SAS Disk Drive
2	Canister Unit of 600GB Drive	3282389-A	SAS Disk Drive

## Modular 2U SAS expansion unit replaceable parts - rear

Figure 3-11 shows the replaceable parts on the rear of the modular 2U SAS expansion unit.

**Figure 3-11: Modular 2U SAS Expansion Unit Replaceable Parts (Rear)**



**Table 3-9: Modular 2U SAS Expansion Unit Replaceable Parts ((Rear)**

Item	Part Name	Part No.	Remarks
3	Power Unit (RKA KS)	3282444-A	Power supply for modular 2U SAS expansion unit
4	Enclosure Control Unit	3282443-A	

### Other system components

The AMS 2100/2300 and the AMS 2500 systems support the high-density expansion unit. The AMS 2500 also supports rack-mounted battery expansion units. Chapter 1 in this service guide contains information about these units for reference. However, these units are not customer installable, serviceable, or replaceable. If you need assistance with these units, please contact your authorized Hitachi Data Systems service representative.

## Replacing parts

This chapter describes how to remove and install parts on the Hitachi AMS 2100/2300 Storage System. The following key topics are covered:

- Before starting maintenance
- Replacing a front bezel
- Replacing a disk drive
- Replacing a power supply
- Replacing a backup battery
- Replacing a control unit
- Replacing a host connector
- Replacing an ENC unit
- Replacing an ENC cable
- Replacing parts in a high-density expansion unit



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**NOTE:** Hitachi Data Systems support policy does not include end-user installation or maintenance for model AMS 2500, base unit, the high-density expansion unit, or the battery expansion unit. However, the Hitachi Data Systems Customer Assist program allows users to upgrade firmware in the AMS 2500 and add or replace disk drives in the RKAK expansion unit.

---

## Before starting maintenance

Even if you are an experienced storage administrator or technician, please take the time to read the instructions before doing anything. The few minutes you spend ahead of time can save you a lot of time later.

### Prerequisites

Please read this entire section before beginning any work on an array.



---

**CAUTION! Back up your data before adding or replacing hardware components. If a part is installed or configured incorrectly, it is possible to lose data from the system. Hitachi Data Systems strongly recommends that you back up your data to a remote array before beginning hardware upgrades or replacements.**

**When hot-swapping parts, complete the installation of the replacement part within ten minutes. If a slot in any unit in the array is left open for more than ten minutes, the loss of cooling air could cause the unit to overheat and shut down.**

**Wait at least 20 seconds after removing a part from the system before replacing it.**

**Do not replace any parts while the green Ready LED on the front of the base unit is blinking at high speed because the firmware is being downloaded at that time. Wait until the Ready LED is ON before replacing parts. Note that the download can take as much as 30 to 50 minutes on an AMS 2100/2300 or 40 to 60 minutes for an AMS 2500.**

**If you remove a SAS self-encrypting drive (SED) from an array, a Data At Rest Encryption feature locks the drive, completely preventing access to its contents. Data cannot be accessed until the drive is placed back into the original array by IT administration and unlocked. If the drive is installed in a different array, the drive becomes unusable and requires intervention by Technical Support. To avoid this situation, always check that you are installing the correct SAS (SED) drive into the appropriate array.**

---

In addition to these prerequisites, also see the safety instructions in the [Safety guidelines](#) section of this manual.

Before adding or replacing any hardware components in either a base unit or an expansion unit, protect your data from accidental loss. The following paragraphs provide important information that can help protect your array from accidental loss of data.

1. The procedure to add an optional component varies depending on the component being added and the location where the component is to be installed.
2. **Before adding, removing, or replacing a part, read the entire procedure.** If you have any questions about the procedure, please call Hitachi Data Systems Technical Support before starting the procedure. It is a lot easier, faster, and less costly than fixing something afterward.

3. Determine whether the work must be done with the array power on or off.
  - The power on condition refers only to the array power and does not consider whether the host power is turned on or off.
  - The power off condition refers only to the array power and does not consider whether the host power is turned on or off.
4. When adding an optional component, change the settings of the array using a management console connected via a LAN. Do the following before starting the addition of an optional component:
  - Set up a management console on which Navigator 2 is installed.
  - Determine whether the array is operable via a LAN.
5. **Ready LED Status.** Do not add or replace any hardware components while the green Ready LED on the front of the base unit is blinking at high speed. When it is blinking at high-speed, the ENC firmware is being downloaded. Depending on the LAN connection and traffic on the LAN, this could take from 30 to 50 minutes on an AMS 2100/2300 or from 40 to 60 minutes on an AMS 2500. Wait at least 30 seconds after the Ready LED lights steadily before making any changes to the hardware.
6. **Warning LED Status.** Do not add or replace any hardware components while the orange Warning LED on the front of the base unit is blinking at high speed. When it is blinking at high-speed, the flash program within the firmware is being updated. This could take from 30 to 85 minutes. Wait at least 30 seconds after the Warning LED goes out and the Ready LED lights steadily before making any changes to the hardware.

If you replace the control unit, you must also upgrade the firmware on that unit. See Chapter 10, *Upgrading the Firmware* in the *Hitachi AMS 2100/2300 Users Guide*, for instructions to upgrade the firmware.

## Unpacking, removing, and replacing parts

Observe the following guidelines when working on the AMS 2100/2300. Failure to follow these guidelines may result in bodily injury or damage to the array chassis or parts. In addition to these safety guidelines and the safety guidelines in each set of instructions, read and follow the warnings and instructions in the safety section at the beginning of this manual.



**ELECTRIC SHOCK HAZARD!** When replacing a part with the array power turned on, do not wear metallic accessories or a watch in order to avoid an electric shock. Do not touch any live parts with a screwdriver or other object.

---



**CAUTION!** Do not disassemble or modify any replacement parts. Most of the parts are precision devices that can be damaged if handled or used incorrectly, dropped, or disassembled. You could also injure yourself or others by incorrectly handling or using the parts that are heavy. In addition, incorrect handling or usage may void the warranty.

---



**Static-sensitive. Ground yourself before touching.**

Most of the replacement parts can be damaged by static electricity. Observe the cautions in the sections that explain how to remove and replace parts. Wear an anti-static wrist strap that is connected to the array chassis when handling static-sensitive parts.

---

## Replacing a front bezel

This section covers replacement of the front bezel on the base unit, expansion unit, and modular 2U SAS expansion unit.

### Tool needed

Front bezel key.

### Before you begin

Note the following precautions before installing or removing a front bezel.



**CAUTION!** Attach and remove the front bezel carefully. Otherwise, you may pinch your fingers between the bezel and the chassis as it snaps closed.

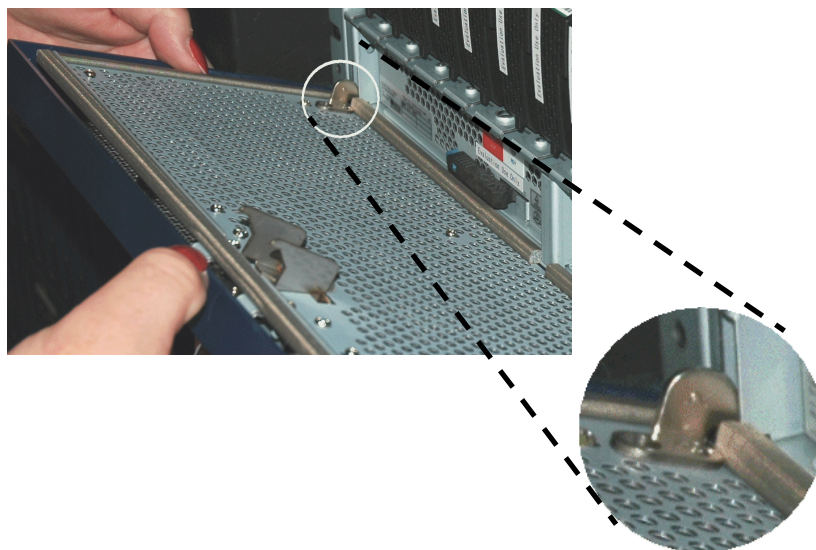


**NOTE:** When installing or removing the front bezel, be careful not to operate the main switch with the hook or the ON/OFF button of the front bezel. You must unlock the front bezel before you can remove it. The same key fits both the base unit front bezel and the expansion unit front bezel.

### Removing the front bezel

Complete the following steps to remove the front bezel.

1. Insert the key into the keyhole on the front bezel and unlock the lock. The key cannot be removed from the lock when the lock is in the unlocked position.
2. Grasp the front bezel on both sides and above the center of the unit. Pull the front bezel toward you to disengage it from the ball catches. The bezel will then swing outward at the top.
3. Disengage the two hooks of the front bezel from the slots on the array chassis by lifting the bezel upward and then pulling it out and away from the base or expansion unit.



**Figure 4-1: Removing the Front Bezel**

**Table 4-1: Removing the Front Bezel**

Item	Description	Item	Description
①	Hook (on back side of bezel)	③	ON/OFF button
②	Key	④	Ball catches

## Removing the front bezel on the modular 2U SAS expansion unit

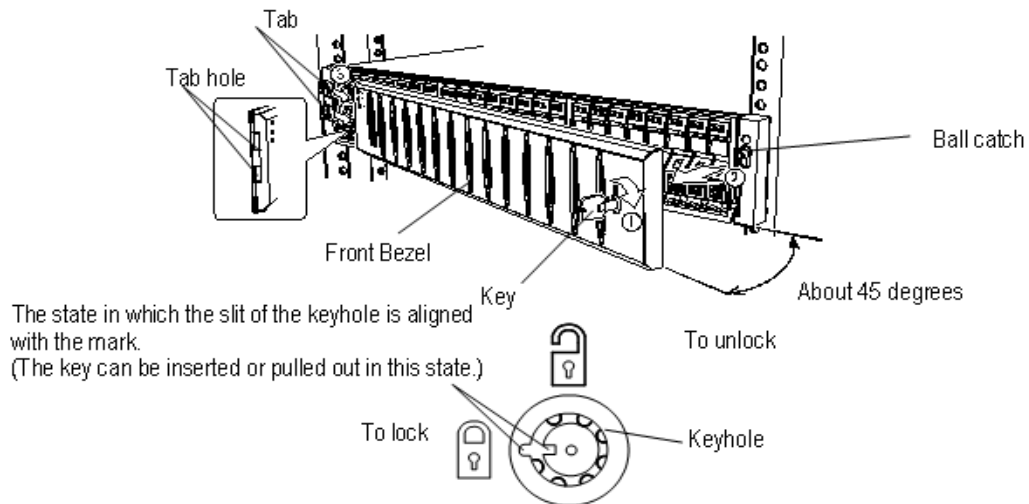
Complete the following steps to remove the front bezel from the modular 2U SAS expansion unit.

1. Insert the key into the keyhole on the front bezel and unlock the lock. The key cannot be removed from the lock when the lock is in the unlocked position.
2. Hold the bottom right part of the front bezel, then pull the front bezel toward you and disengage the right side of the front bezel from the ball catches.



**NOTE:** When the front bezel is removed, open the bezel no more than 45 degrees in relation to the array. If you open it too far, you can damage the front bezel.

3. Remove the front bezel from the claws on the left side of the array's main body.



**Figure 4-2: Removing the Front Bezel on the Modular 2U SAS Expansion Unit**

## Attaching a front bezel

Complete the following steps to attach the front bezel to the array chassis.



---

**CAUTION! Attach the front bezel carefully. Otherwise, you may pinch your fingers between the bezel and the chassis as it snaps closed.**

---



---

**NOTE:** When installing or removing the front bezel, be careful not to operate the main switch with the hook or the ON/OFF button of the front bezel. You must unlock the front bezel before you can install it.

---

1. Insert the key into the keyhole on the front bezel and unlock the lock.
2. Grasp the front bezel on both sides and above the center of the unit.
3. Engage the two hooks at the bottom of the front bezel into the slots on the array chassis, as shown in [Figure 4-1](#).
4. Push the front bezel toward the chassis to engage it into the ball catches.
5. Remove the key from the front bezel and store it in a safe place.

## Attaching a front bezel to the modular 2U SAS expansion unit

Complete the following steps to attach the front bezel to the modular 2U SAS expansion unit.



---

**CAUTION! Attach the front bezel carefully. Otherwise, you may pinch your fingers between the bezel and the chassis as it snaps closed.**

---

1. Insert the key into the keyhole on the front bezel and unlock the lock.
2. Insert the claw on the front side of the subsystem main body into the claw hole in the front bezel.
3. Fix the front bezel by pressing the right side of the front bezel to engage the hook of the front bezel with the ball catch.
4. Remove the key from the front bezel and store it in a safe place.

## Replacing a disk drive

The hot-swappable feature of the Hitachi Data Systems AMS 2000 storage systems allows disk drive replacement with the array power ON. This procedure describes how to replace a disk drive when the array power is on.

### Tools needed

- Anti-static wrist strap
- Navigator 2

### Before you begin

Before replacing a disk drive, read the following information.



**CAUTION!** Back up all user data before replacing a disk drive in the RAID 0 configuration or when a spare disk is not set. When the RAID group and logical unit are deleted or formatted, related user data will be lost.

**Disk drives must be removed and replaced with the power on.**

**When hot-swapping parts, do not leave any slot in the array open for more than ten minutes. Otherwise, the loss of cooling air could cause the unit to overheat and shut down.**

**Wait at least 20 seconds after removing a part from the system before replacing it.**

**Do not replace any parts while the green Ready LED on the front of the base unit is blinking at high speed because the firmware is being downloaded at that time. Wait until the Ready LED is ON before replacing parts. Note that the download can take as much as 30 to 50 minutes on an AMS 2100/2300 or 40 to 60 minutes for an AMS 2500.**

---



**NOTE:** If the Power Saving storage feature is installed on the array, do not install a disk drive while the drives are spinning up. Otherwise, the drive failure may not recover, the Alarm LED may stay ON, and the unit will not cycle to the ready state.

The message "I1GY00 The request of spin up of disk drives is accepted" is displayed in the Navigator 2 Alerts and Events window indicates that the drives are starting to spin up. If you see this message, wait until the message "spin up of disk drives completed" is displayed in the Alerts and Events window in Navigator 2 before installing a part.

If you have inserted a part while the drives are spinning up, remove the part, wait at least 20 seconds, and install the part again. This should clear the failure and allow the part to cycle to the ready state.

You can replace a disk drive in the RAID 0 configuration with a spare disk only after data migration to the spare disk by dynamic sparing has completed normally. When the data migration to the spare disk has failed, replace the disk drive using the procedure for RAID 0 without a spare disk.

User data cannot be backed up when a disk drive targeted for the replacement is blocked or when there is a blocked disk drive in the RAID Group to which the disk drive targeted for the replacement belongs.

---

## Unpacking a disk drive

1. Remove the disk drive from its static-protective container.
2. Verify that the disk drive is the correct model number.
3. Return the disk drive to the container or place it on an antistatic mat until you are ready to install it.

## Verifying a failed disk drive

Verify that the disk drive has failed. See [Chapter 2, Identifying failed parts](#).

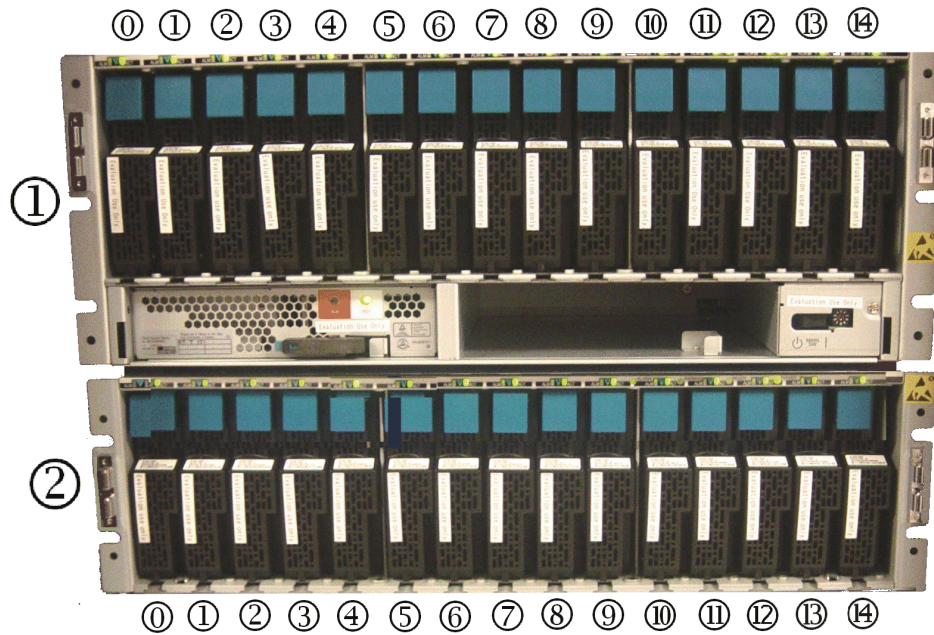
## Disk drive locations

As shown in [Figure 4-3](#), the disk drive numbering in an array is #0 to #14 from the left to right viewed from the front of the array SAS expansion unit. The same numbering applies to both the base unit and the expansion unit.



**NOTE:** Disk drive slots use the same numbers whether they contain a drive or not.

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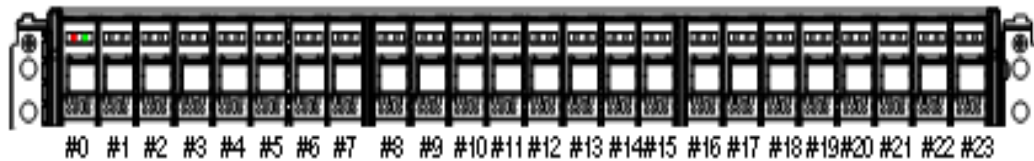


**Figure 4-3: Base and Expansion Unit Disk Drive Numbering**

**Table 4-2: Base and Expansion Unit Disk Drive Numbering**

Item	Description	Item	Description	Item	Description
①	Base Unit	②	Expansion Unit	0-14	Disk Drive Slot Numbers

As shown in [Figure 4-4](#), the disk drive numbering on the modular 2U SAS expansion unit is #0 to #23 from the left to right viewed from the front of the unit.



**Figure 4-4: Modular 2U SAS Expansion Unit Disk Drive Numbering**

## Replacing a disk drive



**NOTE:** Disk drives are replaceable only while the power is turned on. If the LEDs do not indicate the correct status as described in the steps below, or if there is any indication in the error log or Navigator 2 Alerts windows that two drives in the same RAID Group have failed, please contact Hitachi Data Systems Support for assistance. See the [Getting help](#) section in the Preface for information on how to contact Support.



**CAUTION!** Back up any user data before replacing a disk drive in the RAID 0 configuration. When a RAID group and logical unit are deleted or formatted, related user data will be lost.

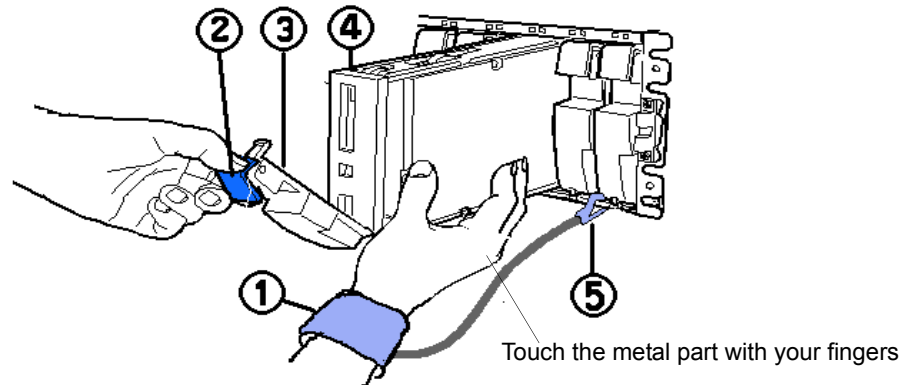
Complete the following steps to replace a failed disk drive. This procedure is used when replacing a disk drive in RAID 0, 1, 5, 6, or 1+0 configuration and the Alarm LED is ON.

1. Remove the front bezel from the base or expansion unit.
2. Verify that the Alarm LED on the failed drive is ON.
3. **Important!** If a spare disk is not set, or if the drive is in the RAID 0 configuration, back up the data on the failed drive. Note that this is not done automatically.
4. Remove the failed disk drive from the unit. See [Removing a disk drive on page 4-12](#).
5. Wait at least 20 seconds but not more than ten minutes after removing the failed drive and then install a replacement disk drive. See [Installing a disk drive on page 4-13](#).
6. The Alarm LED on the replacement drive should go out about 5 minutes after the new drive is installed.
7. As soon as the replacement disk reaches the ready state, the data from the failed disk is automatically copied to the replacement disk and the failure recovery is displayed in Navigator 2.
8. Launch Navigator 2 and display the Alerts window.
9. Double click the disk drive under Recovery Procedure (indicated in yellow) in the Component Status Tag. Verify that the failure has recovered.
10. Verify that the Warning LED on the front panel of the base unit goes out.
11. Verify that the Ready LED on the front panel of the base unit is ON.
12. When all disk drives are operating normally, attach the front bezel.

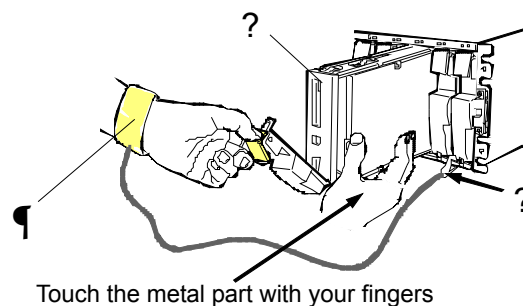
## Removing a disk drive

Before beginning the procedure to add or remove a disk drive, ensure that the prerequisites listed on the previous pages have been met.

1. If you have not already done so, put on an Anti-static wrist strap.
2. Lift the blue lock tab to unlock the lock lever and pull the lock lever outward. As you do this, the lever pulls the drive out of the unit and unplugs it from the connectors inside the unit.
3. Holding the disk drive, as shown in [Figure 4-5](#) (or [Figure 4-6](#) for the modular 2U SAS expansion unit), carefully slide the disk drive out of the unit and place it in a static protective bag.
4. Follow the instructions below to install a replacement disk drive.



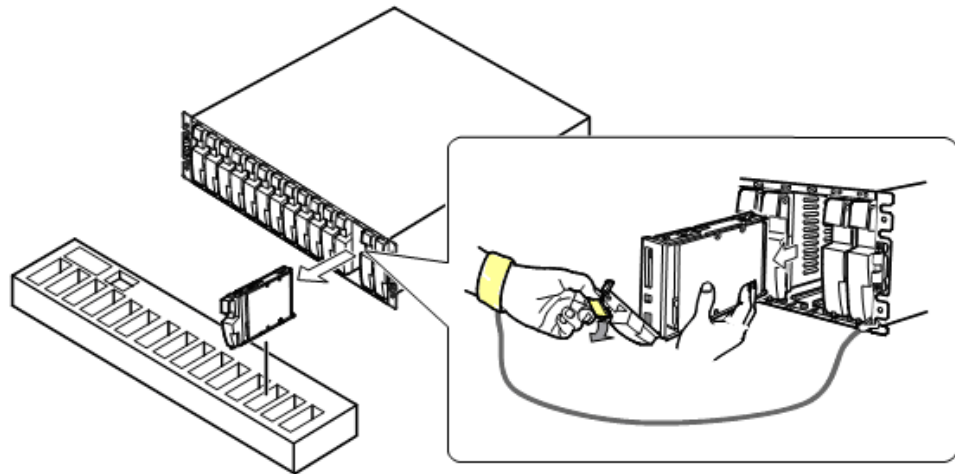
**Figure 4-5: Removing a Disk Drive**



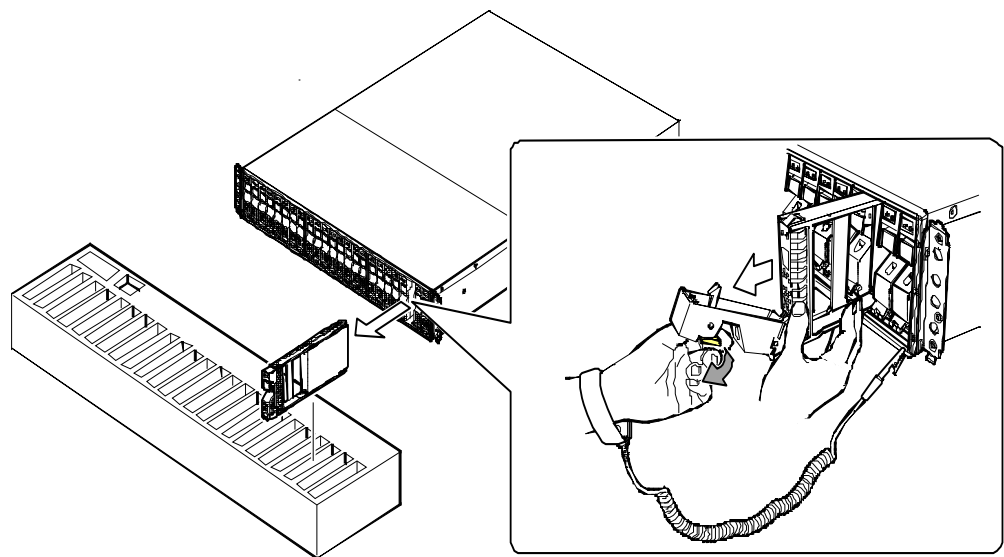
**Figure 4-6: Removing a Disk Drive (Modular 2U SAS Expansion Unit)**

**Table 4-3: Removing a Disk Drive**

Item	Description	Item	Description	Item	Description
①	Anti-static wrist strap	③	Lock Lever	⑤	Anti-static wrist strap clip
②	Lock Tab	④	Disk Drive		



**Figure 4-7: Removing a Disk Drive**



**Figure 4-8: Removing a Disk Drive from Modular 2U SAS Expansion Unit**

## Installing a disk drive

Before beginning the procedure, ensure the prerequisites on the previous page have been met.



**NOTE:** If you are installing multiple drives, remove only one drive filler at a time and install a drive in the slot before removing the next drive filler.

1. If you have not already done so, put on an anti-static wrist strap.
2. Unpack the new disk drive and put the drive on an antistatic mat.
3. If you are adding a new disk drive to expand storage capacity, loosen the mounting screws and remove the filler (dummy disk drive cover) from the slot where you want to install the new drive. You may note that cooling air is coming out of the open slot.

4. Taking care not to apply any mechanical shock to it, install the new disk drive in the open slot.
  - a. Fit the disk drive in the guide rail of the chassis and slide it in the direction shown by the arrow on the disk drive frame.
  - b. Push the disk drive in until it reaches the position where the tab on the bottom of the lock lever on of the handle can be entered into the rectangular hole at the lower part of a frame on the front side of the unit.

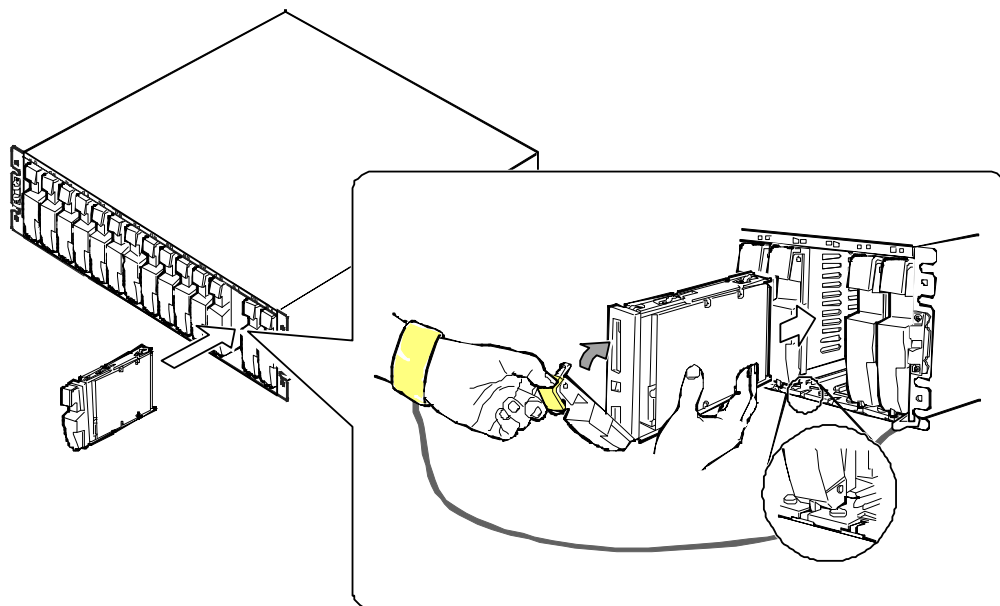


**NOTE:** If the lock lever is closed or nearly closed when you slide the disk into the slot, the tab on the bottom will catch on the front of the unit and cannot be inserted into the slot in the chassis. Be sure the lock lever is open far enough when you slide the disk in so that the tab can be inserted in the slot.

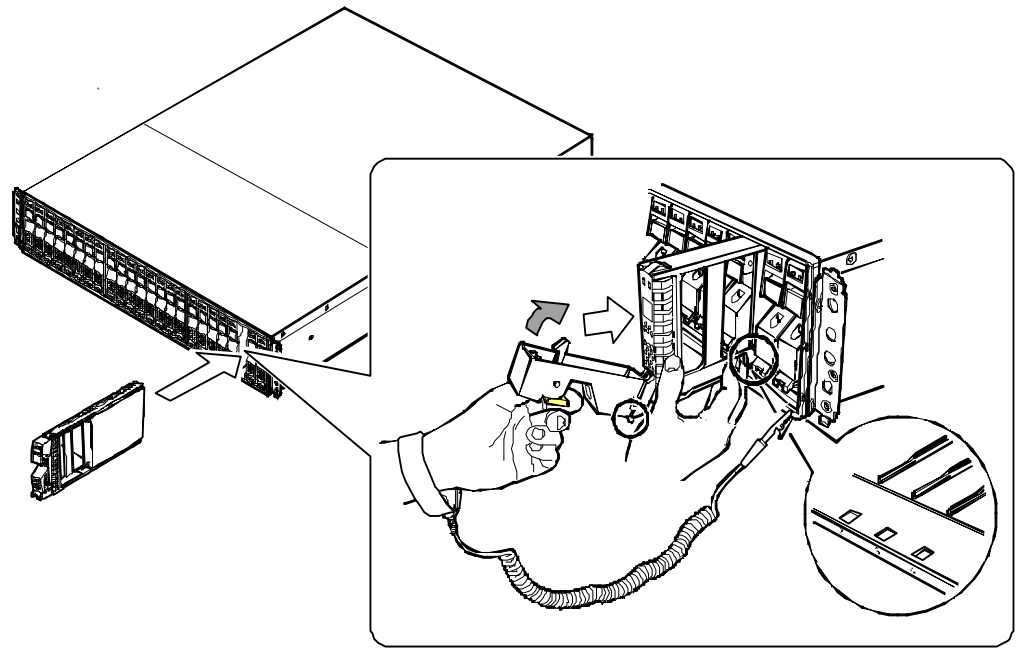
5. Push the lock lever inward until the lock tab clicks.
6. Verify that the drive begins to run (spin up) as soon as it is fully inserted into the slot and is connected electrically to the unit.

If the drive is a replacement for a failed drive, as soon as the replacement drive is operational, the system will begin copying data to it. It takes approximately 1-1/2 minutes to copy the data to the new drive.

7. Repeat steps 3 through 6 for each disk drive that you are installing or replacing.
8. When you have installed all the new or replacement drives, replace the front bezel.



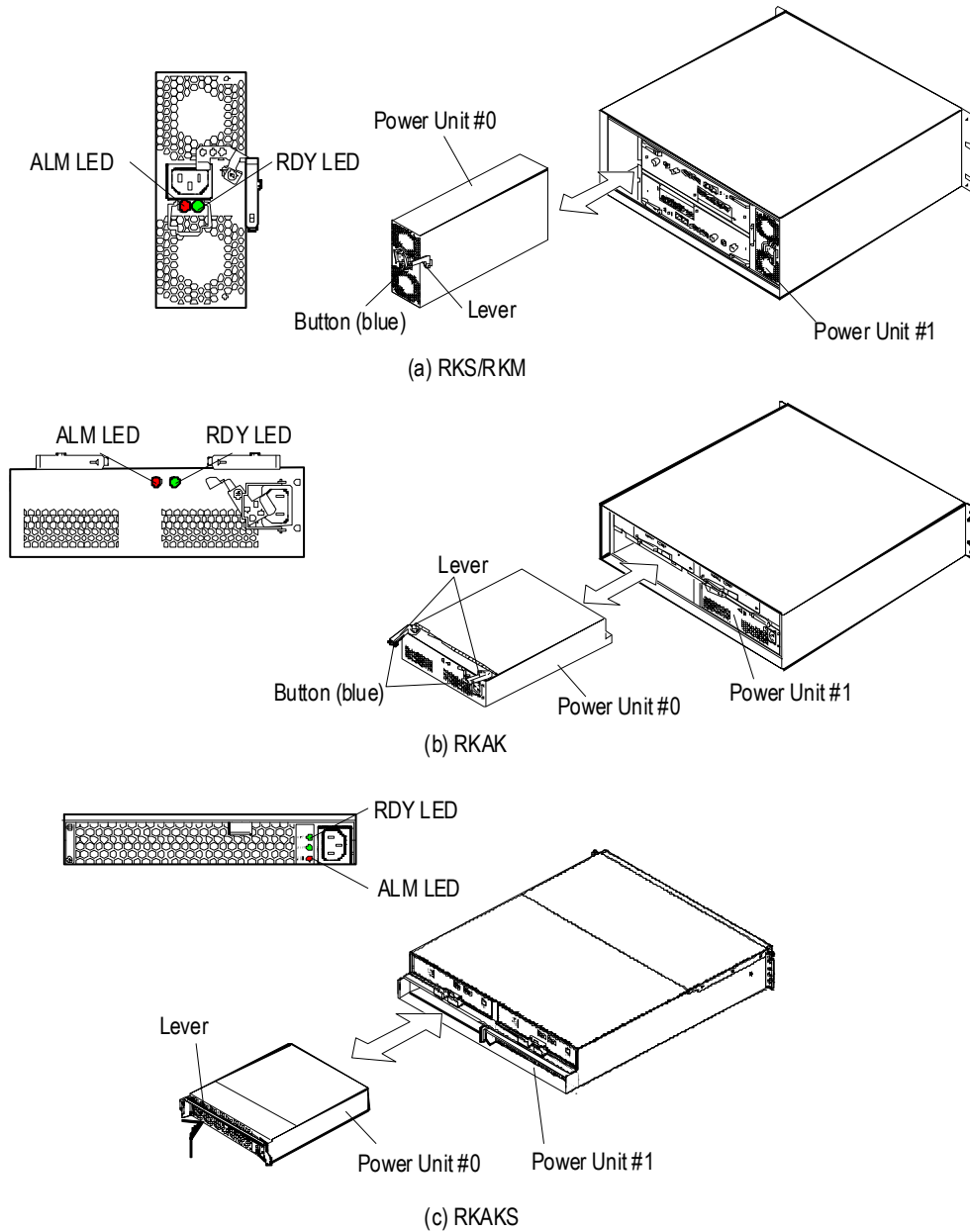
**Figure 4-9: Installing a Disk Drive**



**Figure 4-10: Installing a Disk Drive into Modular 2U SAS Expansion Unit**

# Replacing a power supply

This procedure describes how to replace the base unit power supply and an expansion unit power supply.



**Figure 4-11: Base and Expansion Unit Power Supplies**



**NOTE:** The power supplies for the base unit and expansion unit are different models. Check the model number on the failed power supply before ordering a new one and check the model number on the new power supply to make sure it matches the model number on the failed unit.

## Tool needed

Navigator 2.

## Before you begin

Before beginning work, read the following information.



**CAUTION!** Do not leave a slot open for more than 10 minutes when replacing a part in a unit that has the power turned on. Loss of cooling air can cause the unit to overheat and shut down.

When replacing both power supplies, replace them one at a time, or replace both of them while the power is turned off.

When the power supply and another module fail at the same time, replace the power supply first. Otherwise, a powering off (subsystem down) may occur because of an abnormal temperature rise.

Do not replace any parts while the green Ready LED on the front of the base unit is blinking at high speed because the firmware is being downloaded at that time. Wait until the Ready LED is ON before replacing parts.

Do not replace any parts while the orange Warning LED on the front of the base unit is blinking at high speed because the firmware is being installed at that time. Wait 30 seconds after the Warning LED goes out before replacing parts.

---

## Unpacking a power supply

1. Remove the power supply from its shipping container.
2. Verify that you have the correct model number. See [Chapter 3, Replaceable parts](#) for the model numbers of the power supplies.
3. Return the power supply to the container until you are ready to install it.

## Verifying that the power supply has failed

Verify that the power supply has failed. See [Chapter 2, Identifying failed parts](#).

## Removing an AMS 2100/2300 base unit power supply

Complete the following steps with the power turned on.

1. Verify that the power supply has failed. Check that the red alarm LED on the power supply you are replacing is ON and that the green Ready LED is OFF.



**NOTE:** When the Alarm LEDs on both power supplies in a base or expansion unit are ON, or if they both need replacing for some other reason, turn the power off and then replace both units.

**Table 4-4: AMS 2100/2300 Base Unit Power Supply LEDs**

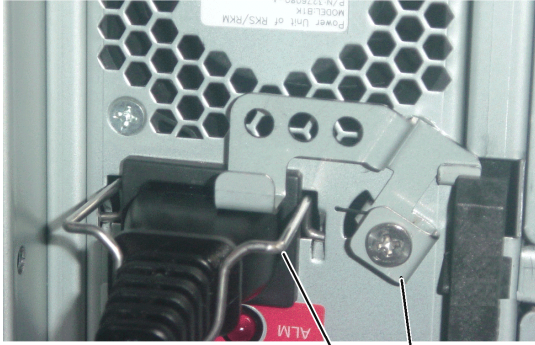
AMS 2100/2300	Item	Description
	①	Ready LED (green). on each power supply blinks when the corresponding power receptacle is connected to a working AC outlet, even if an AMS 2100/2300 array is not turned on; otherwise, the LED is OFF.
	②	Alarm LED (red). This LED indicates that the power supply has failed. Although the other power supply can supply sufficient power and cooling for the array, Hitachi Data Systems recommends that you replace the failed power supply as soon as possible. See the Hitachi AMS 2100/2300 Service Guide for instructions.
	③	Power Cable Retainer.

2. Slide the power cable retainer off the power cable and disconnect the power cord from the power supply. When you disconnect the power cable, the fans on the other power supply will switch to high speed to make up for the loss of the fans on the power supply that you disconnected. This is normal.



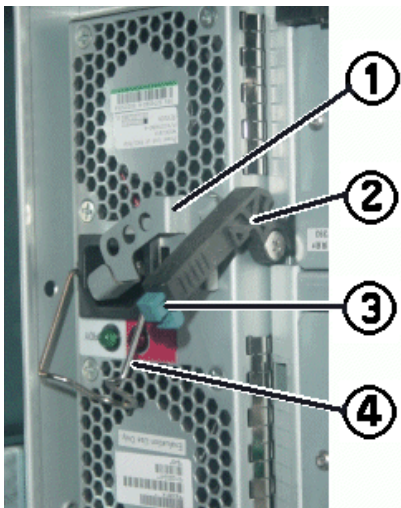
**NOTE:** The power supply includes a safety lock. It prevents the lock lever from being opened until the power cable is disconnected from the power supply. This prevents the power supply from being removed from the array with the power applied.

**Table 4-5: Base Unit Power Supply Safety Components**

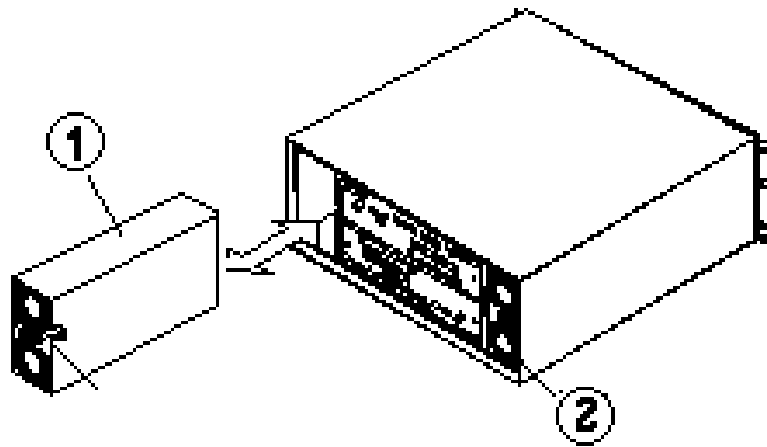
	Item	Description
 <p data-bbox="500 617 716 653"><b>AMS 2100/2300</b></p>	①	Power Cable Retainer
	②	Safety Lock

- Push the blue lock button on the end of the lock lever inward to unlock the lever. Then pull the lever outward from the power supply. As you do this, the lever will pull the power supply out of the unit and unplug the power supply from the connectors inside the unit. The power supply will now be about 1/2" (12 mm) out of the unit, as shown below.

**Table 4-6: Unlocked Base Unit Power Supply**

AMS 2100/2300	Item	Description
	①	Safety Lock
	②	Lock Lever
	③	Lock Button
	④	Power Cable Retainer

- Using both hands, slide the power supply out of the unit. See [Figure 4-12](#).



**Figure 4-12: Base Unit Power Supplies**

**Table 4-7: Base Unit Power Supplies**

Item	Description	Item	Description
①	Power Supply 0	②	Power Supply 1

## Removing an expansion unit or modular 2U expansion unit power supply

Complete the following steps with the power turned on.

1. Verify that the power supply has failed. Check that the red Alarm LED on the power supply you are replacing is ON and that the green Ready LED is OFF.
2. Slide the power cable retainer off the power cord and disconnect the power cord from the power supply.



**NOTE:** The AC power supply includes a safety lock that prevents the lock lever from being opened until the power cable is disconnected from the power supply. This prevents the power supply from being removed from the unit with the power applied. See [Figure 4-13](#).

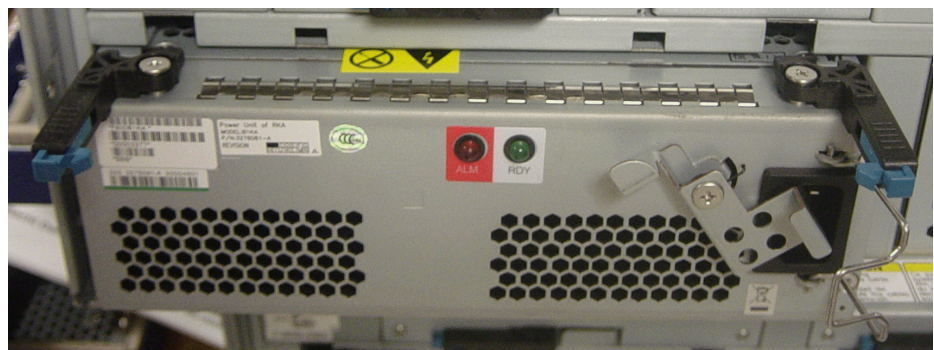


**Figure 4-13: Expansion Unit Power Supply Safety Components**

**Table 4-8: Expansion Unit Power Supply Safety Components**

Item	Description	Item	Description	Item	Description
①	Lock Lever	②	Safety Lock	③	Power Cable Retainer

3. For an expansion unit, push the blue lock button on the end of the lock lever inward to unlock the lever. Then pull the lever outward and away from the power supply. As you do this, the lever will unplug the power supply from the connectors inside the unit. The power supply is now about 1/2" (12 mm) out of the unit.



**Figure 4-14: Expansion Unit Power Supply Partly Removed**

**Table 4-9: Expansion Unit Power Supply Partly Removed**

Item	Description	Item	Description
①	Power Supply 0	②	Power Supply 1

4. For a modular 2U SAS expansion unit, open the lever toward you. When the levers are completely opened, the lever will unplug the power supply from the connectors inside the unit. The power supply is now about 1/2" (12 mm) out of the unit.

## Installing a power supply

These instructions apply to both the base unit power supply, expansion unit power supply, and modular 2U SAS expansion unit.



**NOTE:** There is no power switch on an expansion unit. Power to expansion units is controlled by the base unit to which the expansion unit is connected.

---



**CAUTION!** After removing a power supply, wait at least 20 seconds before reinstalling it or installing a new one.

---



**NOTE:** If the Power Saving storage feature is installed on the array, you must wait at least 20 seconds after you remove a power supply from the unit before inserting it into the unit again.

---

Complete the following steps with the expansion unit power turned on.

1. Open the lock levers and position them straight out from the expansion unit or modular 2U SAS expansion unit.
2. For the base unit and expansion unit, slide the power supply into the slot until it is almost completely into the unit and the levers on the power supply are just slightly open. Push the lock levers toward the front of the unit until you hear the lock button on the lever click.

For the modular 2U SAS expansion tray, slide the power supply into the slot until it is almost completely into the unit and the levers on the power supply are just slightly open. Then push the left and right levers toward the power supply.

3. Connect the power cord to the power supply and slide the cable retainer onto the cable so that it cannot accidentally become unplugged. The power supply turns on as soon as the power cord is plugged in. There is no switch on the supply.
4. When the power supply is plugged in, it immediately does a self test during which time the green Ready light on the front of the supply is blinking. When the power supply is operating normally, the light changes from blinking to ON. The test takes about 20 seconds.
5. After plugging the power supply in, wait at least 20 seconds and then verify that the green Ready light on the power supply is on.
6. If it does not turn on, unplug the power cord, open the lock levers, and slide the power supply part way out of the unit.
7. Wait at least 20 seconds and then insert the power supply again. Repeat steps 3 - 6. If the Ready LED comes on go to step 9. If not, contact Hitachi Data Systems Technical Support. See the Getting Help section in the preface of the users guide or the service guide.
8. Connect all of the previously removed cables.
9. Verify that the green READY LED on the power supply is ON.

10. Verify that both the red Alarm LED and the orange Warning LED on the front of the base unit and the Locate LED on the front of are OFF. The green Ready LED on the front of the unit might blink rapidly for 30 to 50 seconds before it turns ON.

## Replacing a backup battery

This procedure describes how to replace a cache backup battery when the power is on. By default, only one backup battery (#0) is installed in a base unit. The same backup batter is used in all models of the AMS 2000 family.

### Tools needed

- Anti-static wrist strap
- Navigator 2

### Before you begin

Before replacing a backup battery, read the following information.



---

**CAUTION!** The backup battery in the base unit must be removed and replaced with the power turned on. When the power is turned off during replacement, user data on the cache that has not been written on a disk is not backed up because the power is not supplied from the battery.

**When hot-swapping a part, do not leave any slot in the array open for more than ten minutes. Otherwise, the loss of cooling air could cause the unit to overheat and shut down.**

**A closed nickel-hydrogen battery can cause an electric shock or explosion if it is handled incorrectly. Observe the following requirements when handling the battery:**

- **Do not connect the battery to anything other than a base unit for charging or use.**
  - **Do not leave the battery in a hot place. Store the battery in a dark cool place.**
  - **When replacing both cache backup batteries on the AMS 2100/2300, the cache changes to the Write-Through mode and the R/W performance is deteriorated. Also, if the cache backup batteries are removed from the base unit, the array changes to the Warning status. However, when the cache backup batteries are recovered normally, the array Warning status displays.**
- 

### Unpacking a new backup battery

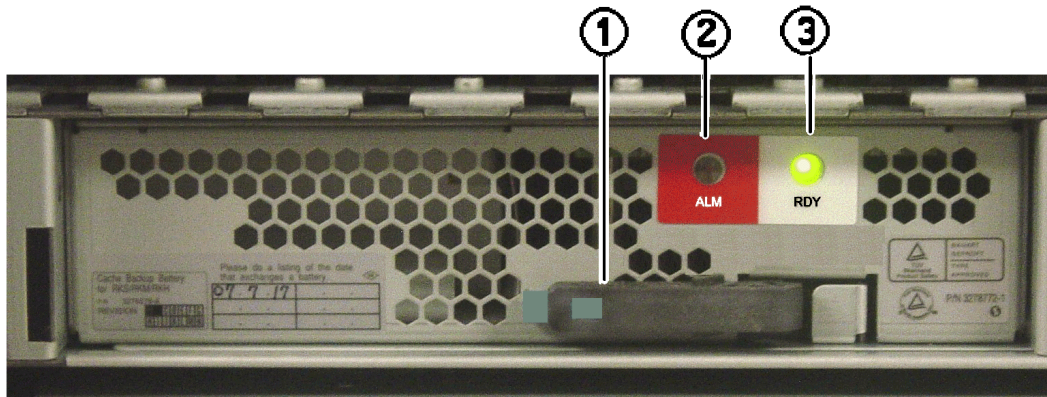
1. Remove the cache backup battery unit from the container.
2. Verify that you have the correct model number. See [Chapter 3, Replaceable parts](#).

### Verifying that the backup battery has failed

Verify that the cache backup battery unit has failed. See [Chapter 2, Identifying failed parts](#).

## Removing a backup battery

Figure 4-15 shows the cache backup battery. The front panel on the battery contains an Alarm LED and a Ready LED. The battery includes a lock lever that keeps the battery securely installed in the array and is used to remove the battery when needed.



**Figure 4-15: Cache Backup Battery**

**Table 4-10: Cache Backup Battery**

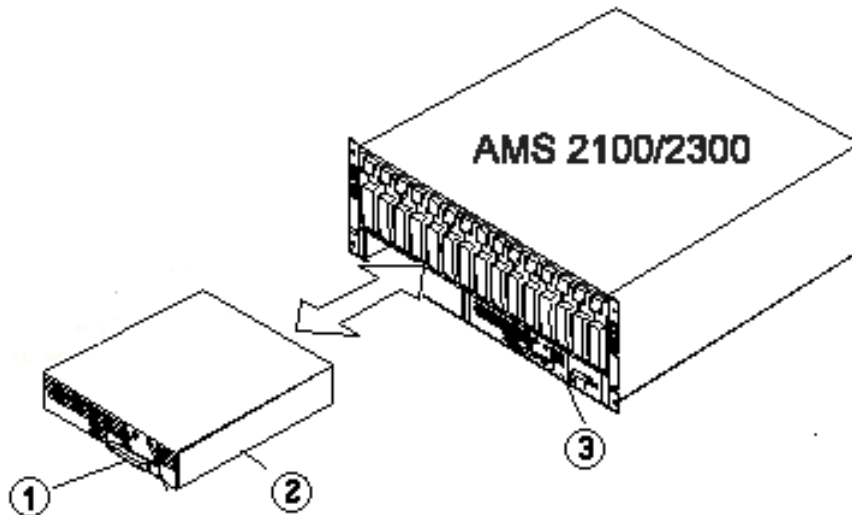
Item	Description	Status
①	Lock Lever	When the lock lever is closed and the blue button is fully extended, the battery is secured to the array.
②	<b>Alarm LED</b> <b>RED</b>	<ul style="list-style-type: none"> <li>When on, indicates that the battery has failed.</li> <li>When off, indicates that the battery status is normal.</li> </ul>
③	<b>Ready LED</b> <b>GREEN</b>	This LED indicates the condition of the battery. <ul style="list-style-type: none"> <li>On: normal status</li> <li>Low-speed blinking (1 blink per second): The battery is not fully charged.</li> <li>Off or high-speed blinking (8 blinks per second): Abnormal status</li> </ul>

Perform the following procedure with the power turned on.

1. Remove the front bezel.
2. Press the blue lock button on the end of the lock lever and pull the lever outward and away from the unit. This will disconnect the battery from the connectors in the unit and pull it about 1/2 inch (13 mm) out of the unit.
3. Holding the battery with both hands, slide it out of the base unit.



**NOTE:** The depth of the cache backup battery about 8 inches (200 mm) and it weighs about 4-1/2 lbs (2.0 kg). Be careful when sliding it out of the base unit.



**Figure 4-16: Cache Backup Battery**

**Table 4-11: Cache Backup Battery**

Item	Description
①	Backup battery unit 1. The backup battery is installed on the left side of the array.
②	Lock Lever
③	Cache backup battery unit 0

## Installing a cache backup battery

1. After removing a backup battery, wait at least 20 seconds before reinstalling it or replacing it with a new one.



**NOTE:** If a cache backup battery is inserted without waiting 20 seconds, it may not recover from the failure. If that happens, unlock the battery and slide it partway out of the base unit (only far enough to unplug it), wait at least 20 seconds, and then resinsert the battery into the base unit.

2. Slide the new battery until the lock lever is slightly opened. Close the lever until you hear the lock button click.



**NOTE:** Do not install a battery while the power savings feature is spinning up the disk drives. The backup battery may not recover normally if you install it during this time. If that happens, check Navigator 2 and wait until the message *I1GZ00 The spin up of disk drives completed* is displayed. Then unlock the battery and slide it partway out of the base unit (only far enough to unplug it). Wait at least 20 seconds and then resinsert the battery into the base unit.

3. While the battery is charging, the green Ready LED blinks slowly. Charge the battery until Ready LED stops blinking and changes to steady ON. This may take up to 12 hours.

4. While the battery is charging, the green Ready LED blinks slowly. Charge the battery until Ready LED stops blinking and changes to steady ON. This may take up to 24 hours.
5. Verify that the Ready LED on the backup battery is ON.
6. Verify that the green Ready LED on the front of the base unit is on steadily, and the red Alarm and orange Warning LEDs are not ON. The green Ready LED on the front of the base unit may blink rapidly for a maximum of 30 to 50 minutes.
7. Attach the front bezel.
8. The backup battery is not repairable. Recycle the removed backup battery according to local ordinances.

## Replacing a control unit

This procedure describes how to replace a control unit under the following conditions:

- When the Alarm LED on the control unit is ON
- When the Alarm LED and Reset LED on the base unit is OFF



**NOTE:** Please contact Hitachi Data Systems Support Center before replacing a control unit.

---

### Tool needed

Anti-static wrist strap.

### Before you begin

Before replacing a control unit, read the following information.

---



**Static-sensitive. Ground yourself before touching.**

---



**CAUTION!** When hot-swapping a part, do not leave any slot in the array open for more than ten minutes. Otherwise, the loss of cooling air could cause the unit to overheat and shut down.

**Do not replace any parts while the green Ready LED on the front of the base unit is blinking at high speed because the firmware is being installed during that time. Wait until the Ready LED is ON before replacing any parts.**

**When replacing both control units, turn off the array before replacing the control units.**

**Keep a new control unit in the packing box until you are ready to install it.**

**Replacing a control unit may cause an error report in the host computer depending on the operating conditions of the host computer.**

---

### Unpacking a control unit

1. Remove the control unit from its static-protective container.
2. Verify that you have the correct model number. See [Chapter 3, Replaceable parts](#).
3. Return the control unit to the container until you are ready to install it.

### Verifying a control unit failure

Verify that the control unit has failed. See [Chapter 2, Identifying failed parts](#).

## Replacing a control unit



### NOTE:

- In the unlikely event the array power is on and both control units in a base unit fail at the same time, replace them one at a time.
- The system parameters are stored on an internal disk drive (one that is not used for user data storage) and when you install a new controller, the system parameters are automatically installed on it.
- If you replace a control unit while a logical unit in the array is being formatted, the restoration of the controller will be delayed until the LUN formatting is complete.

---

Complete the following steps to replace a control unit:

1. Follow the troubleshooting and failure identification procedures described in [Chapter 2, Identifying failed parts](#) and [Chapter 6, Troubleshooting](#).
2. Verify that the red Alarm LED or orange Reset LED on the control unit you are replacing is ON.



**CAUTION! Do not disconnect the ENC cables from the controller until after the controller has been disconnected from the base unit. All other cables may be disconnected first.**

3. Follow the procedure below and then the procedure titled [Installing a control unit on page 4-30](#).

## Removing a control unit

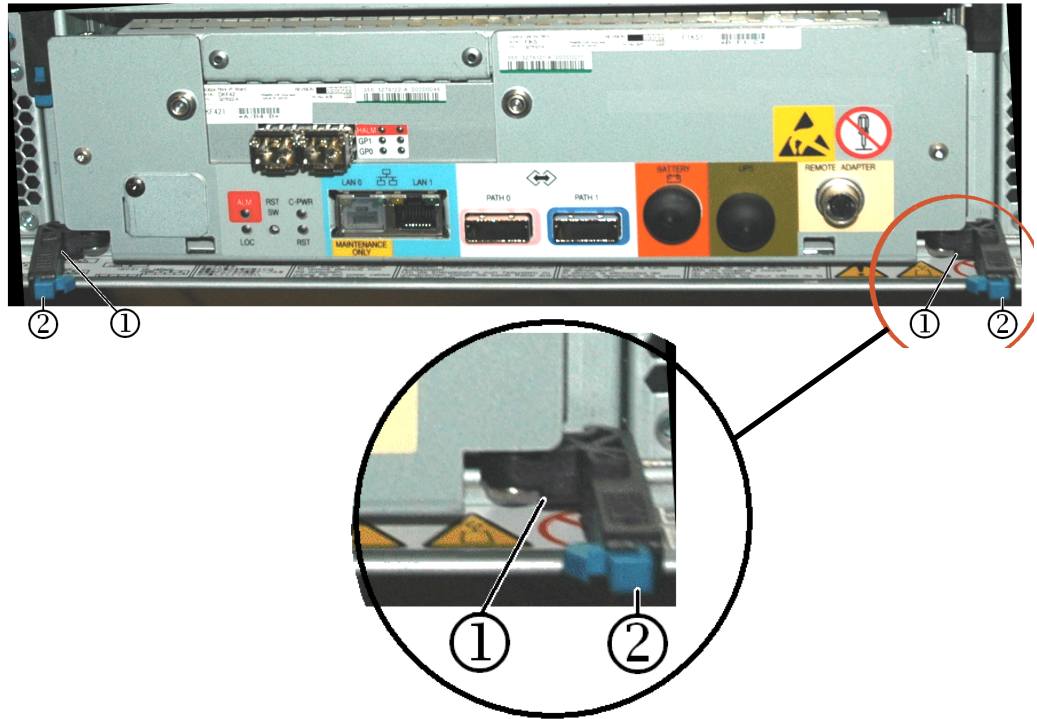
Complete the following steps to remove a control unit from a base unit. This procedure applies to both the Fibre Channel and iSCSI controllers.

1. Label all cables that are connected to the control unit so that they are easy to replace after the new control unit is installed.
2. If you have not already done so, put on an anti-static wrist strap.



**CAUTION! Do not disconnect the ENC cables until the control unit has been disconnected (partially removed) from the base unit.**

3. Disconnect all cables except the ENC cables from the control unit.
4. Push the blue lock buttons on the lock levers to unlock them.
5. Pull outward on both lock levers to disengage the connectors in the unit. See [Figure 4-17](#).

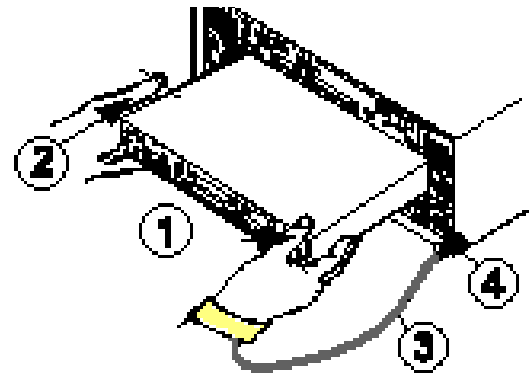


**Figure 4-17: Unlocking a Control Unit**

**Table 4-12: Unlocking a Control Unit**

Item	Description	Item	Description
①	Lock Lever	②	Lock Button

6. Slide the control unit part way out of the base unit.
7. Disconnect the ENC cables from the control unit.
8. Grasp the control unit with both hands and slide it out of the base unit.



**Figure 4-18: Removing a Control Unit**

**Table 4-13: Removing a Control Unit**

Item.	Description	Item.	Description
①	Control Unit	③	Anti-static Wrist Strap
②	Support the control unit with both hands	④	Anti-static Wrist Strap Clip

## Installing a control unit

Complete the following steps to install a control unit:

1. Ensure that you wait 20 seconds or longer after removing the control unit.
2. When the expansion unit is connected, connect the ENC cable. When the expansion unit is not connected, go to step 3.



### NOTE:

- When an expansion unit is connected to a control unit via ENC cables, always leave the ENC cables connected to the control unit while removing or installing the control unit. Otherwise, the loop will not recover from the failure and neither will the control unit.
- The upper control unit is upside down. Take care when connecting the cables.

- 
3. Insert the control unit with the right and left levers open and then close the levers completely until you hear the lock buttons on the levers click. After you install the new control unit, the Alarm LED on the control unit will stay on for a few minutes until the failure has recovered.

If the control unit is inserted without waiting for 20 seconds, it is possible that the control unit may not recover normally from a failure.

If a control unit does not recover from a failure after 10 minutes or more, perform the dummy replacement (see Note) of the control unit which was inserted.

If a control unit has not recovered after another 10 minutes, call Hitachi Data Systems technical support. See the Getting Help section in the Preface of this manual.

4. Make sure that the orange Warning LED on the front of the base unit goes out (see Note). The control unit usually recovers in about three minutes, but if the I/O load from the host computer is high, it may take three minutes or more to recover.
5. Connect all of the cables to the control unit.
  - When connecting the Fibre Channel interface cables, insert the Fibre Channel interface cables until they are completely seated in the host connectors. If the fibre channel Interface cables are partially inserted into the host connectors, the control unit continues to detect the fibre channel failures, and the I/O processing of the control unit may be deteriorated.
  - Control unit #0 is installed upside down and therefore all of the connectors in it are also upside down. Verify the orientation of the cable connectors when you install them.
6. Check that the green READY LED on the front of the base unit illuminates. The green READY LED on the front of the base unit may blink rapidly for a maximum of 30 to 50 minutes before it illuminates.
7. Check that the LED of the remote adaptor connected to the control unit illuminates when the remote adaptor is connected.

- Using Navigator 2, set the date and time for the system. See the section titled **Initial Array Setup** in Chapter 7 (Configuration) in the *Hitachi AMS 2100/2300 Storage System Hardware Guide*. The same section is also in the *Hitachi AMS 2500 Storage System Hardware Guide*.

## Replacing a host connector

This procedure describes how to replace a host connector. Host connectors are described in Chapter 4 in the *Hitachi AMS 2100/2300 Storage System Hardware Guide*.

### Tool needed

- Anti-static wrist strap

### Before you begin

- Verify that if the power saving storage feature is installed on the array, the disk drives are not in the process of spinning up.
- Note the LED status on the front of both the base and expansion units before replacing parts. See Chapter 4 in the *Hitachi AMS 2100/2300 Storage System Hardware Guide* for a description of the LEDs and their functions. Verify the following conditions:
  - No Alarm LEDs are ON anywhere on the base unit, except the HALM (Host Alarm) LED on a control unit.
  - The Warning LED on the base unit is not blinking.



---

**CAUTION! Do not replace any parts while the green Ready LED on the front of the base unit is blinking at high speed. The blinking green LED means that a firmware upgrade is being downloaded to the unit. Wait until after the download is complete before replacing any parts.**

---

### Unpacking a host connector

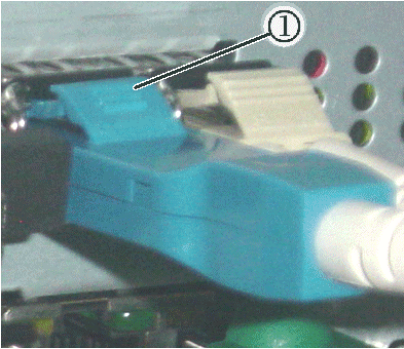
- If you have not already done so, put on an anti-static wrist strap and connect the clip to the frame of the base array.
- Remove the host connector from its shipping container.
- Verify that you have the correct part. See Chapter 3, Parts List, in the *Hitachi Adaptable Modular Storage 2100/2300 Service Guide*
- Set the host connector aside until you are ready to install it.

## Removing a host connector

Complete the following procedure with the power turned on.

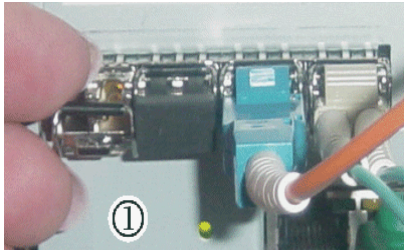
1. Lift up on the cable retainer and completely disconnect the fibre channel cable from the failed host connector. See the following illustration.

**Table 4-14: Fibre Channel Cable Retainer**

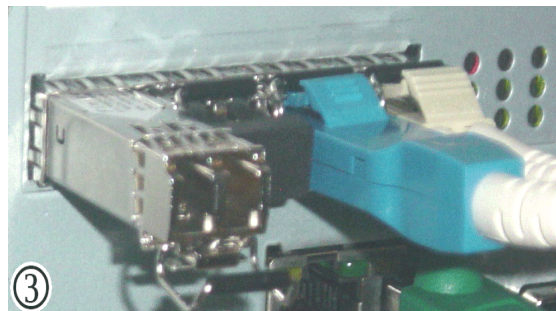
	Item	Description
	①	Fibre Channel Cable Retainer

2. Unlock the host connector. Pull down and outward on the host connector lock bar to unlock.

**Table 4-15: Host Connector Lock**

	Item	Description
	①	Host Connector Lock

3. Slide the host connector out of the base unit and put it on an antistatic mat or into a static-protective bag.



**Figure 4-19: Removing a Host Connector**

## Installing a host connector

Complete the following steps to install a host connector.



**CAUTION!** After removing a host connector, wait at least 20 seconds before reinstalling it or installing a new one.

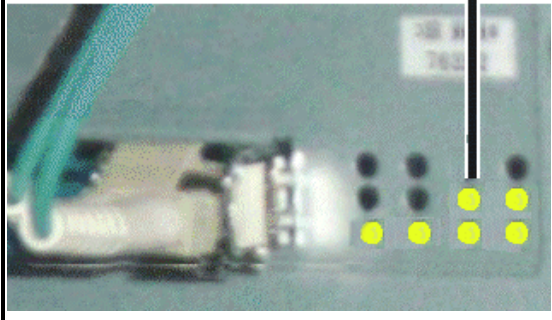
1. Check the insertion direction of the host connector and insert the host connector into the part as far as you can.
2. Lift the host connector lock upward and inward until it clicks, locking the host connector to the base unit.



**NOTE:** If using an 8 Gbps interface board (DF-F800-DKF84), insert the 8 Gbps host connector to the 8 Gbps interface board (DF-F800-DKF84).

3. Connect the fibre channel cables. Ensure that the cable retainer locks in place. Pull gently on the connector to make sure that the cables are secure and cannot be removed accidentally.
4. Observe the port LED and verify that it is ON. If it is not ON, there may be other failures.

**Table 4-16: Fibre Channel Port LED**

	Item	Description
	①	Fibre Channel Port LED

## Replacing an ENC unit

This replacement procedure includes instructions to remove and replace a failed ENC unit with the power turned on. Before beginning this procedure, see [Chapter 6, Troubleshooting](#) to identify and resolve problems that you may encounter with a Hitachi AMS 2100/2300 Storage System and [Chapter 2, Identifying failed parts](#) to locate the failed ENC unit.



**NOTE:** Please contact Hitachi Data Systems Support Center before replacing a control unit.

---

### Tools needed

- Anti-static wrist strap
- Storage Navigator Modular 2

### Before you begin

1. Verify the following conditions before replacing an ENC unit:
  - The base unit controller firmware is NOT being uploaded or updated.
  - No other parts except an ENC unit have failed and/or are being replaced at the same time.
  - No failures are listed in the Navigator 2 Alerts window except one for an ENC unit.
2. Note the LED status on the front of both the base and expansion units before replacing parts. See Chapter 4 in the *Hitachi AMS 2000 Family Storage System Hardware Guide* for a description of the LEDs and their functions. Verify the following conditions:
  - No Alarm LEDs are ON anywhere on the base, expansion units, or modular 2U SAS expansion unit, except the Alarm LED on the ENC unit you are replacing.
  - Neither the Ready or Warning LEDs on the base unit is blinking.



#### CAUTION!

- **When replacing a part with the power turned ON, do not leave any slot in the array open for more than ten minutes. Be sure to install the new part within that time. Otherwise, the loss of cooling air could cause the unit to overheat and shut down.**
  - **Do not replace any parts while the green Ready LED on the front of the base unit is blinking at high speed. The blinking green LED means that a firmware upgrade is being downloaded to the unit. Wait until after the download is complete before replacing any parts.**
  - **If a backup battery and an ENC unit fail at the same time, replace the backup battery first. The failure code for a backup battery (shown in the Alerts window of Navigator 2) is W03z0x, W0400x or W3Tz0x.**
-



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**NOTE:** If the Power Saving storage feature is installed, wait at least 20 seconds after removing a part before reinstalling it or installing a replacement part. Do not replace any parts while the disks are spinning up. To determine if the drives have started to spin up, look for the message “The request of spin up of disk drives is accepted” in the Navigator 2 Alerts window. If you see that message, do not reinstall the part until the message “I1GZ00 The spin up of disk drives completed” is displayed. This indicates that the drives are at operating speed.

---

## Task list

Complete the following tasks to replace an ENC unit. For detailed information, see the sections with the same titles that are in the table.

1. Troubleshoot the array according to the instructions in the *Hitachi AMS 2100/2300 Storage System Service Guide* and the error message(s) and instructions in the Navigator 2 Alerts window.
2. Unpack the ENC unit and verify that you have the correct part.



---

**CAUTION! Do not disconnect the ENC cables first. Partially remove the ENC unit from the expansion unit or modular 2U SAS expansion unit and then disconnect the ENC cables.**

---

3. Slide the ENC unit partway out of the expansion unit.
4. Disconnect the ENC cables from the unit. If the connectors on the cables are tight in the socket, gently wiggle them out of the sockets. Be careful not to bend the cable sharply while unplugging the cable.
5. Remove the failed ENC unit from the expansion unit.
6. Slide the new ENC unit partway into the slot.
7. Connect the ENC cables to the ENC unit.
8. Slide the ENC unit all the way into the expansion unit.
9. Open the lock lever just far enough so that the tab on the lock lever can be inserted into the slot in the frame of the expansion unit or modular 2U SAS expansion unit when you slide the ENC unit into the unit.
10. When the tab on the lock lever is engaged in the slot, push the lock lever closed until you hear the lock button click. This pulls the ENC unit all the way into the expansion unit or modular 2U SAS expansion unit and plugs it in.
11. The firmware from the other ENC unit in the expansion unit will automatically be loaded onto the ENC unit you just installed.

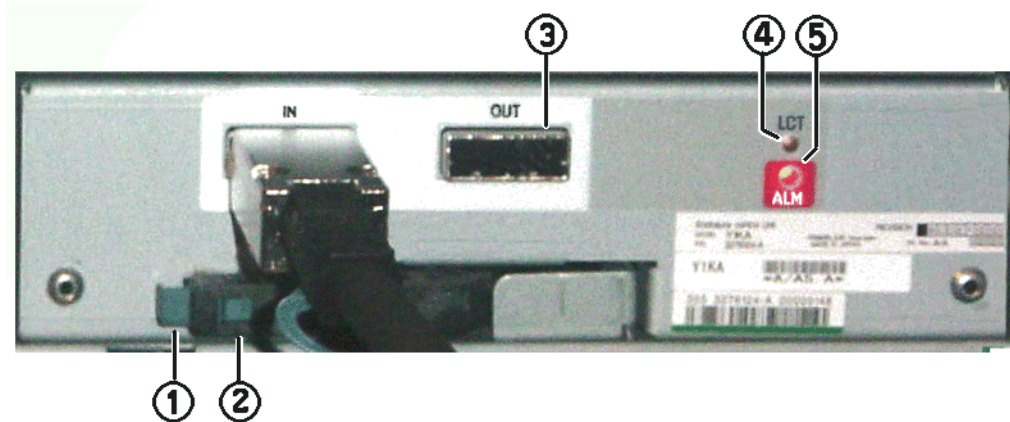
## Unpacking an ENC unit

1. Remove the ENC unit from its shipping container.
2. Verify that the unit is part number 3276159-A.
3. Return the ENC unit to the container until you are ready to install it.

## Removing an ENC unit

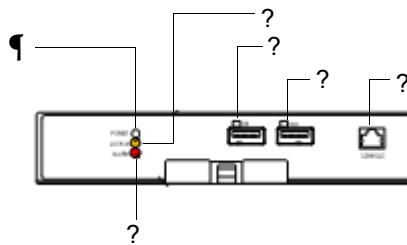
To remove an ENC unit, complete the following steps with power turned on.

1. Verify that the ENC unit has failed. Check that the red alarm LED on the ENC unit you are replacing is ON and that the orange LCT LED is OFF. [Figure 4-20](#) shows the location of the LEDs.



**Figure 4-20: Unit Controls and Connectors**  
**Table 4-17: Unit Controls and Connectors**

Item	Description	Item	Description
①	Lock Button	④	Alarm LED <b>RED</b> This LED indicates that the ENC unit has failed.
②	Lock Lever	⑤	LCT (locate) LED See users guide. <b>ORANGE</b>
③	Port (OUT)		



**Figure 4-21: Unit Controls and Connectors on RKAKS**  
**Table 4-18: Unit Controls and Connectors (RKAKS)**

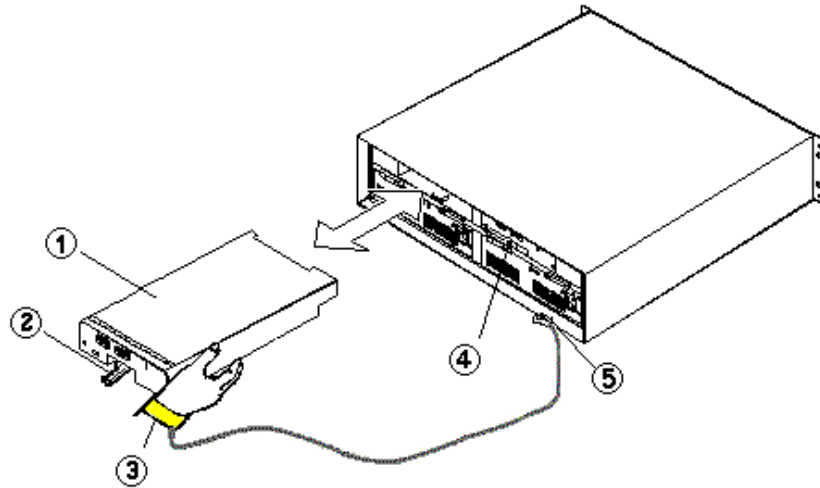
Item	Description	Item	Description
4	POWER LED <b>GREEN</b>	?	PATH (OUT) Side (green)
5	LOCATE LED See users guide. <b>ORANGE</b>	?	Console
6	PATH (IN) Side (green)	?	ALARM LED <b>RED</b> This LED indicates that the ENC unit has failed.



**NOTE: Replacement order**

- When a controller on the base unit and an ENC unit in an expansion unit in the same path have failed at the same time, replace the controller first. See the Hitachi AMS 2100/2300 Storage System Control Unit Replacement Guide for instructions to replace a control unit.
- When two ENC units in the same path have failed, replace the ENC unit closest to the controller first.

2. If you have not already done so, put on an anti-static wrist strap and attach the clip to the unpainted front part of the expansion unit.
3. Press the blue lock button on the end of the lock lever and pull the lever open to unlock it. Then quickly pull outward on the lock lever as far as you can. This unplugs the ENC unit from the expansion unit and slides it partway out of the unit.
4. Disconnect the ENC cables from the ENC unit.



**Figure 4-22: Replacing an ENC Unit**  
**Table 4-19: Replacing an ENC Unit**

Item	Description	Item	Description		
①	Unit	③	Anti-static Wrist Strap	⑤	Anti-static Wrist Strap Clip
②	Lock Lever	④	Expansion Unit		

5. If removing the ENC unit on the expansion unit, slide the failed ENC unit out of the expansion unit and set it aside.  
If removing the ENC unit on the modular 2U SAS expansion unit, raise and pull toward you the right and left levers that secure the ENC unit to remove the ENC unit.

## Installing an ENC unit

Complete the following steps to install an ENC unit.

1. Wait at least 20 second before installing the new ENC unit. If the ENC Unit is inserted without waiting at least 20 seconds, the ENC unit encounter an unrecoverable failure.
2. Slide the new ENC unit partway into the slot in the expansion unit or modular 2U SAS expansion unit. Make sure that the connectors on the ENC unit do not plug in to the expansion unit or modular 2U SAS expansion unit.
3. Connect the ENC cables to the ENC unit.
4. Push the blue lock button on the end of the lock lever and unlock it.
5. Open the lock lever far enough so that the tab on the lock lever can be inserted into the slot in the frame of the expansion unit when you slide the ENC unit into the expansion unit.
6. When the tab on the lock lever is engaged in the slot, push the lock lever closed until you hear the lock button click. This pulls the ENC unit all the way into the expansion unit and plugs it in to the connector.
7. Verify the Alarm LED on the new ENC unit and the Warning LED on the front of the expansion unit are OFF. If the Warning LED is blinking slowly, view the Alerts window in Navigator 2 and follow the instructions there to recover the ENC unit. All you may need to do is unplug the ENC unit by sliding it part way out of the expansion unit, wait at least 20 seconds, and install it again.

## Replacing an ENC cable

This procedure describes how to replace an ENC cable from a base unit to an expansion unit and from one expansion array to another.

### Tools needed

None.

### Before you begin

1. Verify the following conditions before replacing an ENC cable:
  - The base unit controller firmware is NOT being uploaded or updated.
  - No other parts except an ENC unit have failed and/or are being replaced at the same time.
  - No failures are listed in the Navigator 2 Alerts window except possibly one for an ENC unit.
  - If the power saving storage feature is installed on the array, the disk drives are not in the process of spinning up.
2. Note the LED status on the front of both the base and expansion units before replacing parts. See Chapter 4 in the *Hitachi AMS 2000 Family Storage System Hardware Guide* for a description of the LEDs and their functions. Verify the following conditions:
  - No Alarm LEDS are ON anywhere on the base or expansion units, except possibly the Alarm LED on an ENC unit.

- Neither the Ready or Warning LEDs on the base unit is blinking.



---

**CAUTION! Do not replace any parts while the green Ready LED on the front of the base unit is blinking at high speed. The blinking green LED means that a firmware upgrade is being downloaded to the unit. Wait until after the download is complete before replacing any parts.**

---

## Task list

Complete the following tasks to replace an ENC cable.

1. Troubleshoot the array according to the instructions in Chapter 6 and the error message(s) and instructions in the Navigator 2 Alerts window.
2. Unpack the ENC cable(s).
3. Partially remove the furthest ENC unit to which the cable is connected.
4. Disconnect the failed ENC cable at both ends.
5. Connect the new ENC cable at both ends.
6. Reinstall the ENC unit.

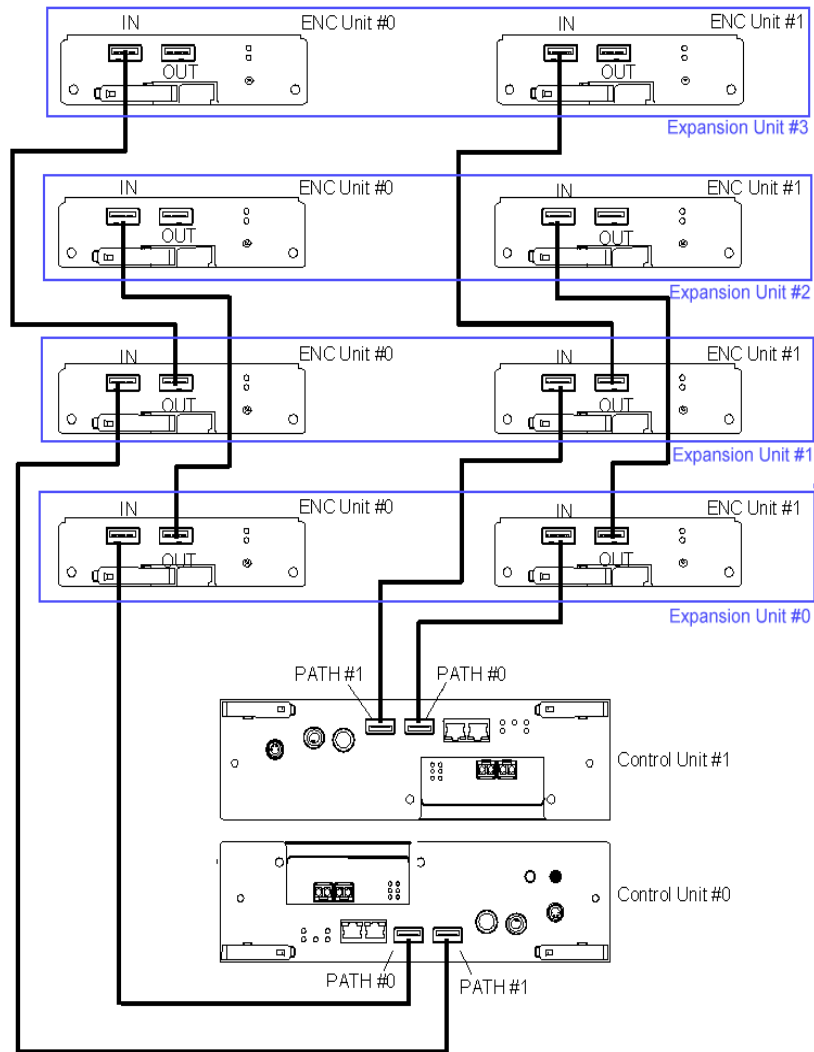
## Unpacking an ENC cable

1. Remove the ENC cable from its shipping container.
2. Verify that you have the correct cable. See Chapter 3, Parts List, in the *Hitachi Adaptable Modular Storage 2100/2300 Service Guide*.
3. Set the cable aside until you are ready to install it.

## Removing an ENC cable

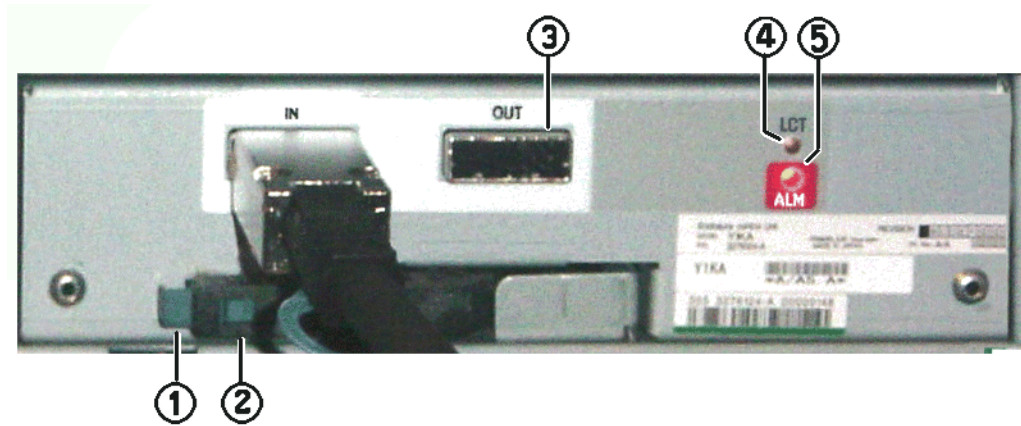
Complete the following procedure with the power turned on.

1. Within the ENC units that are connected to the ENC cable to be replaced, locate the ENC unit on the expansion array that is furthest from the base unit. [Figure 4-23](#) shows how the units are connected together.



**Figure 4-23: AMS 2100/2300 ENC Cable Routing**

2. Carefully move the ENC cable out of the way so that you can access the lock lever below it.
3. Push the blue lock button on the end of the lock lever inward to unlock the lever. Then pull the lever outward from the ENC unit. As you do this, the lever will pull the ENC unit out of the unit and unplug the unit from the connectors inside the expansion unit. The ENC unit will now be about 1/2 inch (12 mm) out of the unit. See [Figure 4-24](#).



**Figure 4-24: Unit Controls and Connectors**

**Table 4-20: Unit Controls and Connectors**

Item	Description	Item	Description
①	Lock Button	④	Alarm LED <b>RED</b> This LED indicates that the ENC unit has failed.
②	Lock Lever	⑤	LCT (locate) LED See users guide. <b>ORANGE</b>
③	Port (OUT)		

4. Disconnect the defective ENC cable from the ENC unit, taking care not to bend it in the process.
5. Disconnect the other end of the ENC cable from the ENC unit or control unit to which it is attached. It is not necessary to remove that ENC unit or the controller.

## Installing an ENC cable

Complete the following steps to install an ENC cable.



**NOTE:** If you need to bend an ENC cable to make a connection, keep the bends as large as possible. Do not make the radius of the bend any smaller than 1-1/4 inches (30 mm) to avoid putting excessive stress on the cable and connector.

1. Connect the new ENC cable to the ENC unit in the expansion array closest to the base unit, or to the controller on the base unit.
2. Connect the other end of the ENC cable to the ENC unit that is partially removed from the expansion unit.
3. Make sure that at least 20 seconds has elapsed from the time when you removed the ENC unit from the expansion unit. Otherwise, the ENC unit will not recover from the failure caused by removing it and will not cycle to the Ready state. If that happens, slide the ENC unit out of the expansion unit, wait a full 20 seconds, and then reinstall the ENC unit.



**NOTE:** If the Power Saving storage feature is installed on the array, do not install a disk drive while the drives are spinning up. Otherwise, the drive failure may not recover, the Alarm LED may stay ON, and the unit will not cycle to the ready state.

The message "I1GY00 The request of spin up of disk drives is accepted" is displayed in the Navigator 2 Alerts window indicates that the drives are starting to spin up. If you see this message, wait until the message "spin up of disk drives completed" is displayed in the Alerts window in Navigator 2 before inserting a part.

If you inserted a part while the drives are spinning up, remove the part, wait at least 20 seconds, and install the part again. This should clear the failure and allow the part to cycle to the ready state.

4. Slide the ENC unit into the expansion unit until the tabs on the lock levers enter the slots in the frame of the expansion unit.
5. Quickly (within one second) and equally, push the lock levers toward the unit until you hear the lock buttons click.
6. Observe the Alarm light on the ENC unit and verify that it goes out within 20 seconds after installation.
7. Verify that the green LED on the front of the base unit is ON and that the Alarm and Warning LEDs are OFF. (see Note). The green READY LED on the front of the base unit may blink rapidly for a maximum of 30 to 50 seconds before it illuminates.

## Replacing parts in a high-density expansion unit

Hitachi Data Systems support policy does not include end-user installation or maintenance for model AMS 2500 base unit, the high-density expansion unit, or the battery expansion unit.

## Maintenance

This chapter contains information about replacing components on a periodic basis to prevent array failures and to maintain optimum performance. The following key topics are covered:

- Before starting general maintenance
- Inspecting and cleaning the array
- Checking for loose or damaged cables or connectors
- Moving an array
- Long term array storage

## Before starting general maintenance

### Periodic maintenance items

Table 5-1 shows periodic maintenance items of the array. Inspect and clean the array regularly according to the operating environment.

**Table 5-1: Periodic Maintenance Items**

Item		Interval <sup>1</sup>	Task	Normal Time Required	
Inspection	Inspect fans	Power Unit and Fan Unit	Yearly	Inspect fans	5 minutes
	Clean the array	Front bezel	Yearly	Clean the array	5 minutes
		Rear cover	Yearly		5 minutes
		Rear door	Yearly		5 minutes

1. The maintenance intervals were set on the assumption that the average operation hours of the array is 400 hours/month. Change the intervals according to the operating hours per month of your system. See Table 5-2.

**Table 5-2: Changing Maintenance Intervals**

Task	Factors requiring change of maintenance interval		Remarks
	Reasons to shorten maintenance intervals	Reasons to lengthen maintenance intervals	
<ul style="list-style-type: none"> <li>Inspecting fans</li> <li>Cleaning the array</li> </ul>	<ul style="list-style-type: none"> <li>Long operating hours</li> <li>Installation environment is bad.</li> <li>To fit the interval for user's operation schedule.</li> <li>To improve service for the user</li> <li>Necessity to shorten the interval is recognized for other reason.</li> </ul>	<ul style="list-style-type: none"> <li>Short operating hours</li> <li>Installation environment is excellent.</li> </ul>	Also examine items to be added to the factors shown on the left such as the frequency of the array failure occurrence and items common to the array and a connected system.

# Inspecting and cleaning the array

## Inspecting fans

The cooling fans are built into the power supplies in all units, and in the fan units in the AMS 2500. They may be inspected while the arrays are running.



**CAUTION! The fan blades rotate at high speed. Be careful not to let anything enter the screens over the fans and catch in the blades.**

---

Complete the following steps to inspect the array fans:

1. Open the rear door of the rack.
2. Visually check each fan and make sure that it is rotating and not clogged with dust.
3. Close the rear door of the rack.
4. For AMS 2500 arrays, open the front door of the rack.
5. Visually check each fan in the fan units and make sure that they are rotating and not clogged with dust.
6. Close the rear door of the rack.

## Cleaning the array



**CAUTION! Keep the fan screens and air vents on the array clean. If they become clogged with dust, air circulating within the array can be reduced. This can cause the array to overheat and shut down or fail.**

---

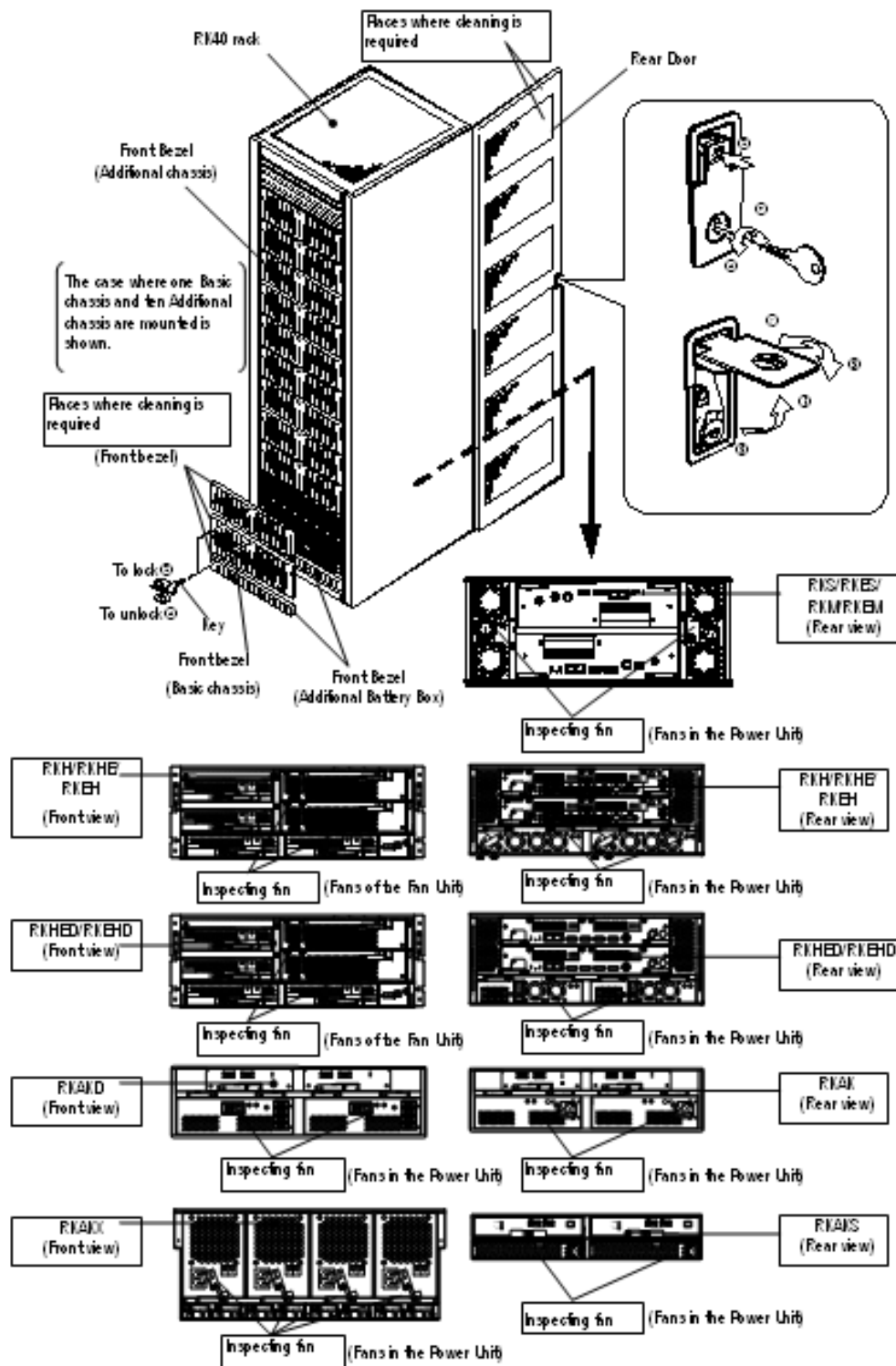


**NOTE:** Be careful not to move the array during cleaning.

---

Complete the following steps to clean the array. See [Figure 5-1](#).

1. Open the rack rear door.
2. Wipe the fan screens with a dry towel to remove dust. If needed, use a vacuum cleaner to remove heavy dust collections.
3. Close the rear door.
4. Remove the front bezel from one of the units in the rack. See chapter 4 for instructions if needed.
5. Wipe the front and back sides of the bezels with a dry towel. If needed, Use a vacuum cleaner to remove heavy dust collections.
6. Reattach the front bezel to the unit. Be careful not to pinch your fingers when the ball catches engage and pull the front bezel tightly to the unit.



**Figure 5-1: Inspecting and Cleaning an AMS 2000 Family Storage System**

## Checking for loose or damaged cables or connectors

Check that the cable has not been damaged. Confirm that each cable is properly connected to its connector.

## Moving an array

Observe the following when moving an array.

### Before starting relocation/removal

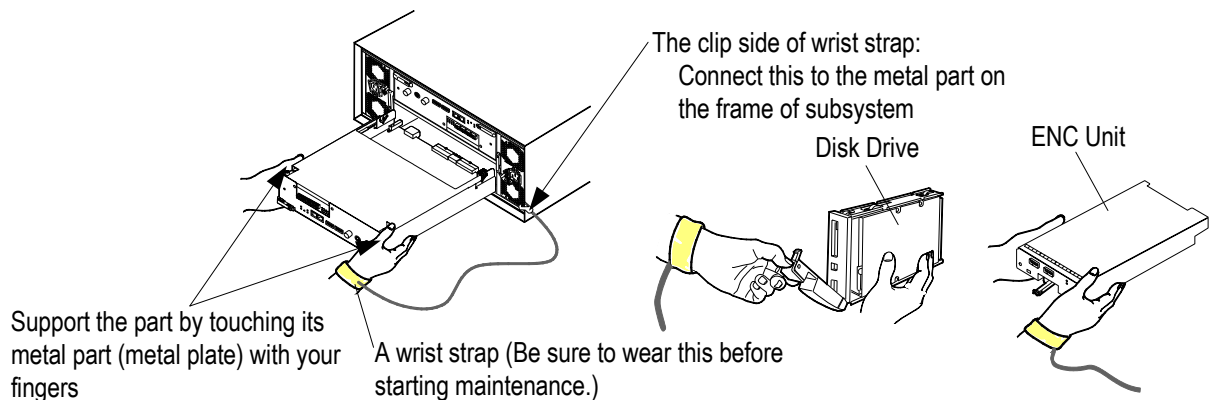
Read and follow the safety instructions located in the Preface of this manual. Note the following caution before starting installation or moving an array.



**CAUTION! Generally, each part is equipped with high-precision components. Remove and install the part gently to prevent mechanical shock to the parts.**

**To prevent part failures caused by static electricity, wear an anti-static wrist strap connected to the chassis before starting work and do not take it off until you finish. This includes unpacking and any time you handle static-sensitive parts.**

When you install a disk drive, control unit, or ENC unit, support its metal part with your hand that has the wrist strap. You can discharge static electricity by touching the metal plate.



**Figure 5-2: Preventing Electrostatic Discharge to Equipment**

## Routing cables

This section discusses cable routing issues.

### Handling cables on the floor

Note the following precautions when handling or routing cables:

- Route the cables so that you do not trip on them.
- Protect cables which cannot be routed within a rack and are laid on the floor including across a doorway. Use a cable duct to prevent wear on

the cable, tripping over, and walking on the cables. and thus laid on the floor or cables which cross a passage with cable ducts, etc.

- Do not put heavy objects on the cables.
- Do not put the cables near any heat generating objects since the cable coating can break down and could cause an electric shock, fire, or power failure.
- Do not route rack-to-rack cables in the air. Route them down the rack and under the floor if possible. Otherwise route the cables across the floor and use a cable duct to protect them.

## Handling under-floor cables

Use cables with sufficient length so the cables can be laid somewhat loosely on the floor under the computer room floor, and are not hanging or stretched between the racks or arrays. Tight cables can be damaged or broken if stretched beyond their specified limits, as could happen in an earthquake.

- Make power cable and power cable apart each other. When they have to be positioned close each other, do not make them run in parallel but make them cross each other.
- When using cable protecting duct, be careful not to damage or break cables by catching them.
- Be sure to insert or pull out a cable connector holding it with your hand. If you pull a cable, a trouble may be caused.
- When bending the Fibre Channel I/F cable and RC ( ) cable to connect it, give it a bend with a long radius (not less than 30 mm) so as not to apply the cable and the connector excessive stresses.

## Restarting an array

Wait at least one minute after the power has been turned off and the LED goes out before turning on the main switch.

## Completing maintenance work

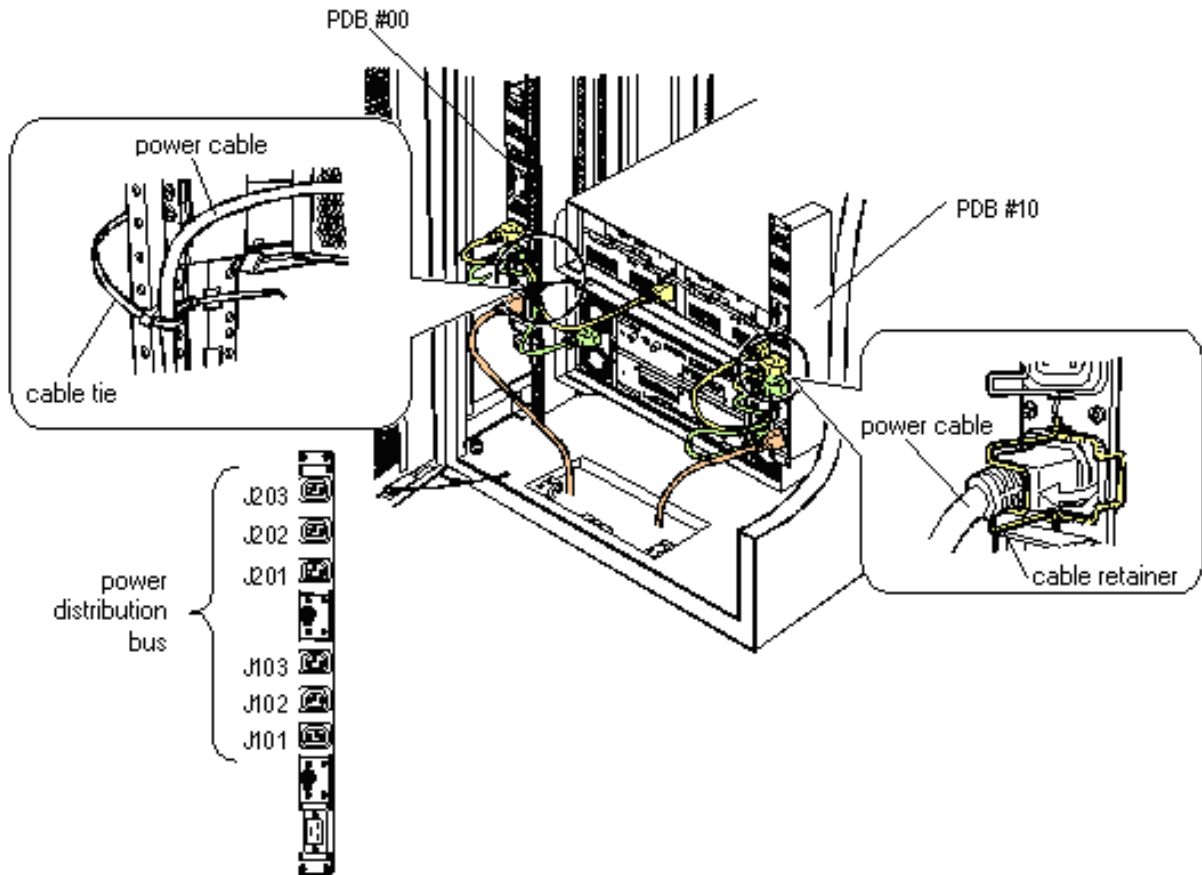
Close all the external covers and rack doors when maintenance work is completed. This helps to protect the arrays from interference that can be caused by electromagnetic radiation from outside sources.

## Relocating or removing an array

Complete the following steps before moving an array that is installed in a rack. Refer to [Figure 5-3](#).

1. Shut down all software running on the array and stop all host I/Os.
2. Turn off all array power switches and wait for the power LEDs to go out.
3. Turn off all switches or circuit breakers on the power distribution buses in the rack.
4. Label the array and the interface cables so that you can easily reconnect them to the same connectors after you move the array.

5. Disconnect all power cables from the PDUs in the rack.
6. Remove all cable ties that secure the power cables to the rack frame.
7. At the power supply end of each power cable, slide the cable retainer off the power cable and disconnect the power cable from the receptacle on the power supply.

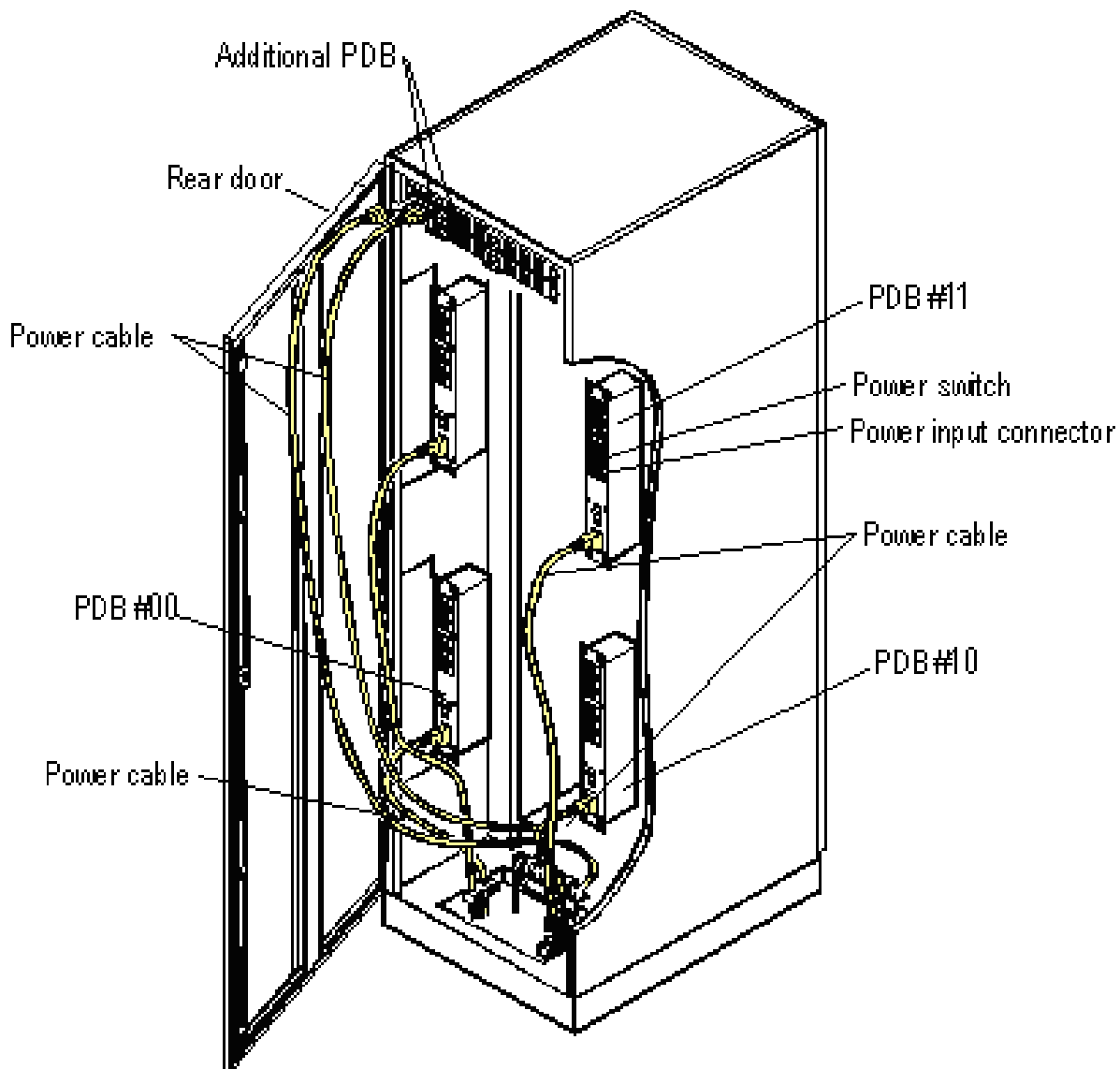


**Figure 5-3: Disconnecting Power Cables**

## Disconnecting power from the rack

Complete the following steps to remove power from a rack before moving the rack. Refer to [Figure 5-4](#).

1. Open the rear door of the rack.
2. Ensure that all power switches on the arrays and the power distribution buses (PDUs) are OFF.
3. Locate the main power cables from the PDUs to the underfloor power connectors and unplug all of them.
4. Tie the main power cables to the rack frame to prevent them from dragging on the floor when moving the rack.



**Figure 5-4: Disconnecting Power Cables from a Rack**

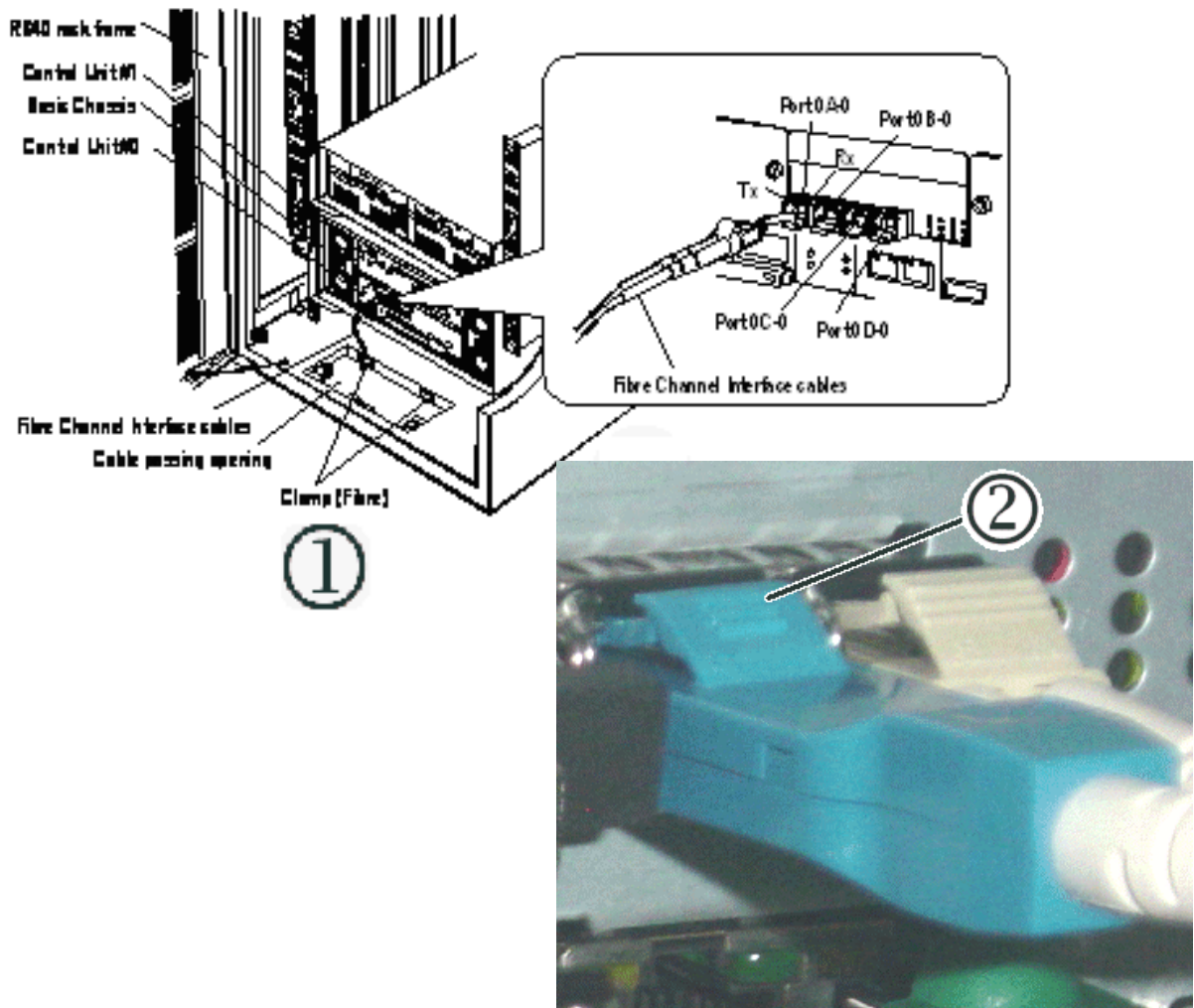
## Disconnecting the Fibre channel interface cable

Complete the following instructions to disconnect a fibre channel interface cable from the host connector on the control unit.



**NOTE:** If the connector is tight in the socket and cannot be easily removed, do not pull hard on it to remove it. Instead, gently wiggle the cable out of the socket on the host connector.

1. Remove the clamps (1) holding the Fibre channel cables to the rack.
2. Disconnect the Fibre channel cable retainer (2) from the cable.
3. Pull the cable out of the host connector.



**Figure 5-5: Disconnecting Interface Cable (AMS 2100/2300 shown)**

## Long term array storage

The cache backup batteries in an AMS 2000 Family array cannot hold a charge indefinitely. If you do not use an array for six months or more, move the batteries to a system that is being used, or turn the array on for at least 24 hours once every six months.



**CAUTION!** If the array is not energized for more than 6 months, the battery will likely discharge completely. When the battery completely discharges, it may be damaged and you may not be able to recharge it. To prevent this from happening, charge the battery for a minimum of 24 hours at least once every six months.



# Troubleshooting

This chapter provides information to help you identify and resolve problems that you may encounter with a Hitachi AMS 2000 Storage System. The following key topics are covered:

- ❑ [Getting help](#)
- ❑ [Troubleshooting tables](#)
- ❑ [Troubleshooting flowcharts](#)
- ❑ [Recovering from failures](#)
- ❑ [Troubleshooting based on LED indications](#)

## Getting help

If you have difficulty with any of the procedures included in this chapter, or if a procedure does not provide the answer or results you expect, please contact the Hitachi Data Systems Customer Support team. See the [Getting help](#) section in the Preface of this manual.

## Troubleshooting tables

[Table 6-1](#) lists common problems and their solutions. Detailed solutions are described in this chapter. The solutions include flowcharts and other instructions to assist you in solving these problems.

**Table 6-1: Problems and Solutions**

Symptom	Possible Cause	Action
Missing or damaged parts	<ul style="list-style-type: none"> <li>Packing error</li> <li>Shipping damage</li> </ul>	If any of the contents listed on the packing list that is included with the unit are missing or damaged, contact your place of purchase.
A failure other than an array failure occurs	No power to host and/or array	<ol style="list-style-type: none"> <li>Check that the host and the array are turned on.</li> <li>Ensure that power cables to the equipment are connected.</li> <li>Ensure that the power source is operational.</li> </ol>
	Communication failure with host	<ol style="list-style-type: none"> <li>Verify that the port activity LEDs on the Fibre Channel data ports being used are ON. If not, try a different Fibre Channel data port.</li> <li>Check the LUN Manager, mapping and LUN settings.</li> </ol>
Array or part has failed	Array or part has failed	<ol style="list-style-type: none"> <li>Start Navigator 2. If it fails to start, see Navigator 2 does not start on page 6-8.</li> <li>Go to the Explorer pane and select Resources &gt; Arrays.</li> <li>In the Array List window, check for a failed array. If you find one, select Components &gt; Trays.</li> <li>From the Alerts screen, click <b>Details</b> to check for additional failed parts.</li> <li>Read any detailed information about the failed part.</li> <li>If the failed component is a drive, order a replacement drive from the Web Portal at <a href="http://support.hds.com">http://support.hds.com</a>.</li> </ol>
An unidentified failure has occurred	Software failure	<ol style="list-style-type: none"> <li>If using preinstalled software (see Features and Benefits in Chapter 1 in the Hitachi AMS 2100/2300 and AMS 2500 Hardware Guides. Refer to the documentation for that product.</li> <li>Turn off the AMS 2100/2300 array. Verify that the front panel Power LED goes OFF. If the Power LED is ON, disconnect both power cables and verify that the front panel Power LED is OFF.</li> <li>Turn on the AMS 2100/2300 array and verify that the Ready LED goes ON.</li> <li>If these steps do not resolve the problem, see <a href="#">Array or part has failed</a>, above.</li> </ol>

**Table 6-1: Problems and Solutions (Continued)**

Symptom	Possible Cause	Action
Navigator 2 does not start	Communication failure with host or management console	<ul style="list-style-type: none"> <li>• Check and reset communications settings.</li> <li>• Check and reconnect LAN cables. Replace if needed.</li> <li>• Check LEDs and take appropriate action. See the LEDs section in this table.</li> <li>• Check and restore power to equipment as needed.</li> <li>• Be sure the computer acting as the management console meets the minimum requirements described in the section titled Prerequisites in the Hitachi AMS 2100/2300 and AMS 2500 Hardware Guides.</li> <li>• Check the settings of your browser.</li> <li>• Verify that the correct IP address was entered in the browser address field.</li> <li>• Verify that the Navigator 2 server is working.</li> <li>• Verify that the host has Java Runtime Environment (JRE) version 1.6 (update 2) installed. This is a free download from <a href="http://java.sun.com/javase/downloads/index.jsp">http://java.sun.com/javase/downloads/index.jsp</a>.</li> <li>• If these steps do not fix the problem, you may need to reinstall the Navigator 2 software.</li> </ul>
	Corrupt Navigator 2 installation	Reinstall Navigator 2. See Chapter 7 in the Hitachi AMS 2100/2300 and AMS 2500 Hardware Guides.
Navigator 2 does not run	Incorrect communication setting: Negotiation	Check the negotiations settings on the management console, and array. Make sure they are the same. The default value for the negotiation is <b>Auto</b> .
	Incorrect value set for the IP address, subnet mask, or default gateway of array	Set a suitable value for the customer's environment for the IP address, subnet mask, and default gateway of array. [IPv4 default value] controller #0: IP address:192.168.0.16 Subnet Mask:255.255.255.0 Default Gateway:0.0.0.0 controller #1: IP address:192.168.0.17 Subnet Mask:255.255.255.0 Default Gateway:0.0.0.0  [IPv6 default value] controller #0: IP Address:Auto controller #1: IP Address:Auto
	Communication failure with host or management console	<ol style="list-style-type: none"> <li>1. Check and reset communications settings.</li> <li>2. See next section in this table.</li> </ol>

**Table 6-1: Problems and Solutions (Continued)**

Symptom	Possible Cause	Action
<p>Navigator 2 cannot communicate with the array</p> <p>In addition to this table, see the flowchart <a href="#">Figure 6-2:Flowchart - Navigator 2 Cannot Connect to an Array on page 6-9</a></p>	iSCSI LAN cables broken or not properly connected	If using iSCSI connections, connect a category 5e or category 6 LAN cable to the RJ-45 connector marked <b>LAN</b> and the management console
	One or more units are powered off or do not have power.	<ol style="list-style-type: none"> <li>1. Check the array power cables, power sources, power switch, and Power LED.</li> <li>2. Check whether other devices in your network, such as a router or switch, are the cause of the problem.</li> <li>3. Turn off the array. Verify that the front panel Power LED goes OFF. If the Power LED stays ON, disconnect both power cables and verify that the front panel Power LED is OFF.</li> <li>4. Turn on the array, wait about 4 minutes for the POST to complete, and verify that the Ready LED goes ON.</li> <li>5. If these steps do not resolve the problem, see <a href="#">Array or part has failed</a>, above.</li> </ol>
	Communication failure: the array is set to use the DHCP server	<ul style="list-style-type: none"> <li>• When the array is set to use the DHCPv4 server, connect with the IP address assigned by the DHCPv4 server. When using the DHCPv4 server, it is recommended that the array be set to statically (Static) assign IP address.</li> <li>• If the IP address is not assigned from the DHCPv4 server to the array when the array is set to use the DHCPv4 server, Navigator 2 cannot be connected to the array. Consult with your network administrator, and review the DHCPv4 server settings.</li> <li>• The default value is DHCPv4:Off (uses a Static IP address)</li> </ul>
	Communication failure:an incorrect value set for the IP address, subnet mask, or default gateway of array	<p>Set a suitable value for the customer's environment for the IP address, subnet mask, and default gateway of array.</p> <p>[default value]</p> <p>controller #0:</p> <p>IP address:192.168.0.16</p> <p>default gateway:0.0.0.0</p> <p>Subnet Mask:255.255.255.0</p> <p>controller #1:</p> <p>IP address:192.168.0.17</p> <p>default gateway:0.0.0.0</p> <p>subnet mask:255.255.255.0</p>
	Communication failure: the array is set to use the same IP address as other arrays or hosts.	When the same IP address as the other arrays or hosts is set for the array, Navigator 2 cannot be connected correctly to the array. Set the array IP address to one that is not used by any other array or hosts on the LAN.
	TCP/UDP port filtering is being performed on the network switch.	<ul style="list-style-type: none"> <li>• The standard default TCP port number for Navigator 2 is 2000. The secure port is 28355. Set a suitable value for the customer's environment.</li> <li>• Be sure to change the port number in the environment using the Cisco SIP Phone.</li> </ul>

**Table 6-1: Problems and Solutions (Continued)**

<b>Symptom</b>	<b>Possible Cause</b>	<b>Action</b>
	Is the Search Array being performed across the IPv6 routers?	The Auto Search Array of IPv6 uses link-local scope multicast. The IPv6 router is unable to transfer this multicast to other local link, so the IPv6 router is unable to search array across the IPv6 router. In case of between different local links, register the array by the static address search.
Host cannot access storage	Communication failure with host or management console.	<ol style="list-style-type: none"><li>1. If you are using Fibre Channel, verify that the port activity LED on the used Fibre Channel data ports is ON or flashing.</li><li>2. Check that all Fibre Channel cables are connected securely at both ends.</li><li>3. If you are using iSCSI, ping the array from the host. If the ping fails, verify that the host is communicating with the array at the appropriate IP address.</li><li>4. Check whether other devices (routers, switches, etc.) in your network) are the cause of the problem.</li><li>5. If these steps do not fix the problem, contact Technical Support. See <a href="#">Getting help</a> in the Preface of this manual.</li></ol>

**Table 6-2: LED Failure Indications**

Unit	Symptom	Possible Cause	Action
In addition to this table, also see <a href="#">Troubleshooting based on LED indications on page 6-12</a> .			
Base Unit	Power LED OFF	<ol style="list-style-type: none"> <li>1. Array power switch OFF</li> <li>2. Power supplies not plugged in</li> <li>3. PDB switch or breaker OFF</li> <li>4. No electric supply to rack</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that the array power switch is ON</li> <li>2. Check that the power cable connections to the array and the PDB are secure.</li> <li>3. Ensure that the PDB switches are ON</li> <li>4. Verify electricity supply to the rack. Work with facility administrator to restore power.</li> <li>5. If these steps do not fix the problem, contact Technical Support. See <a href="#">Getting help</a> in the Preface of this manual.</li> </ol>
	Ready LED OFF	Array failure	Please contact Hitachi Data Systems Technical Support. See the <a href="#">Getting help</a> section in the Preface of this manual.
	Ready LED slow blink	Not a failure. Firmware download is complete. The array is fully operational.	Use the array normally.
	Ready LED fast blink	Not a failure. The firmware is being updated (do not turn off the array).	Wait until the light is ON steady before attempting to replace parts or use the array.
	Warning LED ON	Nonserious Error. The base unit can continue to operate.	See the Alerts & Events window in Navigator 2 for information about the error.
	Alarm LED ON	A serious error has occurred in the array.	Please contact Hitachi Data Systems Technical Support. See the Getting Help section in the Preface of this manual.
Disk Drive	Alarm LED	The drive has failed	Back up data and replace the drive.
Backup Battery	Ready LED blinking slowly (1 blink per second)	Not a failure. The battery is not fully charged.	Allow battery to charge fully.
	Ready LED OFF or high-speed blinking (8 blinks per second):	Abnormal status	Replace battery.
Power Supply	Ready LED OFF	No power to power supply	<ol style="list-style-type: none"> <li>1. Ensure that power cables to the equipment are connected.</li> <li>2. Ensure that the power source is operational.</li> </ol>
	Ready LED blinking	Not a failure. Means that power is connected to the power supply.	Use normally
	Alarm LED ON	The power supply has failed.	Replace the power supply.

**Table 6-2: LED Failure Indications (Continued)**

Unit	Symptom	Possible Cause	Action	
Controller	C-Power LED ON	The cache memory is backed up.		
	RST LED blinking	Not a failure. Blinks while the base unit is resetting.	Wait until reset completes before using the base unit.	
	Link LED OFF	Link status is abnormal	Check LAN cable connections and communications settings. See <a href="#">Navigator 2 cannot communicate with the array</a> in <a href="#">Table 6-1</a> .	
	ACT LED OFF	No data is being transferred.		
	LCT LED blinking	6 (slow)	Voltage on the control unit is abnormal. (Reset of the control unit is not canceled.)	Replace the controller.
		1 (fast) <sup>a</sup>	SRAM error.	
		2 (fast)	hard error.	
		3 (fast)	Firmware error in flash memory.	
4 (fast)		CUDG error in .		
LCT LED ON	Boot section error in the ENC firmware, a RAM error, or ENC hard configuration error.			
Expansion Unit	Power LED OFF	<ol style="list-style-type: none"> <li>1. Array power switch OFF</li> <li>2. Power supplies not plugged in</li> <li>3. PDB switch or breaker OFF</li> <li>4. No electric supply to rack</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that the ENC cables are connected from the base unit to the expansion unit and that Ensure that the array power switch is ON</li> <li>2. Check that the power cable connections to the expansion unit and the PDB are secure.</li> <li>3. Ensure that the PDB switches in the rack are ON.</li> <li>4. Verify electricity supply to the rack. Work with facility administrator to restore power.</li> </ol> <p>If these steps do not fix the problem, contact Technical Support. See <a href="#">Getting help</a> in the Preface of this manual.</p>	
	Locate LED ON	<p>Indicates that a non-fatal failure in the expansion unit, but which does not stop the unit from operating.</p> <p>Indicates that the expansion unit has been added to the array with the power turned on (this is not an error).</p>		

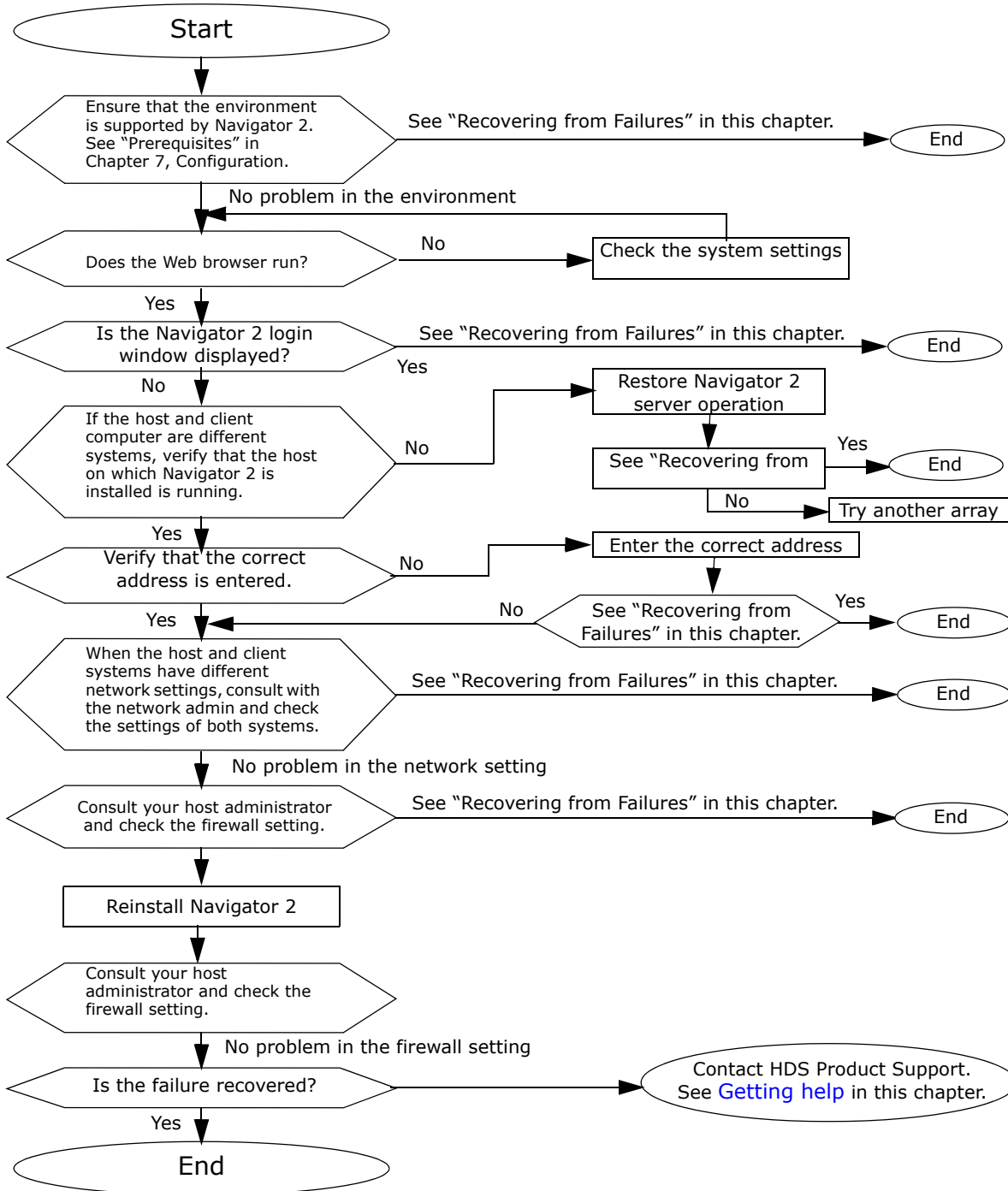
a. When blinking fast, the LED is on for 400 ms and off for 200 ms for each fast blink. After the number of fast blinks has completed, the LED is off for one second.

# Troubleshooting flowcharts

The following section provides step-by-step flowcharts that can assist you in solving two common problems with Navigator 2.

## Navigator 2 does not start

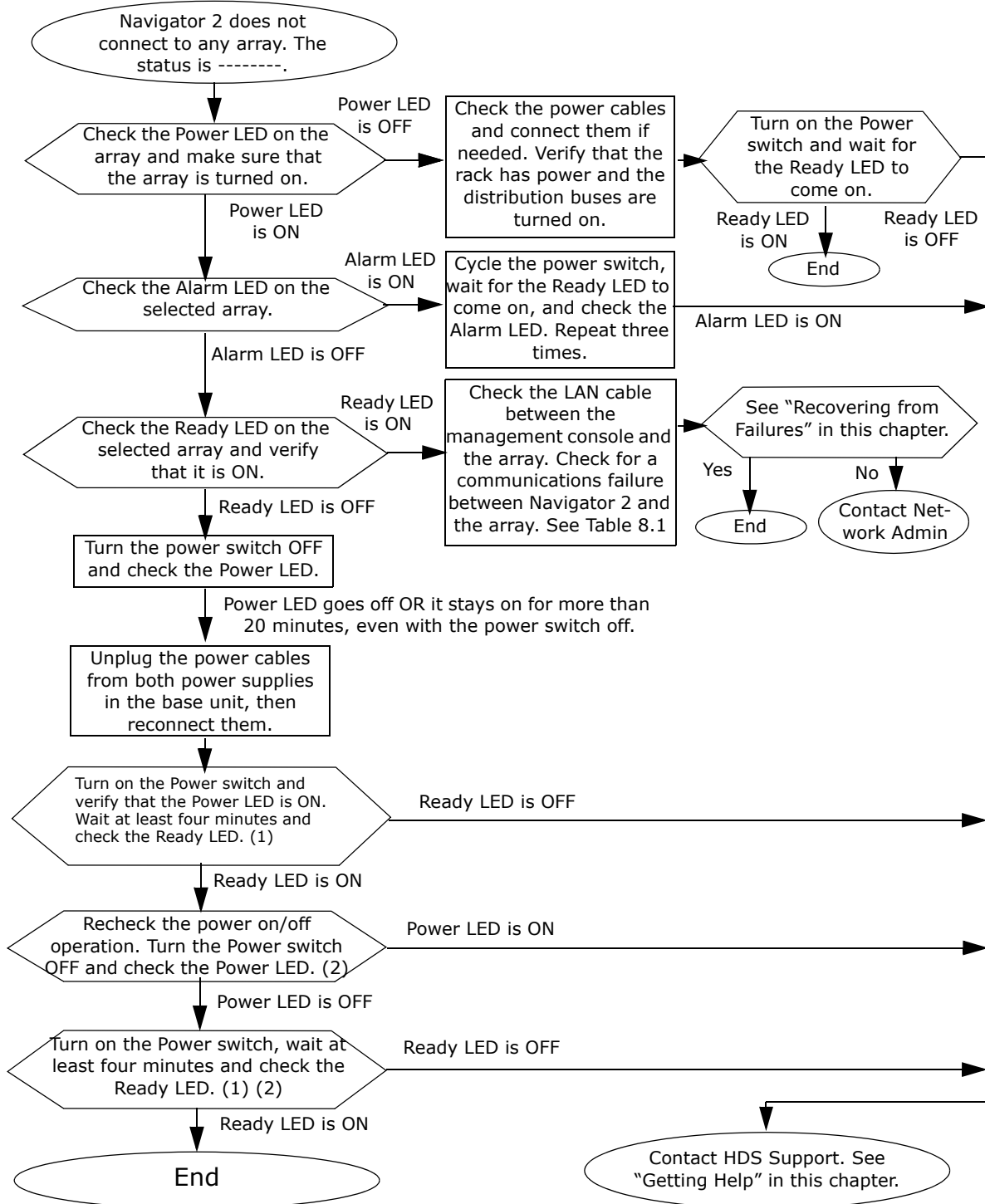
Figure 6-1 provides a series of troubleshooting steps to follow if Navigator 2 does not start upon entering the login URL in your web browser. Look for a communication failure with the host or a corrupt installation.



**Figure 6-1: Flowchart - Navigator 2 Does Not Start**

## Navigator 2 cannot connect to an array

Figure 6-2 provides a series of troubleshooting steps to follow if Navigator 2 runs but cannot connect to an array.



### Notes:

(1) The Ready LED normally lights about four minutes after the power is turned on but can take as long as 20 minutes depending on the array status. If the Ready LED does not light within 20 minutes, check the Power LED and verify that it is ON. If it is not ON, check the power cables and the power to the rack.

(2) If the Power LED stays on when the Power switch is turned OFF, the array may not have powered off correctly. Turn the power on and back off again, then recheck the Power LED.

**Figure 6-2: Flowchart - Navigator 2 Cannot Connect to an Array**

# Recovering from failures

An array failure may have occurred if one or more of the following occurs:

- The AMS 2100/2300 array sends an email alerting you to a failure.
- The **Alarm** or **Warning** LED on the front panel goes ON.
- The **Ready** LED on the front panel is OFF.
- You experience performance deterioration with the AMS 2100/2300 array.
- A LUN cannot be recognized.
- A host cannot see a Fibre channel data port on the AMS 2100/2300 array.

If one or more of these actions occurs, perform the following steps to recover from the failure:

1. Log in to Navigator 2 Enter the following URL in the address field in the web browser:

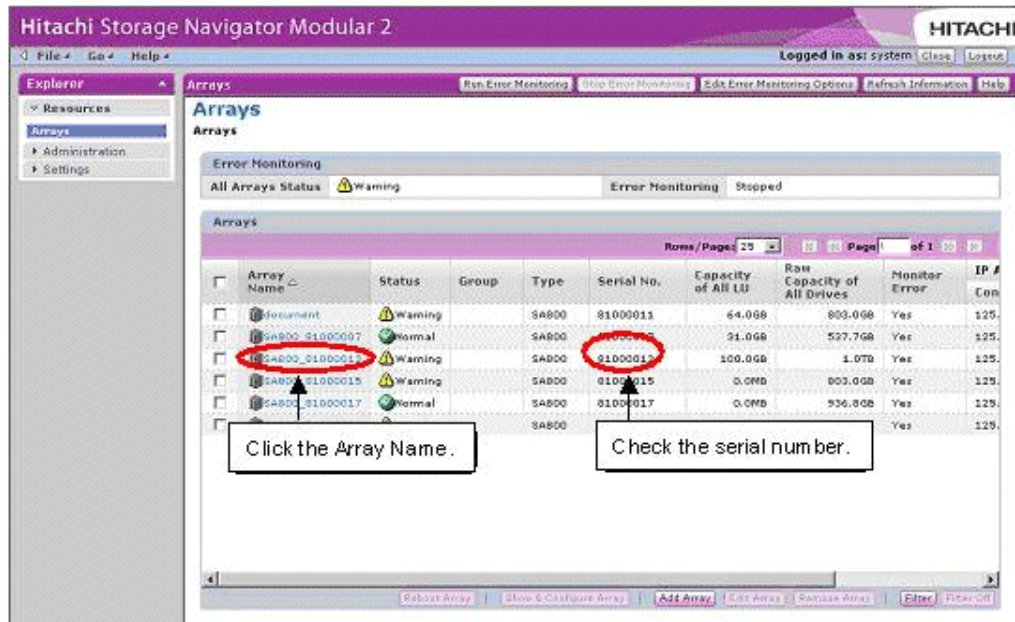
<http://<IP address of management console PC>:23015/StorageNavigatorModular/Login>

2. The Array List window is displayed.



**NOTE:** If Navigator 2 does not start, a communication failure with the Navigator 2 server may have occurred or the Navigator 2 server may not be started normally. See “Navigator 2 does not start” in [Table 6-1:Problems and Solutions, on page 6-2](#) and [Figure 6-1:LED Failure Indications, on page 6-8](#).

3. In the **Arrays** area, check the status and serial number of the array where the failure occurred (see [Figure 6-3 on page 6-10](#)).

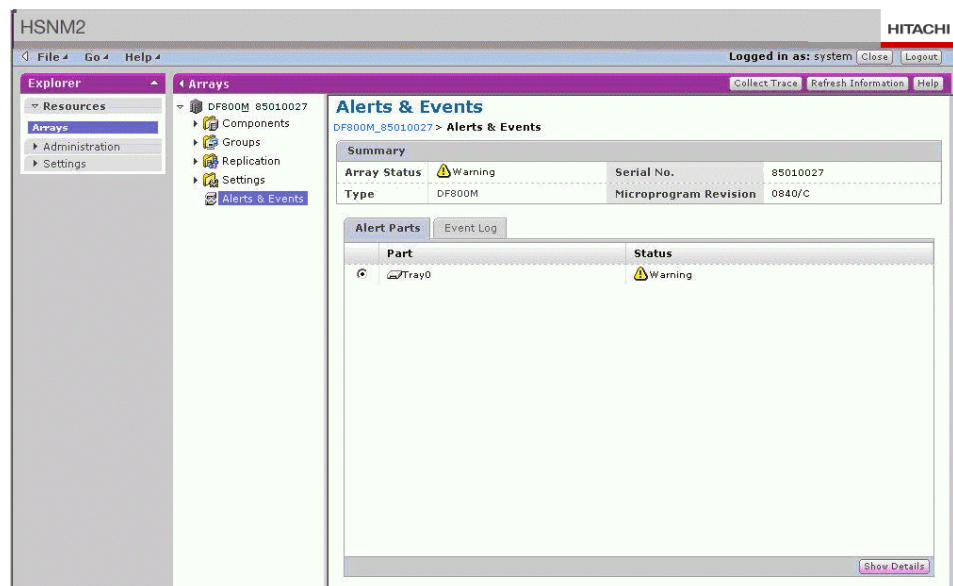


**Figure 6-3: Locating the Array Name and Serial Number**



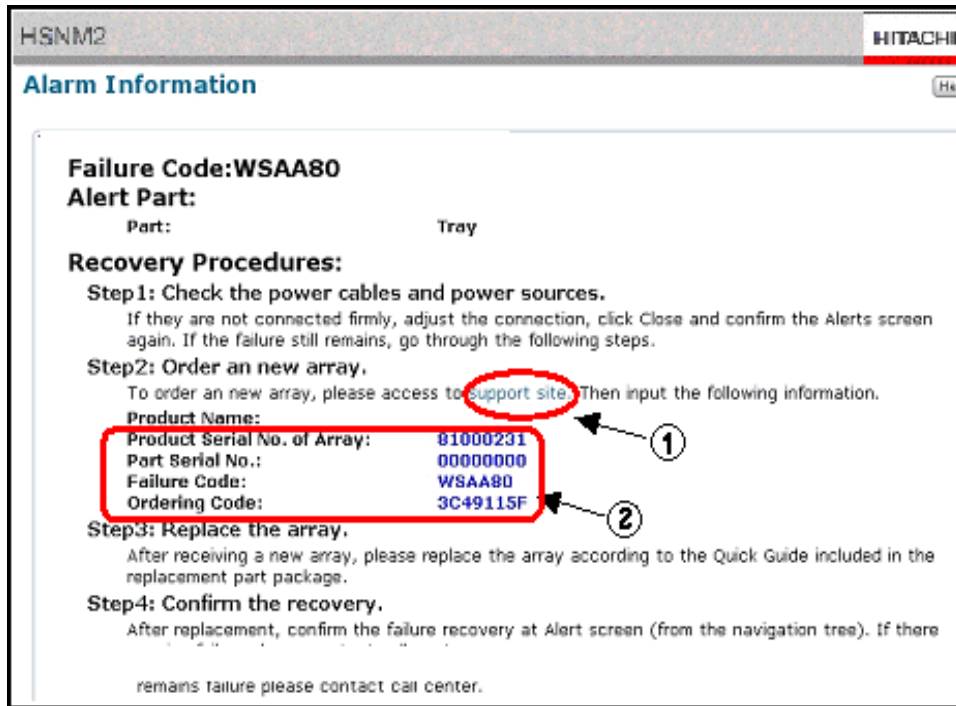
**NOTE:** If Navigator 2 cannot access The array, the array may be turned off or there may be a network failure between Navigator 2 and the array. See [Table 6-1:Problems and Solutions, on page 6-2](#) for more information.

4. If you received an email about the failure or used SNMP to detect the failure, check that the hardware serial number in the email/SNMP matches the one on The array (see [Figure 6-3 on page 6-10](#)).
5. Check the status column of the system that matches the hardware serial number checked in the previous step.
  - **Normal** = The array is operating normally. The fault may have occurred between the array and the host. See “A failure other than an array failure occurs” in [Table 6-1:Problems and Solutions, on page 6-2](#).
  - --- = Navigator 2 cannot access The array. The **MAIN SW** switch may be set to the OFF position or a network failure may have occurred between the host and the array. See “Navigator 2 cannot communicate with the array” in [Table 6-1:Problems and Solutions, on page 6-2](#).
6. From the Arrays area shown in [Figure 6-3](#), click the name of the array. When the next screen appears, click either **Alerts & Events** in the Array List window or **Check for Errors** in the Common Array Tasks area. In the **Alert Parts** tab, check for the failed part, such as a disk drive (see [Figure 6-4](#)).
  - If a disk drive is shown, replace the drive. See Replacing a disk drive on page 4-8.
  - If The array is shown, the array is faulty and should be replaced.
  - If neither appears in the failure list window, a software failure may have occurred. See “Unidentified failure has occurred” in [Table 6-1:Problems and Solutions, on page 6-2](#).



**Figure 6-4: Example of the Failure Parts List Tab**

7. If an entry appears in the failure parts list window, click **Show Details** in the lower right corner of the screen for detailed information (see [Figure 6-5](#)). To remove the information, click **Close**.



**Figure 6-5: Example of an Alarm Information Window**

## Troubleshooting based on LED indications

This section provides step-by-step procedures to help determine the cause of failures that are indicated by the LEDs on the array. This section is intended to be used along with [Table 6-2:LED Failure Indications, on page 6-6](#).

Verify that a failure is recovered after taking the appropriate actions for the following LED indications.



**NOTE:** When a base unit is used as the remote unit in a TrueCopy remote replication/TrueCopy Extended Distance configuration, restarting the base unit can cause the following events:

- Both paths of TrueCopy remote replication/TrueCopy Extended Distance are blocked.
  - At the time the path is blocked, Navigator 2 sends a failure notice to the users whose email addresses are configured in the Alerts and Events window in Navigator 2. The alert contains information regarding the Email Alert and SNMP Agent Support features, and TRAP. Follow the instructions in the email alert. After the remote unit has restarted, the path blockade automatically recovers and the paths are available for use.
  - If the pair status of TrueCopy remote replication/TrueCopy Extended Distance is PAIR or COPY, the pair status changes to PSUE.
  - When the base unit must be restarted, change the pair status of TrueCopy remote replication/TrueCopy Extended Distance to PSUS, and then restart the unit.
- 



**NOTE:** When the Power Saving storage feature is used, if you restart the base unit while the spin-down is in progress, the spin-down may fail because it recognizes the host immediately after the unit starts.

After the spin-down has completed, check the RAID Groups and make sure that none of them are set to the "Normal (command monitoring)" power saving status, then restart the unit. If the spin-down fails, start the spin-down again.

---

### The power LED does not turn on

1. Turn the power switch ON.
2. Is the POWER LED on the base unit on?  
**Yes:** Go to step 10.  
**No:** Power on the host computer.
3. Is the POWER LED on the base unit on?  
**Yes:** Go to step 10.  
**No:** Turn the power switch OFF.
4. Check the PDB to verify that electricity is being supplied to the unit.
5. Verify that the AC cable is correctly connected to the power supply socket and the equipment.
6. Turn the power switch ON.
7. Is the POWER LED on the base unit on?  
**Yes:** Continue normal operation.  
**No:** Turn the power switch OFF.
8. Call your maintenance engineer. Go to step 10.
9. Is the READY LED on?  
**Yes:** Continue to use the equipment in its current operational state. If the READY LED (green) blinks at a high pace, the download of the ENC

firmware is executed. Even when the READY LED (green) blinks, the subsystem is operational.  
No: Refer to (3) READY LED does not turn on or READY LED has turned on once and then turn off off.

10. End of procedure.

### **The power LED has turned off**

1. Is electricity supplied to the equipment?  
Yes: Go to step 2.  
No: Supply electricity to the unit, and then restart the unit. Go to step 2.
2. Set the main switch to Off.
3. After waiting for more than one minute, set the main switch to On.
4. Is the POWER LED on the base unit on?  
Yes: go to step 5.  
No: Set the main switch to Off.
5. Call your maintenance engineer. Go to step 7.
6. Is the READY LED on the base unit on?  
Yes: Continue to use the equipment in its current operational state. If the READY LED (green) blinks at a high pace, the download of the ENC firmware is executed. Even when the READY LED (green) blinks, the subsystem is operational.  
No: Refer to Ready LED does not turn on (next section)
7. End of procedure.

### **Ready LED does not turn on**

This procedure is also used when the Ready LED has turned on once and then turns off.

1. Is the Power LED on the base unit on?  
Yes: Go to step 2.  
No: Go to step 4 in The Power LED does not turn on.
2. Is the Alarm LED on the base unit on?  
Yes: Refer to Alarm LED has turned on on page 6-15.  
No: Go to step 3.
3. Does the Ready LED (green) on the base unit blink at high speed?  
Yes: Wait for up to 30 to 50 minutes until the Ready LED (green) on the base unit lights because the automatic download of the ENC firmware is in progress. Even when the Ready LED (green) blinks, the subsystem is operational.  
No:
4. Does the Warning LED (orange) blink at high speed?  
Yes: Wait until the Warning LED (orange) on the base unit is off, and the Ready LED (green) on the base unit lights because the update of the flash program is executed.  
No: Go to step 5.
5. Turn off the Power switch.
6. After waiting for more than one minute, turn on the Power switch.

7. After 4 minutes, does the ready LED on the base unit go on?  
Yes: Continue to use the equipment in its current operational state. If the Ready LED (green) blinks at high speed, downloading of the ENC firmware is in progress. Even when the Ready LED (green) blinks, the array is operational. And go to step 10.  
No: go to step 9.
8. Set the main switch to off.
9. Contact Technical Support. See [Getting help](#) in the Preface of this manual.
10. End of procedure.

### **Alarm LED has turned on**

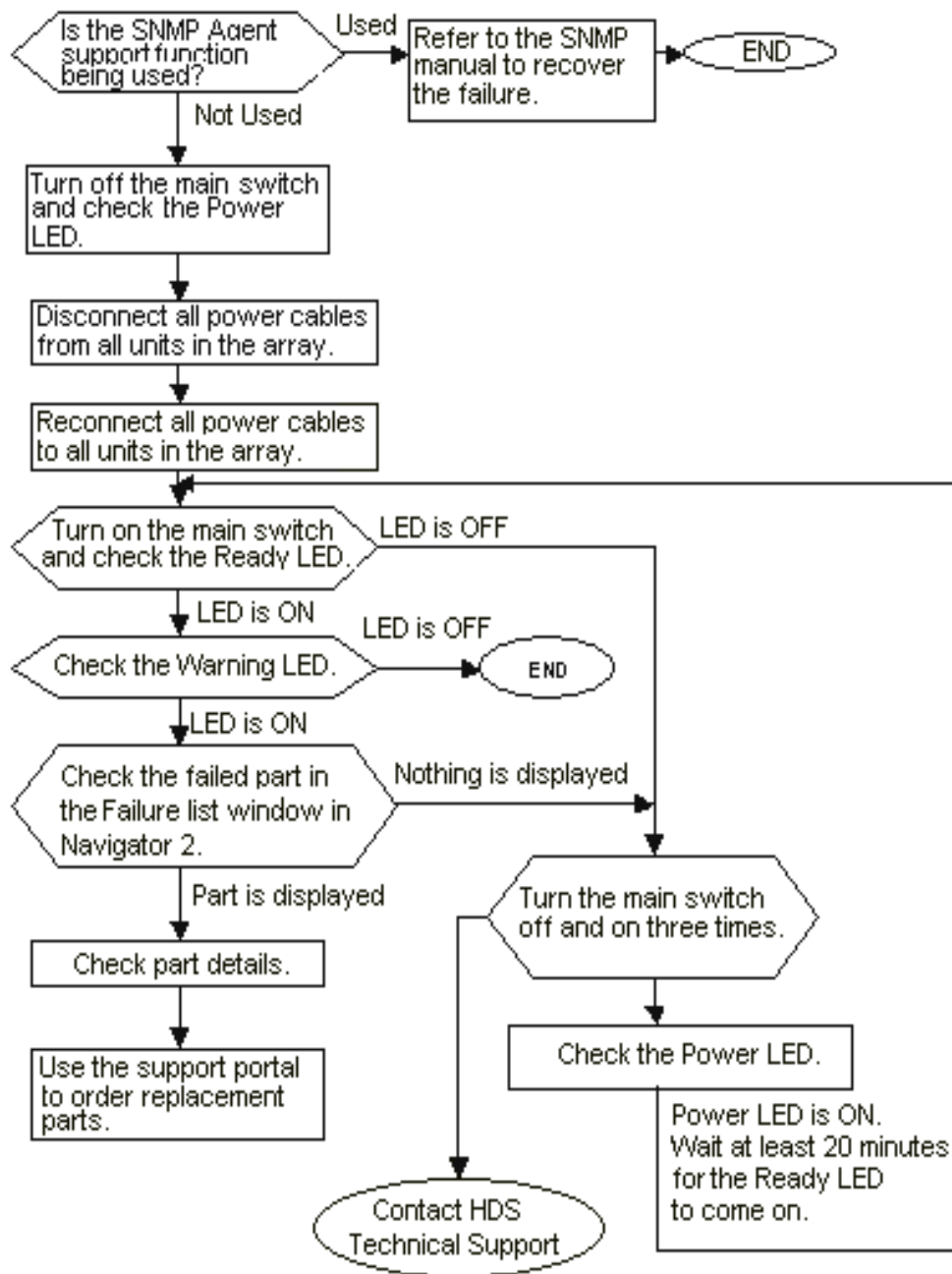
1. Identify the components in which a failure occurs.
2. Replace the failed components. See the *Hitachi AMS 2000 Family Storage System Service Guide* for instructions.

### **Warning LED has turned on or blinks**

1. Does the WARNING LED (orange) blink at high speed?  
Yes: Wait until the WARNING LED (orange) on the base unit is off, and the READY LED (green) on the base unit lights because the firmware is being updated.  
No: Go to step 2.
2. Does the WARNING LED on the base unit blink at low speed?  
Yes: Use Navigator 2 to identify the failure in the base unit, then go to step 6.  
No: Go to step 5.
3. Is the READY LED on the base unit on?  
Yes: Go to step 5.  
No: Refer to (3) READY LED does not turn on or READY LED has turned on once and then turn off off.
4. Identify in which components a failure resides in the base unit.
5. Continue to use the equipment and contact Hitachi Data Systems Technical Support. See [Getting help](#) at the beginning of this chapter.
6. End of procedure.

## When an unknown failure occurs in an array

The troubleshooting flowchart in [Figure 6-6](#) describes the procedure to identify and repair a failed part when Navigator 2 does not display the failed part information.



**Figure 6-6: Recovering a Failure That Cannot Specify the Failed Part**



# 7

## Errors

This chapter provides information about the errors and error messages that can be displayed by the Hitachi AMS 2000 Storage System software. The following key topic is covered:

- ❑ [Error recovery](#)

## Error recovery

After you replace a part with a spare unit and the error recovery completes normally, check the Alerts window in Navigator 2. You should see the information messages shown in the following tables.

### Data recovery when a blocked disk is detected

W060HH HDU alarm (Unit-x, HDU-y)
W09zab HDU alarm (Unit-x, HDU-y)
W0Azab SATA HDU alarm (Unit-x, HDU-y)
.....: Data Disk blocked
I150xy Data recovery started / I150HH Data recovery started
.....: Start of area recovery
I151xy Data recovery completed / I151HH Data recovery completed
.....: Completion of data area recovery
I008xy Data recovery to spare HDU / I008HH Data recovery to spare HDU
.....: Completion of recovery onto Spare Disk
I1GG00 HDU changed to spare (Unit-x, HDU-y)
.....: The blocked data disk is changed to the spare disk, and the spare disk before the failure is changed to the data disk (see Note *).
W061HH Spare HDU alarm (Unit-x, HDU-y)
W0Bzab Spare HDU alarm (Unit-x, HDU-y)
W0Czab SATA Spare HDU alarm (Unit-x, HDU-y)
.....: Spare Disk blocked (see Note **).

\*This message (I1GG00) has set "Spare Drive" of "Configuration Settings" - "Restore Options" of the Hitachi Storage Navigator Modular 2 to variable (default value). This message is displayed after the disk drive restoration is completed if the capacity and the rotational speed of the blocked disk drive and the spare disk drive at the data recovery destination are matched and both of them are not the disk drives of the RKAK when "applying no copy back mode on all the units" is set to disable. Also, this message is displayed after the disk drive restoration is completed if the disk drive capacity of the blocked disk drive and the spare disk drive at the data recovery destination is matched when "spare disk drive active mode" is variable and "applying no copy Back Mode on All the Units" is set to enable.

\*\*This message (W0Czab) is displayed in the Warning Information.

## Data recovery (dynamic sparing from data disk to spare disk)

I15Axy Dynamic sparing start / I15AHH Dynamic sparing start	.....: Start of Dynamic sparing
I150xy Data recovery started / I150HH Data recovery started	.....: Start of disk recovery
I151xy Data recovery completed / I151HH Data recovery completed	.....: Completion of data area recovery
I008xy Data recovery to spare HDU / I008HH Data recovery to spare HDU	.....: Completion of recovery onto Spare Disk
I1GG00 HDU changed to spare (Unit-x, HDU-y)	.....: The blocked data disk is changed to the spare disk, and the spare disk before the failure is changed to the data disk (see Note *).
W060HH HDU alarm	
W09zab HDU alarm	
W0Azab SATA HDU alarm	.....: Data Disk is blocked (see Note **)
W061HH Spare HDU alarm (Unit-x, HDU-y)	
W0Bzab Spare HDU alarm (Unit-x, HDU-y)	
W0Czab SATA Spare HDU alarm (Unit-x, HDU-y)	.....: Spare Disk is blocked (see Note † and Note ††)

---

\*This message (I1GG00) is displayed in the Warning Information.

\*\*This message (W0Azab) is displayed only when "I1GG00 HDU changed to spare (Unit-x, HDU-y)" is not displayed before this.

†This message (W0Czab) has set "Spare Drive" of "Configuration Settings" - "Restore Options" of the Hitachi Storage Navigator Modular 2 to variable (default value), and it is displayed after the Disk Drive restoration is completed if the capacity and the rotational speed of the blocked Disk Drive and the Spare Disk Drive at the data recovery destination are matched and both of them are not the Disk Drives of the RKAK expansion unit when "Applying No Copy Back Mode on All the Units" is set to disable. Also, this message is displayed after the Disk Drive restoration is completed if the Disk Drive capacity of the blocked Disk Drive and the Spare Disk Drive at the data recovery destination is matched when "Spare Disk Drive Active Mode" is variable and "Applying No Copy Back Mode on All the Units" is set to enable.

However, when the Power Saving function is installed and enabled, if the Spare Disk setting is made for the Disk Drives #0 to #4 of the AMS 2100/AMS 2300 (RKM/RKS) or the Disk Drives #0 to #3 of the Additional Chassis (RKAK), the Copy backless does not operate during the data recovery to the Disk Drive set as a Spare Drive, and the Copy back surely operates after changing the Disk Drive.

††This message (W0Czab) is displayed only when "I1GG00 HDU changed to spare (Unit-x, HDU-y)" is displayed before this.

---

## Copy back

```
I140xy System copy started / I140HH System copy started
.....: Start of system area
      recovery (see Note)
I141xy System copy completed / I141HH System copy completed
.....: Completion of system
      area recovery (see Note)
I150xy Data recovery started / I150HH Data recovery started
.....: Start of data area
      recovery
I151xy Data recovery completed / I151HH Data recovery completed
.....: Completion of data area
      recovery
```



**NOTE:** This message is displayed only when the Disk Drives, including the Disk Drives #0 to #4 of the AMS 2100/AMS 2300 (RKM/RKS).

---

When the recovery terminates abnormally, whichever [I142xy System copy failed (Unit-x, HDU-y)] or [I142HH System copy failed (Unit-x, HDU-y)] or [I152xy Data recover failed (Unit-x, HDU-y)] or [I152HH Data recover failed (Unit-x, HDU-y)] is displayed. Take a recovery action following the messages.

## Confirming completion of data recovery or copy back

Select Information Message in Navigator 2 and make sure that the data recovery is completed normally.

Table 7-1 shows the standard of the time required of the Correction copy and the Copy back when selecting optional numbers of the Disk Drives which configure the RAID Group. The time required of the Correction copy and the Copy back also increases as the number of the Fibre Channel or S-ATA Disk Drives that configures the RAID Group increases.

The correction copy, copy back and dynamic sparing do not operate mutually at the same time and also they do not operate at the same time for two or more Disk Drives. Therefore, when the data of two or more Disk Drives (n Disk Drives) was recovered, the time that it takes to complete recovering all the data of the n Disk Drives becomes n times the standard time.

Table 7-1 also shows the standard time required for the correction copy or copy back. The values of storage capacity are calculated as 1 GB = 1,000,000,000 bytes. This definition is different from that (1 KB= 1,024 bytes) shown on PCs you are using.

**Table 7-1: Standard Time Required for the Correction Copy or Copy Back**

Item	Disk Drive (GB) <sup>1</sup>			142.61	287.62	392.73	439.44	
Correction Copy <sup>2</sup>	AMS 2100/ 2300	4 Disk Drives	RAID 6	(2D+2P)	40 min	80 min	130 min	120 min
		6 Disk Drives		(4D+2P)	60	100	190	170
		10 Disk Drives		(8D+2P)	90	150	280	260
		14 Disk Drives		(12D+2P)	120	240	380	360
		18 Disk Drives		(16D+2P)	160	320	500	480
		30 Disk Drives		(28D+2P)	250	500	780	750
		3 Disk Drives	RAID 5	(2D+1P)	30	60	110	90
		5 Disk Drives		(4D+1P)	50	100	160	150
		9 Disk Drives		(8D+1P)	80	160	250	240
		11 Disk Drives		(10D+1P)	100	200	310	300
		13 Disk Drives		(12D+1P)	120	240	380	360
		16 Disk Drives		(15D+1P)	140	280	440	420
		4 Disk Drives	RAID 1+0	(2D+2D)	40	80	130	120
		8 Disk Drives		(4D+4D)	40	80	130	120
	16 Disk Drives	(8D+8D)		40	80	130	120	
	2 Disk Drives	RAID 1	(1D+1D)	40	80	130	120	
	AMS 2500	4 Disk Drives	RAID 6	(2D+2P)	30	60	90	90
		6 Disk Drives		(4D+2P)	50	100	160	150
		10 Disk Drives		(8D+2P)	80	160	250	240
		14 Disk Drives		(12D+2P)	120	240	380	360
		18 Disk Drives		(16D+2P)	150	300	470	450
		30 Disk Drives		(28D+2P)	250	500	780	750
		3 Disk Drives	RAID 5	(2D+1P)	30	60	90	90
		5 Disk Drives		(4D+1P)	50	100	160	150
		9 Disk Drives		(8D+1P)	80	160	250	240
		11 Disk Drives		(10D+1P)	100	200	310	300
		13 Disk Drives		(12D+1P)	120	240	380	360
		16 Disk Drives		(15D+1P)	140	280	440	420
4 Disk Drives		RAID 1+0	(2D+2D)	40	80	130	120	
8 Disk Drives			(4D+4D)	40	80	130	120	
16 Disk Drives	(8D+8D)		40	80	130	120		
2 Disk Drives	RAID 1	(1D+1D)	40	80	130	120		

**Table 7-1: Standard Time Required for the Correction Copy or Copy Back**

Item	Disk Drive (GB) <sup>1</sup>			142.61	287.62	392.73	439.44	
Copy Back <sup>2</sup>	AMS 2100/ 2300	6 Disk Drives	RAID 6	(4D+2P)	40 min	80 min	130 min	120 min
		30 Disk Drives		(28D+2P)	40	80	130	120
		5 Disk Drives	RAID 5	(4D+1P)	40	80	130	120
		16 Disk Drives		(15D+1P)	40	80	130	120
		4 Disk Drives	RAID 1+0	(2D+2D)	40	80	130	120
		16 Disk Drives		(8D+8D)	40	80	130	120
		2 Disk Drives	RAID 1	(1D+1D)	40	80	130	120
	AMS 2500	6 Disk Drives	RAID 6	(4D+2P)	40	80	130	120
		30 Disk Drives		(28D+2P)	40	80	130	120
		5 Disk Drives	RAID 5	(4D+1P)	40	80	130	120
		16 Disk Drives		(15D+1P)	40	80	130	120
		4 Disk Drives	RAID 1+0	(2D+2D)	40	80	130	120
		16 Disk Drives		(8D+8D)	40	80	130	120
		2 Disk Drives	RAID 1	(1D+1D)	40	80	130	120

1. These values of storage capacity are calculated as 1 GB = 1,000,000,000 bytes. See [Convention for storage capacity values](#) in the Preface in this manual for more information.
2. The time shown above is a general guideline of a recovery time for a case where no I/O operation is requested by a host computer. If an I/O operation is requested by a host computer, the time becomes longer.





# Glossary

This glossary provides definitions of general storage networking terms as well as specific terms related to the technology that supports your Hitachi Simple Modular Storage 100 array. Click the letter of the glossary section to display that page.

#	<a href="#">A</a>	<a href="#">B</a>	<a href="#">C</a>	<a href="#">D</a>	<a href="#">E</a>	<a href="#">F</a>	<a href="#">G</a>	<a href="#">H</a>	<a href="#">I</a>	<a href="#">J</a>	<a href="#">K</a>	<a href="#">L</a>	<a href="#">M</a>	<a href="#">N</a>	<a href="#">O</a>	<a href="#">P</a>	<a href="#">Q</a>	<a href="#">R</a>	<a href="#">S</a>	<a href="#">T</a>	<a href="#">U</a>	<a href="#">V</a>	<a href="#">W</a>	<a href="#">X</a>	<a href="#">Y</a>	<a href="#">Z</a>
---	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------	-------------------

## #

### **1000Base-T**

A specification for Gigabit Ethernet over copper wire. The standard defines 1 Gbps data transfer over distances of up to 100 meters using four pairs of Category 5 balanced copper cabling and a 5-level coding scheme.

## **A**

### **Array**

A set of hard disks grouped logically together to function as one contiguous storage space.

### **ATA**

Advanced Technology Attachment. A disk drive implementation that integrates the controller on the disk drive.

## **B**

### **BIOS**

Basic Input Output System. Built-in software code that determines the functions that a computing device can perform without accessing programs from a disk.

### **Bps**

Bits Per Second. The standard measure of data transmission speeds.

## **C**

### **Cache**

A temporary, high-speed storage mechanism. It is a reserved section of main memory or an independent high-speed storage device. Two types of caching are found in computers: memory caching and disk caching. Memory caches are built into the architecture of microprocessors and often computers have external cache memory. Disk caching works like memory caching; however, it uses slower, conventional main memory that on some devices is called a memory buffer.

### **Capacity**

The amount of information (usually expressed in gigabytes) that can be stored on a disk drive. It is the measure of the potential contents of a device; the volume it can contain or hold. In communications, capacity refers to the maximum possible data transfer rate of a communications channel under ideal conditions.

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

## **Glossary–2**

## **Challenge Handshake Authentication Protocol**

A security protocol that requires users to enter a secret for access.

## **CHAP**

See Challenge Handshake Authentication Protocol.

## **D**

### **DHCPv4**

Dynamic Host Configuration Protocol version 4. Allows a computer to join an IP-based network without having a pre-configured IPv4 address. DHCPv4 is a protocol that assigns unique IP addresses to devices, then releases and renews these addresses as devices leave and re-join the network.

### **Duplex**

The transmission of data in either one or two directions. Duplex modes are full-duplex and half-duplex. Full-duplex is the simultaneous transmission of data in two directions. For example, a telephone is a full-duplex device, because both parties can talk at once. In contrast, a walkie-talkie is a half-duplex device because only one party can transmit at a time.

## **F**

### **Fabric**

The hardware that connects workstations and servers to storage devices in a SAN. The SAN fabric enables any-server-to-any-storage device connectivity through the use of Fibre Channel switching technology.

### **Firmware**

Software embedded into a storage device. It may also be referred to as Microcode.

### **Full-duplex**

The concurrent transmission and the reception of data on a single link.

## **G**

### **Gbps**

Gigabits per second.

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

## H

### HBA

Host Bus Adapter. A circuit board and/or integrated circuit adapter installed in a workstation or server that provides input/output processing and physical connectivity between a server and a storage device. An iSCSI HBA implements the iSCSI and TCP/IP protocols in a combination of a software storage driver and hardware.

### HDD

Hard disk drive.

## I

### Initiator

A system component that originates an I/O command over an I/O bus or network, such as an I/O adapters or network interface cards.

### I/O

Input/output.

### IP

Internet Protocol. Specifies the format of packets and addressing scheme. Most networks combine IP with a higher-level protocol called Transmission Control Protocol (TCP), which establishes a virtual connection between a destination and a source.

### IP address

An identifier for a computer or device on a TCP/IP network. Networks using the TCP/IP protocol route messages based on the IP address of the destination. The format of an IP address is a 32-bit numeric address written as four numbers separated by periods. Each number can be zero to 255 (for example, 192.168.0.200). The current main address is IPv4 (Internet Protocol Address Version 4) and the next-generation address is IPv6 (Internet Protocol address Version 6).

### IP-SAN

Block-level Storage Area Networks over TCP/IP using the iSCSI protocol.

### iSCSI

Internet SCSI. An IP-based standard for connecting data storage devices over a network and transferring data using SCSI commands over IP networks. iSCSI enables a Storage Area Network to be deployed in a Local Area Network.

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

## **iSNS**

Internet Storage Name Service. A protocol that allows automated discovery, management and configuration of iSCSI devices on a TCP/IP network.

## **L**

### **LAN**

Local Area Network. A computer network that spans a relatively small area, such as a single building or group of buildings.

### **Loopback address**

Loopback address is virtual address that means itself in network. In case of IPv4 uses "127.0.0.1", in case of IPv6 uses "::1". Also "local host" is used as the host name conventionally.

## **LU**

Logical unit.

## **LUN**

Logical unit number.

## **M**

### **Middleware**

Software that connects two otherwise separate applications. For example, a middleware product can be used to link a database system to a Web server. Using forms, users request data from the database; then, based on the user's requests and profile, the Web server returns dynamic Web pages to the user.

## **N**

### **NIC**

Network Interface Card. An expansion board in a computer that allows the computer to connect to a network

## **R**

### **RAID**

Redundant Array of Independent Disks. A disk array in which part of the physical storage capacity is used to store redundant information about user data stored on the remainder of the storage capacity. The redundant information enables regeneration of user data in the event that one of the array's member disks or the access path to it fails. SNIA.

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## **RAID 6**

An extension of the RAID 5 array that allows for two simultaneous drive failures without downtime or data loss.

## **RPO**

Recovery Point Objective. After a recovery operation, the recovery point objective is the maximum desired time period, prior to a disaster, in which changes to data may be lost. This measure determines up to what point in time data should be recovered. Data changes preceding the disaster are preserved by recovery.

## **S**

### **SAN**

Storage Area Network. A network of shared storage devices that contain disks for storing data.

### **SAS**

Serial Attached SCSI. An evolution of parallel SCSI into a point-to-point serial peripheral interface in which controllers are linked directly to disk drives. SAS delivers improved performance over traditional SCSI because SAS enables up to 128 devices of different sizes and types to be connected simultaneously.

### **SATA**

Serial ATA is a computer bus technology primarily designed for the transfer of data to and from hard disks and optical drives. SATA is the evolution of the legacy Advanced Technology Attachment (ATA) interface from a parallel bus to serial connection architecture.

### **SCSI**

Small Computer System Interface. A parallel interface standard that provides faster data transmission rates than standard serial and parallel ports.

### **Session**

A series of communications or exchanges of data between two end points that occurs during the span of a single connection. The session begins when the connection is established at both ends, and terminates when the connection is ended. For some applications each session is related to a particular port. In this document a session is the exchange of data between groups of primary and secondary volumes.

### **SMTP**

Simple Mail Transfer Protocol. A protocol used to receive and store email data directly from email servers.

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## Software initiator

A software application initiator communicates with a target device. A software initiator does not require specialized hardware because all processing is done in software, using standard network adapters.

## SSD

Solid State Disk (drive). A data storage device that uses solid-state memory to store persistent data. An SSD emulates a hard disk drive interface, thus easily replacing it in most applications.

## Storage Navigator Modular 2

A multi-featured scalable storage management application that is used to configure and manage the storage functions of Hitachi arrays. Also referred to as "Navigator 2."

## Subnet

In computer networks, a subnet or subnetwork is a range of logical addresses within the address space that is assigned to an organization. Subnetting is a hierarchical partitioning of the network address space of an organization (and of the network nodes of an autonomous system) into several subnets. Routers constitute borders between subnets. Communication to and from a subnet is mediated by one specific port of one specific router, at least momentarily. SNIA.

## Switch

A network infrastructure component to which multiple nodes attach. Unlike hubs, switches typically have internal bandwidth that is a multiple of link bandwidth, and the ability to rapidly switch node connections from one to another. A typical switch can accommodate several simultaneous full link bandwidth transmissions between different pairs of nodes. SNIA.

## T

### Target

Devices that receive iSCSI requests that originate from an iSCSI initiator.

### TOE

A dedicated chip or adapter that handles much of the TCP/IP processing directly in hardware. TCP/IP transmission is inherently a CPU-intensive operation. Therefore, using dedicated hardware that can operate in parallel with the main processor allows for superior system performance. Although all iSCSI HBAs have a TOE, a generic TOE only implements TCP/IP, while an iSCSI HBA implements the iSCSI protocol in addition to TCP/IP.

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## Glossary-8



## **Hitachi Data Systems**

### **Corporate Headquarters**

750 Central Expressway  
Santa Clara, California 95050-2627  
U.S.A.  
Phone: 1 408 970 1000  
[www.hds.com](http://www.hds.com)  
[info@hds.com](mailto:info@hds.com)

### **Asia Pacific and Americas**

750 Central Expressway  
Santa Clara, California 95050-2627  
U.S.A.  
Phone: 1 408 970 1000  
[info@hds.com](mailto:info@hds.com)

### **Europe Headquarters**

Sefton Park  
Stoke Poges  
Buckinghamshire SL2 4HD  
United Kingdom  
Phone: + 44 (0)1753 618000  
[info.eu@hds.com](mailto:info.eu@hds.com)



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