IBM System Storage EXN2000 Storage Expansion Unit

Hardware and Service Guide

GA32-0516-02

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Note:
Before using this information and the product it supports, be sure to read the general information in "Notices" on page 51.

Third Edition (March 2006)

Safety and environmental notices

This section contains information about:

Safety notices and labels

When using this product, observe the danger, caution, and attention notices contained in this guide. The notices are accompanied by symbols that represent the severity of the safety condition.

The following sections define each type of safety notice and provide examples.

The following notices and statements are used in IBM® documents. They are listed below in order of increasing severity of potential hazards. Follow the links for more detailed descriptions and examples of the danger, caution, and attention notices in the sections that follow.

- **Note:** These notices provide important tips, guidance, or advice.
- **"Attention notices" on page vii:** These notices indicate potential damage to programs, devices, or data.
- **"Caution notices" on page vi:** These statements indicate situations that can be potentially hazardous to you.
- **"Danger notices":** These statements indicate situations that can be potentially lethal or extremely hazardous to you. Safety labels are also attached directly to products to warn of these situations.
- In addition to these notices, "Labels" on page v may be attached to the product to warn of potential hazards.

Danger notices

A danger notice calls attention to a situation that is potentially lethal or extremely hazardous to people. A lightning bolt symbol accompanies a danger notice to represent a dangerous electrical condition. A sample danger notice follows.

DANGER

An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.

A comprehensive danger notice provides instructions on how to avoid shock hazards when servicing equipment. Unless instructed otherwise, follow the procedures in the following danger notice.

DANGER

Electrical voltage and current from power, telephone, and communication cables are hazardous.

To avoid a shock hazard:

- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded electrical outlet. Ensure outlet supplies proper voltage and phase rotation according to the system rating plate.**
- **Connect any equipment that will be attached to this product to properly wired outlets.**
- **When possible, use one hand only to connect or disconnect signal cables.**
- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described below when installing, moving, or opening covers on this product or attached devices.**

To Disconnect:

1. **Turn everything OFF (unless instructed otherwise).**
2. **Remove power cords from the outlet.**
3. **Remove signal cables from connectors.**
4. **Remove all cables from devices.**

To Connect:

1. **Turn everything OFF (unless instructed otherwise).**
2. **Attach all cables to devices.**
3. **Attach signal cables to connectors.**
4. **Attach power cords to outlet.**
5. **Turn device ON.**

Labels

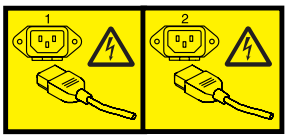
As an added precaution, safety labels are often installed directly on products or product components to warn of potential hazards.

The actual product safety labels may differ from these sample safety labels:

DANGER

Hazardous voltage, current, or energy levels are present inside any component that has this label attached.

Do not service, there are no serviceable parts.



DANGER

Multiple power cords

To remove all power to the device, disconnect all power cords.

Caution notices

A caution notice calls attention to a situation that is potentially hazardous to people because of some existing condition. A caution notice can be accompanied by different symbols, as in the examples below:

If the symbol is...	It means...
	A hazardous electrical condition with less severity than electrical danger.
	A generally hazardous condition not represented by other safety symbols.
 Class I	A hazardous condition due to the use of a laser in the product. Laser symbols are always accompanied by the classification of the laser as defined by the U. S. Department of Health and Human Services (for example, Class I, Class II, and so forth).

Sample caution notices:

CAUTION:
This product is equipped with a 3–wire (two conductors and ground) power cable and plug. Use this power cable with a properly grounded electrical outlet to avoid electrical shock.

CAUTION:
Data processing environments can contain equipment transmitting on system links with laser modules that operate at greater than Class 1 power levels. For this reason, never look into the end of an optical fiber cable or open receptacle.

Attention notices

An attention notice indicates the possibility of damage to a program, device, or system, or to data. An exclamation point symbol may accompany an attention notice, but is not required. A sample attention notice follows:

Attention: Do not bend a fibre cable to a radius less than 5 cm (2 in.); you can damage the cable. Tie wraps are not recommended for optical cables because they can be easily overtightened, causing damage to the cable.

Laser safety

When using an NVRAM5 or NVRAM6 cluster media converter, the storage system must be installed in a restricted access location.

CAUTION:
This product contains a Class 1M laser. Do not view directly with optical instruments. (C0280)

This equipment contains Class 1 laser products, and complies with FDA radiation Performance Standards, 21 CFR Subchapter J and the international laser safety standard IEC 825-2.

CAUTION:
Data processing environments can contain equipment transmitting on system links with laser modules that operate at greater than Class 1 power levels. For this reason, never look into the end of an optical fiber cable or open receptacle.

Attention: In the United States, use only SFP or GBIC optical transceivers that comply with the FDA radiation performance standards, 21 CFR Subchapter J. Internationally, use only SFP or GBIC optical transceivers that comply with IEC standard 825–1. Optical products that do not comply with these standards may product light that is hazardous to the eyes.

Usage restrictions

The optical ports of the modules must be terminated with an optical connector or with a dust plug.

Rack safety

Rack installation

DANGER

- **Always lower the leveling pads on the rack cabinet.**
- **Always install stabilizer brackets on the rack cabinet.**
- **To avoid hazardous conditions due to uneven mechanical loading, always install the heaviest devices in the bottom of the rack cabinet. Always install servers and optional devices starting from the bottom of the rack cabinets.**
- **Rack-mounted devices are not to be used as a shelf or work space. Do not place any object on top of rack-mounted devices.**
- **Each rack cabinet might have more than one power cord. Be sure to disconnect all power cords in the rack cabinet before servicing any device in the rack cabinet.**
- **Connect all devices installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device installed in one rack cabinet into a power device installed in a different rack cabinet.**

CAUTION:

- **Do not install a unit in a rack where the internal rack ambient temperatures will exceed the manufacturer's recommended ambient temperature for all your rack-mounted devices.**
- **Do not install a unit in a rack where the air flow is compromised. Ensure that air flow is not blocked or reduced on any side, front, or back of a unit used for air flow through the unit.**
- **Consideration should be given to the connection of the equipment to the supply circuit so that overloading of the circuits does not compromise the supply wiring or overcurrent protection.**
- **To provide the correct power connection to a rack, refer to the rating labels located on the equipment in the rack to determine the total power requirement of the supply circuit.**
- **This drawer is a fixed drawer and should not be moved for servicing unless specified by manufacturer. Attempting to move the drawer partially or completely out of the rack may cause the rack to become unstable or cause the drawer to fall out of the rack.**

Rack relocation (19″ rack)

CAUTION:
Removing components from the upper positions in the rack cabinet improves rack stability during relocation. Follow these general guidelines whenever you relocate a populated rack cabinet within a room or building:

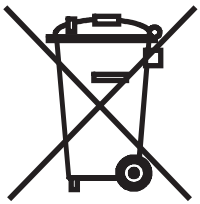
- **Reduce the weight of the rack cabinet by removing equipment starting at the top of the rack cabinet. When possible, restore the rack cabinet to the configuration of the rack cabinet as you received it. If this configuration is not known, you must do the following:**
  - **Remove all devices in the 32U position and above.**
  - **Ensure that the heaviest devices are installed in the bottom of the rack cabinet.**
  - **Ensure that there are no empty U-levels between devices installed in the rack cabinet below the 32U level.**
  - **If the rack cabinet you are relocating is part of a suite of rack cabinets, detach the rack cabinet from the suite.**
  - **Inspect the route that you plan to take when moving the rack to eliminate potential hazards.**
  - **Verify that the route that you choose can support the weight of the loaded rack cabinet. Refer to the documentation that came with your rack cabinet for the weight of a loaded rack cabinet.**
  - **Verify that all door openings are at least 760 x 2030 mm (30 x 80 in.).**
  - **Ensure that all devices, shelves, drawers, doors, and cables are secure.**
  - **Ensure that the four leveling pads are raised to their highest position.**
  - **Ensure that there is no stabilizer bracket installed on the rack cabinet during movement.**
  - **Do not use a ramp inclined at more than ten degrees.**
  - **Once the rack cabinet is in the new location, do the following:**
    - **Lower the four leveling pads.**
    - **Install stabilizer brackets on the rack cabinet.**
    - **If you removed any devices from the rack cabinet, repopulate the rack cabinet from the lowest position to the highest position.**
  - **If a long distance relocation is required, restore the rack cabinet to the configuration of the rack cabinet as you received it. Pack the rack cabinet in the original packaging material, or equivalent. Also, lower the leveling pads to raise the casters off of the pallet and bolt the rack cabinet to the pallet.**

Product recycling and disposal

This unit must be recycled or discarded according to applicable local and

national regulations. IBM encourages owners of information technology (IT) equipment to responsibly recycle their equipment when it is no longer needed. IBM offers a variety of product return programs and services in several countries to assist equipment owners in recycling their IT products. Information on IBM product recycling offerings can be found on IBM's Internet site at:

www.ibm.com/ibm/environment/products/prp.shtml



Notice: This mark applies only to countries within the European Union (EU) and Norway.

This appliance is labelled in accordance with European Directive 2002/96/EC concerning waste electrical and electronic equipment (WEEE). The Directive determines the framework for the return and recycling of used appliances as applicable throughout the European Union. This label is applied to various products to indicate that the product is not to be thrown away, but rather reclaimed upon end of life per this Directive.

注意: このマークは EU 諸国およびノルウェーにおいてのみ適用されます。

この機器には、EU 諸国に対する廃電気電子機器指令 2002/96/EC(WEEE) のラベルが貼られています。この指令は、EU 諸国に適用する使用済み機器の回収とリサイクルの骨子を定めています。このラベルは、使用済みになった時に指令に従って適正な処理をする必要があることを知らせるために種々の製品に貼られています。

Remarque : Cette marque s'applique uniquement aux pays de l'Union Européenne et à la Norvège.

L'étiquette du système respecte la Directive européenne 2002/96/EC en matière de Déchets des Equipements Electriques et Electroniques (DEEE), qui détermine les dispositions de retour et de recyclage applicables aux systèmes utilisés à travers l'Union européenne. Conformément à la directive, ladite étiquette précise que le produit sur lequel elle est apposée ne doit pas être jeté mais être récupéré en fin de vie.

In accordance with the European WEEE Directive, electrical and electronic equipment (EEE) is to be collected separately and to be reused, recycled, or recovered at end of life. Users of EEE with the WEEE marking per Annex IV of the WEEE Directive, as shown above, must not dispose of end of life EEE as unsorted municipal waste, but use the collection framework available to

customers for the return, recycling and recovery of WEEE. Customer participation is important to minimize any potential effects of EEE on the environment and human health due to the potential presence of hazardous substances in EEE. For proper collection and treatment, contact your local IBM representative.

Battery return program

This product may contain sealed lead acid, nickel cadmium, nickel metal hydride, lithium, or lithium ion battery. Consult your user manual or service manual for specific battery information. The battery must be recycled or disposed of properly. Recycling facilities may not be available in your area. For information on disposal of batteries outside the United States, contact your local waste disposal facility or go to the following Web site:

www.ibm.com/ibm/environment/products/batteryrecycle.shtml

In the United States, IBM has established a return process for reuse, recycling, or proper disposal of used IBM sealed lead acid, nickel cadmium, nickel metal hydride, and other battery packs from IBM Equipment. For information on proper disposal of these batteries, contact IBM at 1-800-426-4333. Please have the IBM part number listed on the battery available prior to your call.

For Taiwan:

廢電池請回收

Cable warning

WARNING: Handling the cord on this product or cords associated with accessories sold with this product, will expose you to lead, a chemical known to the State of California to cause cancer, and birth defects or other reproductive harm. *Wash hands after handling.*

Contents

Figures

Tables

About this document

This guide provides general information about the IBM EXN2000 Storage Expansion Unit (model number 2863-001), a roadmap on the installation, and information on managing the disk shelf that connects to N series storage systems.

Note: In a previous release, the EXN2000 was called the EXP600.

Compliance ID 2863–NAS covers the following models: 2863–A10, 2863–A20, and 2863–001.

Who should read this document

This document is for customer use. It addresses setup, operation, and servicing of the 2863–A10, 2863–A20, and 2863–001. This document is intended to provide information to customers, operators, administrators, installers, and service personnel.

Supported features

IBM N series products are driven by NetApp® Data ONTAP® software. Some features described in the product software documentation are neither offered nor supported by IBM. Please contact your local IBM representative or reseller for further details.

Information about supported features can also be found at the following Web site:

www.ibm.com/storage/support/nas/

A listing of currently available N series products and features can be found at the following Web site:

www.ibm.com/storage/nas/

How this document is organized

This document contains the following chapters:

- Chapter 1, "Preparing for the installation," on page 1 describes the preparation requirements for first-time installation of the IBM EXN2000 Storage Expansion Unit (model number 2863-001).

- Chapter 2, “Connecting an EXN2000 expansion unit,” on page 13 describes how to connect a single EXN2000 expansion unit or a loop of EXN2000 expansion units to a supported N series storage system, how to ground your system, and how to connect your system to power.
- Chapter 3, “Monitoring the EXN2000 expansion unit,” on page 19 describes how to monitor the EXN2000 expansion unit from the error messages displayed on the console that is connected to the N series storage system and identifies the location of the various LEDs on the EXN2000 expansion unit.
- Chapter 4, “Replacing EXN2000 expansion unit devices,” on page 33 describes how to replace EXN2000 expansion units in a rack, disks in an EXN2000 expansion unit, and other devices.
- Appendix A, “Recommended power line sizes,” on page 43 describes the recommended AC power line lengths.
- Appendix B, “Power cord list for the EXN2000,” on page 45 lists the feature codes for the power cords for the EXN2000.
- Appendix C, “Parts list for the EXN2000,” on page 49 lists the part numbers for the EXN2000.

Getting information, help, and service

If you need help, service, or technical assistance or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you. This section contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your IBM N series product, and whom to call for service, if it is necessary.

Before you call

Before you call, make sure that you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system is turned on.
- Use the troubleshooting information in your system documentation and use the diagnostic tools that come with your system.
- Refer to the IBM Support Web site for information on known problems and limitations.

Using the documentation

Information about the N series product and Data ONTAP software is available in printed documents and a documentation CD that comes with your system. The same documentation is available as PDF files on the IBM NAS support Web site:

www.ibm.com/storage/support/nas/

Web sites

IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates.

- For N series product information, go to the following Web site:
  www.ibm.com/storage/nas/
- For N series support information, go to the following Web site:
  www.ibm.com/storage/support/nas/
- For AutoSupport information, go to the following Web site:
  www.ibm.com/storage/support/nas/
- You can order publications through the IBM Publications Ordering System at the following Web site:
  www.elink.ibmlink.ibm.com/public/applications/publications/cgibin/pbi.cgi/

Hardware service and support

You can receive hardware service through IBM Integrated Technology Services. Visit the following Web site for support telephone numbers:

www.ibm.com/planetwide/

Supported servers and operating systems

IBM N series products attach to many servers and many operating systems. To determine the latest supported attachments, visit the following Web site and access the IBM System Storage™ N series interoperability matrix:

www.ibm.com/storage/support/nas/

Firmware updates

As with all devices, it is recommended that you run the latest level of firmware, which is embedded in DataONTAP. If there are changes, they will be posted to the following Web site:

www.ibm.com/storage/support/nas/

Note: If you do not see new changes on the Web site, you are running the latest level of firmware.

Verify that the latest level of firmware is installed on your machine before contacting IBM for technical support.

Fire suppression systems

A fire suppression system is the responsibility of the customer. The customer's own insurance underwriter, local fire marshal, or a local building inspector, or

both, should be consulted in selecting a fire suppression system that provides the correct level of coverage and protection. IBM designs and manufactures equipment to internal and external standards that require certain environments for reliable operation. Because IBM does not test any equipment for compatibility with fire suppression systems, IBM does not make compatibility claims of any kind nor does IBM provide recommendations on fire suppression systems.

Conventions and terminology used in this document

This guide uses the following terminology, command conventions, format conventions and keyboard conventions:

Terminology

In this and other IBM N series documents, the term *filer* or *storage system* describes IBM N series models (such as the N3700, N5200, and N5500) that either contain internal disk storage or attach to the disk storage expansion units specifically designed for the IBM N series storage systems. There are two disk storage expansion units specifically designed for the IBM N series:

- IBM EXN2000 Fibre-Channel disk storage expansion unit
- IBM EXN1000 serial advanced technology attachment (SATA) storage expansion unit

Note: Neither the EXN1000 nor the EXN2000 expansion unit is intended to attach to a gateway.

This guide uses the following terms:

- *Disk shelf* or *expansion unit* refers to any shelf or expansion unit containing hard disk drives.
- *ESH2* refers to the EXN2000 controller module.
- *Device carrier* refers to the container that encases a fan/power supply unit or a disk.
- *Disk* applies to any Fibre Channel disk encased in its device carrier.
- *Loop* refers to one or more daisy-chained EXN2000 expansion units connected to an N series storage system.
- *Module* refers to the ESH2 module.
- *System* and *storage system* refer to the filer, either by itself or with additional disk shelves.
- *SES* refers to SCSI Enclosure Services.

Command conventions

You can enter filer commands on the system console or from any client that can obtain access to a filer using a Telnet session. In examples that illustrate

commands executed on a UNIX® workstation, the command syntax and output might differ, depending on your version of UNIX.

Formatting conventions

The following table lists different character formats used in this guide to set off special information.

Formatting convention	Type of information
Italic type	• Words or characters that require special attention. • Placeholders for information you must supply. For example, if the guide requires you to enter the `fctest` *adaptername* command, you enter the characters "fctest" followed by the actual name of the adapter. • Book titles in cross-references.
`Monospaced` font	• Command and daemon names. • Information displayed on the system console or other computer monitors. • The contents of files.
`Bold monospaced` font	Words or characters you type. What you type is always shown in lowercase letters, unless your program is case-sensitive and uppercase letters are necessary for it to work properly.

Keyboard conventions

This guide uses capitalization and some abbreviations to refer to the keys on the keyboard. The keys on your keyboard might not be labeled exactly as they are in this guide.

What is in this guide...	What it means...
hyphen (-)	Used to separate individual keys. For example, Ctrl-D means holding down the Ctrl key while pressing the D key.
Enter	Used to refer to the key that generates a carriage return, although the key is named Return on some keyboards.
type	Used to mean pressing one or more keys on the keyboard.
enter	Used to mean pressing one or more keys and then pressing the Enter key.

How to send your comments

Your feedback is important in helping us to provide the most accurate and high-quality information. If you have comments or suggestions for improving this publication, you can send us comments electronically by using these addresses:

- Internet: starpubs@us.ibm.com
- IBMLink™ from U.S.A.: STARPUBS at SJEVM5
- IBMLink from Canada: STARPUBS at TORIBM
- IBM Mail Exchange: USIB3WD at IBMMAIL

You can also mail your comments by using the Reader Comment Form in the back of this manual or direct your mail to:

International Business Machines Corporation
Information Development Dept. GZW
9000 South Rita Road
Tucson, AZ 85744–0001
U.S.A.

Chapter 1. Preparing for the installation

This chapter describes the preparation requirements for first-time installation of the IBM EXN2000 Storage Expansion Unit (model number 2863-001).

This chapter discusses the following topics:

Required manuals, tools and equipment

In addition to this document, you need the following manuals:

- *Installation and Setup Instructions* for your filer
- *EXN1000 and EXN2000 Installation and Setup Instructions*
- Hardware guide for your expansion unit

Required tools and equipment for installation

You must supply the following tools and equipment:

- Ethernet LAN cables
- Fibre Channel cables
- Console (for example, a PC or laptop) with a serial cable
- #2 Phillips screwdriver
- Pointed tool for setting switches
- Antistatic ESD strap and grounding leash

Handling static-sensitive devices

CAUTION:
The EXN2000 expansion unit uses electronic components that are sensitive to static electricity. Static discharge from your clothing or other fixtures around you can damage these components. Put on an antistatic ESD strap and grounding leash to free yourself of static electricity before touching any electronic components.

Attention: Static electricity can damage electronic devices and your system. To avoid damage, keep static-sensitive devices in their static-protective packages until you are ready to install them.

To reduce the possibility of electrostatic discharge (ESD), observe the following precautions:

- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed printed circuitry.
- Do not leave the device where others can handle and possibly damage the device.
- While the device is still in its static-protective package, touch it to an unpainted metal part of the system unit for at least two seconds. This drains static electricity from the package and from your body.
- Remove the device from its package and install it directly into your system unit without setting it down. If it is necessary to set the device down, place it in its static-protective package. Do not place the device on your system unit cover or on a metal table. Take additional care when handling devices during cold weather because heating reduces indoor humidity and increases static electricity.

Planning and organizing the installation

This section identifies the shipment contents and the rules and regulations you need to observe for the proper installation of your EXN2000 expansion unit. It also provides an overview of the entire system installation process and the appropriate documentation references for the procedures.

For detailed information, see the following topics:

- "Hardware specifications" on page 3
- "Checking shipment package contents" on page 4
- "Rules for installing EXN2000 expansion units in a rack" on page 4
- "Guide to the installation process" on page 5

Hardware specifications

The following table lists the characteristics and requirements for your hardware.

Table 1. EXN2000 characteristics hardware specifications

Physical characteristics			
	Weight	With maximum number of disk drives	77 lbs (35 kg)
		Empty	50.6 lbs (23 kg)
	Rack units		3U
	Height		5.25 in. (13.3 cm)
	Width		17.6 in. (44.8 cm)
	Depth		20 in. (50.9 cm)
Clearance dimensions			
	Front-cooling	All versions	6 in. (15.3 cm)
	Rear-cooling	All versions	12 in. (30.5 cm)
	Rear-maintenance	All versions	12 in. (30.5 cm)
Environmental requirements **Note:** Operating at the extremes of the following environmental requirements might increase the risk of device failure.			
	Operating temperature maximum range		50° F to 104° F (10° C to 40° C)
	Operating temperature recommended range		68° F to 77° F (20° C to 25° C)
	Nonoperating temperature range		-40° F to 149° F (-40° C to 65° C)
	Relative humidity		10 to 90% noncondensing
	Recommended operating temperature relative humidity range		40 to 55%
	Maximum wet bulb temperature		28° C (82° F)
	Maximum altitude		3050 m (10,000 ft.)
	Acoustic level		56.4 dBA @ 23° C 5.64 bels @ 23° C
Electrical requirements			

Table 1. EXN2000 characteristics hardware specifications (continued)

	Input voltage, V	100-120/200-240
	Input current actual, A	4/2
	Maximum electrical power	100 to 120 VAC, 7 A/200 to 240 VAC, 3.5 A; 50/60Hz
	Input power actual, with all drives writing, W	400
	Input power actual, by JEL measurements, W	389
	Thermal dissipation, BTU/hr	1,215
	Inrush current, A @ V	25A @ 100-127 / 50A @ 200 - 240

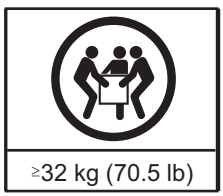
Checking shipment package contents

Make sure that your shipment package includes the following items, in addition to the *EXN2000 Hardware and Service Guide*:

- *EXN1000 and EXN2000 Installation and Setup Instructions*.
- An EXN2000 expansion unit containing the power supplies and Fibre Channel disks you ordered.
- FC-AL cables and power cords, as ordered.
- A rail kit for mounting the EXN2000 in a standard 19–inch rack may also be included.

Rules for installing EXN2000 expansion units in a rack

You need to observe the following rules and restrictions when installing an EXN2000 expansion unit in a standard 19-inch (48.26 cm) equipment rack with mounting rails:



CAUTION:
Use safe practices when lifting.

- You must work with two other people.

- Install the expansion unit at the bottom of the rack first.

  DANGER

  Install the heaviest equipment from the bottom up when installing it in a movable rack. This helps prevent the rack from tipping over and seriously injuring you or someone else.

- When installing EXN2000 expansion units in a rack, do not exceed the maximum storage limit for your N series storage system.
- Always install the EXN2000 expansion units fully loaded. Do not remove the disk drives or drive blank covers to reduce the weight.

Guide to the installation process

The following table provides a guide to the EXN2000 expansion unit installation process.

Refer to *Installation and Setup Instructions* for your filer or *EXN1000 and EXN2000 Installation and Setup Instructions* for complete installation details.

DANGER

Three people are required to lift the EXN2000 during installation. Do not remove the disk drives or drive blank covers to reduce the weight.

Table 2. EXN2000 expansion unit installation process

Stage	Procedure	Is the procedure required?	For instructions, go to...
1	Install the N series storage system in a freestanding rack.	Only if the EXN2000 expansion unit installation is part of a new system installation.	Hardware guide for your N series storage system, or the *Installation and Setup Instructions* that came with your N series storage system.
2	Install the EXN2000 expansion units in the rack. **Attention:** When installing multiple storage expansion units that share a drive loop, always install them sequentially as they will appear in the loop.	Yes, if the EXN2000 expansion unit is an addition to your existing system or if your new system was not shipped in a rack.	See the *EXN1000 and EXN2000 Installation and Setup Instructions*.

Table 2. EXN2000 expansion unit installation process (continued)

Stage	Procedure	Is the procedure required?	For instructions, go to...
3	Connect the EXN2000 expansion unit to the N series storage system.	Only in the following scenarios: • If the EXN2000 expansion unit installation is part of a new system installation. • If the EXN2000 expansion unit is the first in an additional loop to your existing system.	Chapter 2, "Connecting an EXN2000 expansion unit," on page 13, or the *EXN1000 and EXN2000 Installation and Setup Instructions*.
4	Connect the EXN2000 expansion units.	Only in the following scenarios: • If the new system installation has multiple EXN2000 expansion units. • If the EXN2000 expansion unit is an addition to your existing system.	See the *EXN1000 and EXN2000 Installation and Setup Instructions*.
5	Ground the EXN2000 expansion units and N series storage system.	Yes.	"Grounding EXN2000 expansion units " on page 15, or the *EXN1000 and EXN2000 Installation and Setup Instructions*.
6	Connect the EXN2000 expansion units to a power source.	Yes.	"Connecting the EXN2000 expansion unit to a power source" on page 15
		If the system was shipped in a rack, you must connect the rack to a power source.	See the documentation that shipped with your cabinet.
7	Configure the system.	Yes, if the EXN2000 expansion unit installation is part of a new system installation.	See the *Software Setup Guide*.

Before you begin your installation

Before you install one or more EXN2000 expansion units in a rack, you need to understand the following information:

- EXN2000 expansion unit numbering
- Speed setting
- Drive addressing
- Supported disk drives
- Drive bay requirements

Attention: Verify that all shelf IDs are correct and sequential in the individual loop(s). If this system was configured by manufacturing, there are labels on the outside of the packaging carton and on the side of the expansion unit chassis to indicate which loop on which node (Filer 1 or 2) that shelf should be located. Make certain the expansion units are placed and cabled according to these labels. The filer nodes may also have a label on the packaging carton and chassis side to clearly distinguish the nodes (Filer 1 and Filer 2).

EXN2000 expansion unit numbering

Each EXN2000 expansion unit in a loop must have a unique ID. A valid shelf ID is from 1 through 7. ID 1 is used for the first EXN2000 in a new loop, or if the filer also contains disks, then ID 2 is used for the EXN2000 closest to the N series storage system controller (which uses ID 1). Shelf IDs for additional expansion units are incremented sequentially from the number of the first expansion unit (either 1 or 2).

Each EXN2000 expansion unit shipped with an N series storage system has its assigned ID already set on its back panel and has a shelf ID label already placed on its front bezel.

You must ensure that the EXN2000 expansion unit has the correct ID number on the label. If you change the shelf ID of the expansion unit by changing the ID switch at the rear of the unit, replace the shelf ID label on the expansion unit to match the new shelf ID.

Note: Additional shelf ID labels are supplied with your unit.

The ID label is on the right side of the unit, as shown in the following illustration.

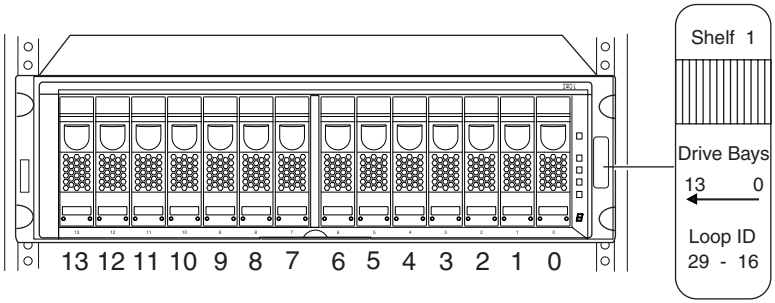


Figure 1. Shelf ID label

IBM sets the disk shelf IDs at the factory on configured systems, using an ID switch on the back panel. If you order additional EXN2000 expansion units, you must set the disk shelf ID and apply the correct labels provided with the EXN2000.

Note: If you enter a shelf ID that is not from 1 through 7, the drive addresses default to those of a shelf with the ID switch set to 7 even though the Shelf ID indicator in the front operation panel displays a dash (-).

The example in Figure 2 on page 9 shows an EXN2000 expansion unit with the disk shelf ID set to 2.

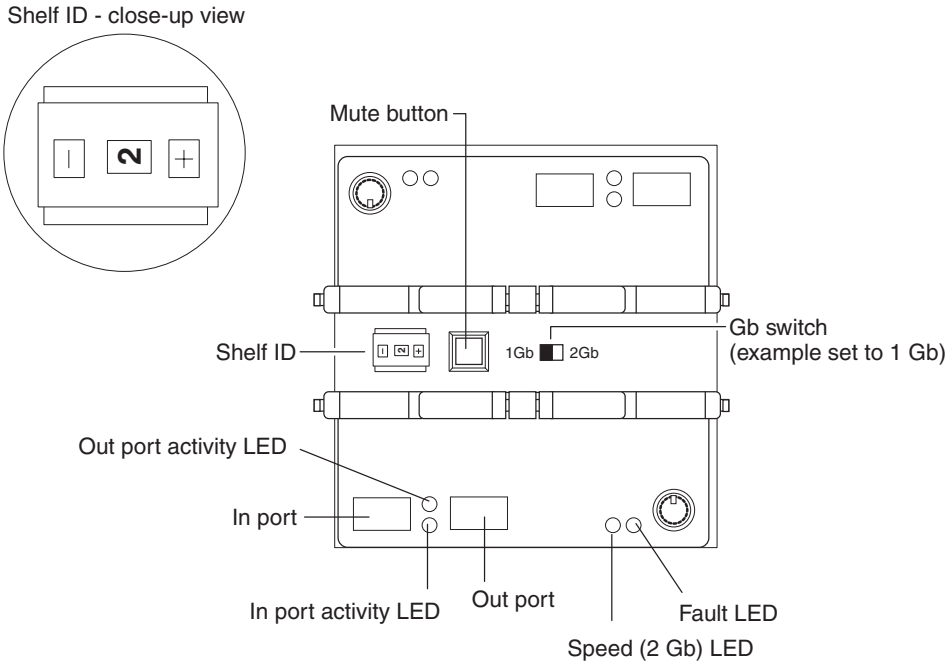


Figure 2. EXN2000 shelf ID and speed switch

Speed setting

Make sure that all expansion unit speed switches are set to the correct position for your application.

- If connecting to an N3700 storage system, the speed switch must be set to the 1Gb position.
- If connecting to any other N series storage system, the speed switch must be set to the 2Gb position.

See Figure 2 for the location of the speed switch on the rear of the expansion unit.

Drive addressing

In addition to identifying the disk shelf ID and the direction of the drive bays, the ID label on the right side of the EXN2000 expansion unit includes the drive address. The drive address identifies the disks in the EXN2000 expansion unit. The last sheet of the quick reference cards that come with your EXN2000 expansion unit shows the seven disk shelf IDs and their corresponding drive addresses.

Note: For ESH2 module A, drive addressing is in descending order, and for ESH2 module B, drive addressing is in ascending order. ESH2 A is the top controller module in the EXN2000. ESH2 B is the bottom controller module.

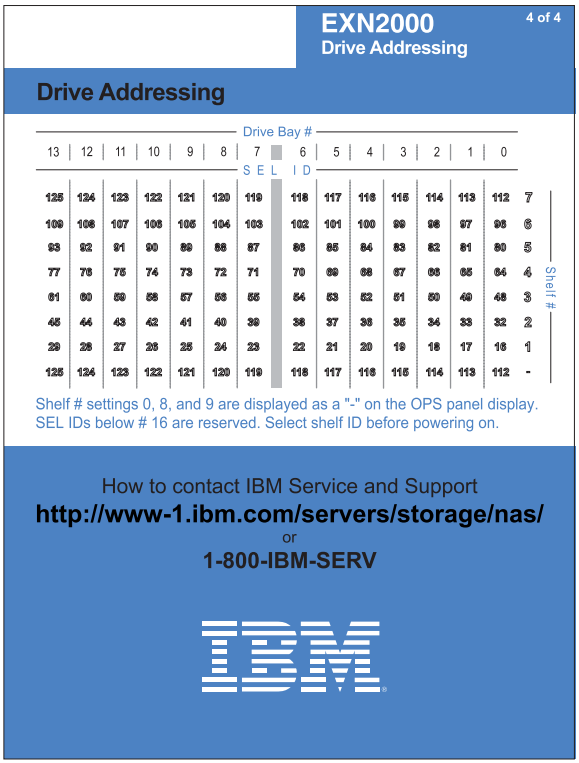


Figure 3. EXN2000 disk shelf IDs and drive addresses

Supported disk drives

For the types of disks the EXN2000 expansion unit supports, visit the following Web site:

www.ibm.com/storage/nas/

Note: You should not mix different drive types in the same expansion unit.

Drive bay requirements

For enclosure services monitoring to work, drive bays 0 and 1 must contain a disk. In addition, the EXN2000 expansion unit must be populated with at least 4 hard disk drives to ensure proper operation.

Attention: All drive bays in the expansion must contain either a hard disk drive or a drive blank cover to maintain proper air flow and cooling.

The 14 drive bays in the EXN2000 expansion unit are numbered 0 through 13 from right to left, as shown in Figure 1 on page 8. Hard disk drives should be populated in adjacent drive bays in the expansion unit in this sequence, beginning with drive bay 0.

The N series storage system uses the enclosure services monitoring method to monitor environmental conditions of the EXN2000 expansion unit. Enclosure services conditions are communicated to the N series storage system through the ESH2 module.

The following table describes the three stages of enclosure services monitoring.

Table 3. Stages of enclosure services monitoring

Stage	Device	What it does...
1	N series storage system	Uses a subset of SCSI-3 commands to monitor the EXN2000 expansion unit for data related to disk presence, temperature, power supply units, and fan status.
2	N series storage system	Sends the commands through its Fibre Channel interface to drive bays 0 and 1 on the EXN2000 expansion unit.
3	Drive bays 0 and 1	Communicate the request to the ESH2 module and send the data to the N series storage system.
	ESH2 module	Collects the requested data and sends it to drive bays 0 and 1.

Chapter 2. Connecting an EXN2000 expansion unit

This chapter describes how to connect a single EXN2000 expansion unit or a loop of EXN2000 expansion units to a supported N series storage system or to other expansion units. This chapter also describes how to ground your system, and how to connect your system to power.

This chapter discusses the following topics:

Handling fiber-optic cables

Before you use fiber-optic cables, read the following precautions.

Attention: To avoid damage to the fiber-optic cables, follow these guidelines:

- Do not route the cable along a folding cable-management arm.
- When attaching to a device on slide rails, leave enough slack in the cable so that it does not bend to a radius of less than 38 mm (1.5 in.) when extended or become pinched when retracted.
- Route the cable away from places where it can be snagged by other devices in the rack cabinet.
- Do not overtighten the cable straps or bend the cables to a radius of less than 38 mm (1.5 in.).
- Do not put excess weight on the cable at the connection point. Be sure that the cable is well supported.

CAUTION:
Data processing environments can contain equipment transmitting on system links with laser modules that operate at greater than Class 1 power levels. For this reason, never look into the end of an optical fiber cable or open receptacle.

Connecting EXN2000 expansion units

This section describes the requirements for connecting an EXN2000 expansion unit to N series storage systems and other expansion units. For detailed instructions about how to install and connect one or more EXN2000 expansion units in a rack, or to connect an EXN2000 to your storage system, refer to the *Installation and Setup Instructions* for your storage system.

- IBM strongly recommends using optical (fibre channel) cabling whenever possible.
- Refer to the *IBM System Storage N series Introduction and Planning Guide* for details about the maximum number of drive loops, maximum number of expansion units or hard disk drives per loop, maximum total storage capacity, and maximum total number of hard disk drives for configurations using your N series storage system. (For example, you can connect a maximum of one loop of three fully populated expansion units to an N3700.)
- Multipath looping is recommended for all configurations to provide additional redundancy. This includes single or dual controller and single or multiple expansion units.
- Do not mix Fibre Channel EXN2000 and SATA EXN1000 expansion units in the same loop.

EXN2000 expansion unit cabling requirements

You must meet the cabling requirements discussed in the following sections when connecting the EXN2000 ESH2 module to an N series storage system or to other expansion units.

For the latest information on cabling requirements, see *Installation and Setup Instructions* and the *Hardware and Service Guide* for your storage system.

Connecting the expansion unit directly to the N series storage system

When connecting the EXN2000 to an N series storage system, you must use appropriate cables and connectors according to the following guidelines:

- **For direct connections to N3700 storage systems with system serial numbers between 13-00032 and 13-01000 (in general, these are N3700 systems shipped prior to January 31, 2006):** Use a NAS-to-EXP fibre channel copper cable (#2020 or 2022). For attachment to an N3700 Model A10, one NAS-to-EXP fibre channel copper cable is required. For attachment to an N3700 Model A20, two NAS-to-EXP fibre channel copper cables are required.
- **For direct connections to N3700 storage systems with system serial numbers 13-01001 or higher (in general, these are N3700 systems shipped after January 31, 2006):** Use an LC-to-LC fibre channel optical cable and 2 SFPs for attachment to an N3700 Model A10. Use 2 LC-to-LC fibre channel optical cables and 4 SFPs for attachment to an N3700 Model A20.

- **For direct connections to all other N series storage systems:** Use an LC-to-LC fibre channel optical cable and one SFP.

Connecting the expansion unit to other expansion units

When connecting the EXN2000 to other expansion units, IBM strongly recommends using LC-to-LC fibre channel optical cables. You must use 2 SFPs per LC-to-LC fibre channel optical cable.

Note: SFP-to-SFP fibre channel copper cables may also be used for connections (to a maximum of three meters) between expansion units.

Grounding EXN2000 expansion units

For proper grounding, you must daisy-chain the EXN2000 expansion units together with the provided braided copper cables and screws. If possible, you should ground the N series storage system to the EXN2000.

Each EXN2000 expansion unit is shipped with a 0.25m (~6 inch) braided copper cable and an M5 x 0.5 inch Phillips head screw. The copper cable has a hole on each end for grounding filer-to-shelf or shelf-to-shelf.

For detailed instructions about how to ground connected EXN2000 expansion units in a rack, refer to the *Installation and Setup Instructions* for your storage system.

Connecting the EXN2000 expansion unit to a power source

The EXN2000 expansion unit is shipped with two power supplies, installed in bay PSU1 and bay PSU2, respectively and an AC power cord for each power supply. You must have separate circuit breakers for each power supply.

For detailed instructions about how to connect EXN2000 expansion units to a power source, refer to the *EXN1000 and EXN2000 Installation and Setup Instructions*.

Hot-adding an EXN2000 expansion unit to an existing loop

This section provides information about how to hot-add an EXN2000 expansion unit to an existing loop. It also tabulates the error messages that appear on your N series storage system console if the attempt at hot-adding was unsuccessful.

Note: The hot-added EXN2000 expansion unit must have new drives that will be used as spares only.

Attention: It is recommended that you stop all I/O processes before hot-adding an EXN2000 to an existing loop. Perform a hot-add only during off-peak times.

To hot-add an EXN2000 expansion unit to an existing loop, complete the following steps:

1. Put on the antistatic ESD strap and grounding leash.
2. Verify that you received the disk shelf ID labels.
3. Install the new EXN2000 expansion unit in the rack, cable and ground the EXN2000, and connect the power cables to the EXN2000, as described in the *Installation and Setup Instructions* you received with your N series product.

   CAUTION:
   Do not turn on the power to the EXN2000 expansion unit yet.

   After you have completed the installation steps described in the *Installation and Setup Instructions*, continue with Step 4.
4. Verify that all the cables are securely fastened.

   CAUTION:
   Poorly secured cables cause the N series storage system to panic over an open loop.
5. If you have not done so, give the EXN2000 expansion unit a unique disk shelf ID. It is recommended that you choose a number which is one higher than the previous shelf or storage system if the storage system contains disks.
   a. Using the switch on the rear of the EXN2000 expansion unit, press the + button to raise the number and the - button to lower the number to a valid ID from 1 through 7. Refer to Figure 2 on page 9 for an illustration.

      Note: Only use disk shelf ID 7 if it is the last ID available. If you change a disk shelf ID, you must power-cycle the EXN2000 expansion unit for the new ID to take effect. The disk shelf ID display on the front of the EXN2000 expansion unit blinks until you power-cycle the EXN2000 expansion unit.

   b. Verify that the disk shelf ID is not being used in the loop by entering the following command at the console:

      ```
      fcstat device_map adaptername
      ```

   c. Select the correct matching shelf ID label identified in Figure 1 on page 8 and attach it to the right flange of the new EXN2000 expansion unit.

   CAUTION:
   An invalid disk shelf ID causes the N series storage system to panic.

6. Set the loop speed for the new EXN2000 to the correct speed setting for your N series storage system. See "Speed setting" on page 9.
7. Turn on the power to the EXN2000 expansion unit. You must wait 30 seconds for the shelf electronics to finish initializing.
8. In 60 seconds, the N series storage system recognizes the hot-added EXN2000 expansion unit.

Error messages

The following error messages appear on your N series storage system console if your attempt at hot-adding the EXN2000 expansion unit is unsuccessful.

Table 4. N series storage system console error messages

Error message	Explanation
`Open loop panic`	One of two reasons cause this error message to appear: • The shelf-to-shelf cable between the now second-to-last unit and the newly added EXN2000 expansion unit is defective or is not securely fastened. • The speed of the newly added EXN2000 expansion unit is incorrectly set.
`Soft address panic`	One of two reasons cause this error message to appear: • There is an invalid disk shelf ID. • The power was turned on before the disk shelf ID was changed and the EXN2000 expansion unit was not power-cycled after the disk shelf ID was changed.
`Speed mismatch termination`	The ESH2 modules on the EXN2000 expansion unit detected a speed mismatch between the preceding unit and this EXN2000 expansion unit and is reporting them as automatic terminate errors.

Chapter 3. Monitoring the EXN2000 expansion unit

This chapter describes how to monitor the EXN2000 expansion unit from the error messages displayed on the console that is connected to the N series storage system and identifies the location of the various LEDs on the EXN2000 expansion unit.

Note: The quick reference cards in the slide-out tray at the base of the EXN2000 expansion unit describe the functions of each LED on the EXN2000 expansion unit and the suggested course of action.

This chapter discusses the following topics:

Monitoring the front operation panel

The front operation panel has five LEDs and a disk shelf ID display. The LEDs indicate whether your EXN2000 expansion unit is functioning normally or there are problems with the hardware. You can also identify any hardware failure associated with the front operation panel of the EXN2000 expansion unit from the error messages displayed on your N series storage system console.

Location of LEDs

The following illustration shows the location of the disk shelf ID display and the front panel LEDs.

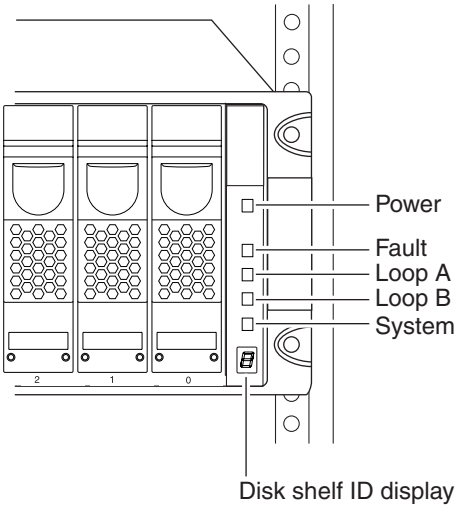


Figure 4. Front panel LEDs

Note: The Fault and System LEDs are amber. The other three LEDs are green. See "LED status on the front operation panel" for an illustrated explanation of how the LEDs function.

Monitoring the disk shelf ID

When you use the switch on the back of the EXN2000 expansion unit to change the disk shelf ID, the disk shelf ID display on the front panel blinks until you power-cycle the EXN2000 expansion unit to make the change take effect.

LED status on the front operation panel

The following illustration is of the first sheet of the quick reference cards that come with your EXN2000 expansion unit. It shows the normal and fault conditions that the LEDs indicate and recommends a corrective action.

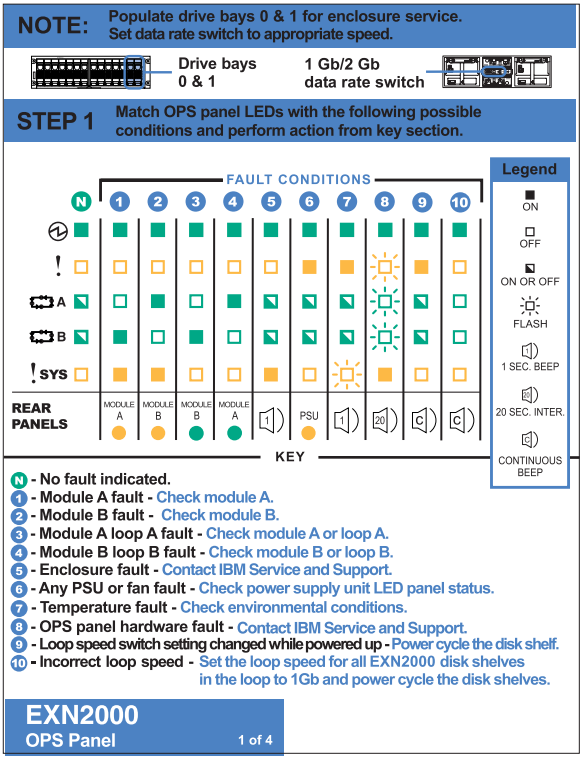


Figure 5. LED indications of normal and fault conditions

Front operation panel console error messages

The following error messages appear on your N series storage system console if an SES element on the front operation panel fails. For information about replacing an EXN2000 expansion unit, see "Removing an EXN2000 expansion unit" on page 33.

Table 5. N series storage system error messages

Error message	Action required
`Temperature sensor Element 1: failed`	The temperature sensor on the front operation panel failed. Contact IBM customer service to replace the EXN2000 expansion unit.
`Alarm Element 1: failed`	The alarm on the front operation panel failed. Contact IBM customer service to replace the EXN2000 expansion unit.

Table 5. N series storage system error messages (continued)

Error message	Action required
`Display Element 1: failed`	The display on the front operation panel failed. Contact IBM customer service to replace the EXN2000 expansion unit.

Monitoring the ESH2 modules

The ESH2 has four LEDs. The LEDs indicate whether the module is functioning normally, whether there are any problems with the hardware, and if the ESH2 module is set to function at a 2-Gb loop speed. You can also identify any hardware failure associated with the module from the error messages displayed on your N series storage system console.

This section also describes the different types of messages that appear on the N series storage system console in response to a command monitoring the ESH2.

Location of the module LEDs

The modules are in the middle of the back of the EXN2000 expansion unit. The following illustration shows the location of the LEDs for an ESH2. See "LED status on the ESH2" on page 23 for an illustrated explanation of the LED functions.

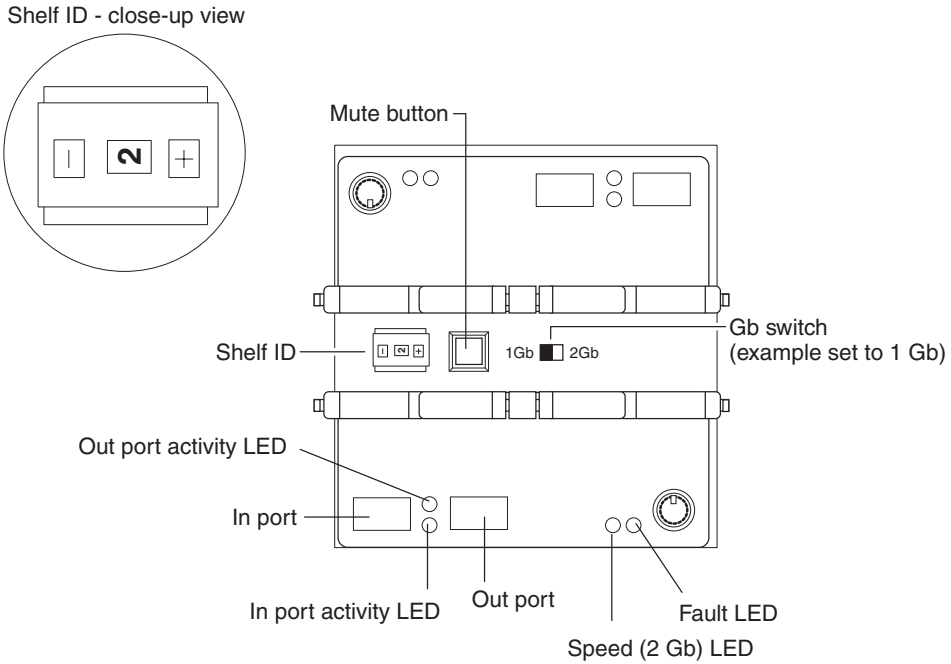


Figure 6. Location of the LEDs for an ESH2

Note: Because module A on the EXN2000 expansion unit is inverted, the location of the module A LEDs is the inverse of what is shown in the preceding illustrations.

LED status on the ESH2

The following illustration is of the second sheet of the quick reference cards that come with your EXN2000 expansion unit.

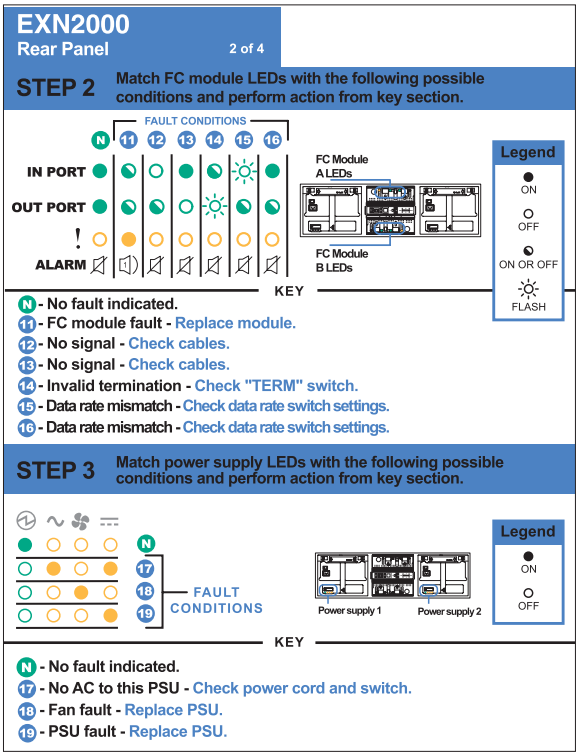


Figure 7. EXN2000 rear panel quick reference card

Note: The rest of the second sheet of the quick reference card identifies the LED status conditions for the power supply and the integrated fan module.

ESH2 console error messages

The following error messages appear on your N series storage system console if an SES element on the ESH2 fails. For information about replacing the ESH2, see "Replacing an ESH2 module" on page 39.

Table 6. ESH2 console error messages

Error message	Action required
`SES electronics Element 1: failed`	ESH2 module A on the top back of the EXN2000 expansion unit failed. Contact IBM customer service to replace the module.
`SES electronics Element 2: failed`	ESH2 module B on the bottom back of the EXN2000 expansion unit failed. Contact IBM customer service to replace the module.

Table 6. ESH2 console error messages (continued)

Error message	Action required
`Temperature sensor Element 2: not installed or failed`	Communication was possible with the temperature sensor on ESH2 module A at one point, but it is not possible now. Even if traffic is flowing through the Fibre Channel loop, contact IBM customer service to replace the ESH2.
`Temperature sensor Element 3: not installed or failed`	Communication was possible with the temperature sensor on ESH2 module B at one point, but it is not possible now. Even if traffic is flowing through the Fibre Channel loop, contact IBM customer service to replace the ESH2.
`SES electronics Element 1: not installed or failed`	Communication was possible with ESH2 module A at one point, but it is not possible now. Even if traffic is flowing through the Fibre Channel loop, contact IBM customer service to replace the ESH2.
`Vendor-specific Element 1: not installed or failed`	
`SES electronics Element 2: not installed or failed`	Communication was possible with ESH2 module B at one point, but it is not possible now. Even if traffic is flowing through the Fibre Channel loop, contact IBM customer service to replace the ESH2.
`Vendor-specific Element 2: not installed or failed`	

Monitoring the ESH2

The **storage show hub** command enables you to monitor the ESH2.

Sample output

The following is an example of the output from the **storage show hub** command. The exact messages that appear on your system console depend on your system configuration.

Note: For the ESH2, the following output shows the `Term switch` status as N/A or not applicable because the ESH2 does not have a terminate switch.

```
Hub name: 9.shelf2
Channel: 9
Loop: B
Shelf id: 2
Shelf UID: 50:05:0c:c0:02:00:24:02
Term switch: N/A
Shelf state: ONLINE
ESH state:   OK
```

Disk ID	Disk Bay	Port State	Loop up Count	Invalid CRC Count	Invalid Word Count	Clock Delta	Insert Count	Stall Count	Util %
[IN]		OK	8	0	0	0	20	0	0
[OUT]		TERM	8	0	0	-8	6	0	0
[32]	0	OK	10	0	0	0	6	0	0
[33]	1	OK	8	0	0	-8	9	0	0
[34]	2	OK	10	0	0	-8	6	0	0
[35]	3	OK	10	0	0	0	8	0	0
[36]	4	OK	10	0	0	0	9	0	0
[37]	5	OK	10	0	0	-16	7	0	0
[38]	6	OK	10	0	0	0	6	0	0
[39]	7	OK	10	0	0	16	16	0	0
[40]	8	BYP/TBI	10	0	0	0	8	0	0
[41]	9	OK	8	0	0	-8	6	0	0
[42]	10	OK	8	0	0	0	6	0	0
[43]	11	EMPTY	8	0	0	0	15	0	0
[44]	12	OK	8	0	0	8	4	0	0
[45]	13	OK	10	0	0	16	8	0	0

Description of hub status information

You might receive some of the following status reports in response to the **storage show hub** command.

Shelf state

The following table lists and describes the shelf status responses.

Table 7. Shelf status responses

Shelf state	Description
ONLINE	Shelf is fully configured and operational.
INIT REQD	Shelf needs to configure one or both ESH2 modules.
OFFLINE	Contact was lost with shelf (SES drive access is down).
MISSING	Shelf was removed from the system entirely (all paths).
FAILED	Failure occurred on the shelf.

ESH2 state

The following table lists and describes the ESH2 status responses.

Table 8. ESH2 status responses

Shelf state	Description
OK	ESH2 is fully operational.

Table 8. ESH2 status responses (continued)

Shelf state	Description
MISSING	ESH2 is missing from the specified slot.
XPORT ERROR	Communication with the ESH2 is not possible.

ESH2 port state

The following table lists and describes the ESH2 status responses.

Table 9. ESH2 status responses

Shelf state	Description
OK	Port is functioning normally.
EMPTY	No drive is present in bay.
BYP/TBI	Port failed loop test before insert and was not allowed into loop.
BYP/XMIT	Port bypassed due to transmitter default.
BYP/LIPF8	Port bypassed due to drive generating LIP F8s.
BYP/DTO	Port bypassed due to data timeout errors.
BYP/RLOS	Port bypassed due to receiver loss of signal.
BYP/CLOS	Port bypassed due to comma loss of signal.
BYP/RPRT	Port bypassed due to redundant port connection.
BYP/STALL	Port bypassed due to excessive stall errors.
BYP/WRD	Port bypassed due to excessive word errors.
BYP/CRC	Port bypassed due to excessive CRC errors.
BYP/CLK	Port bypassed due to excessive clock delta.
BYP/MIR	Port bypassed due to cluster mirror bit being set (check partner).
BYP/LIPF7	Port bypassed due to drive transmitting LIP F7s.
BYP/GEN	Port bypassed due to a *generic* error.

Table 9. ESH2 status responses (continued)

Shelf state	Description
BYP/MAN	Port was manually bypassed (Manufacturing test only).
BYP/LIP	Port bypassed due to drive generating excessive LIP requests.
BYP/OSC	Port bypassed due to excessive port state changes.
BYP/INIT	Port bypassed as part of ESH Power-On Self-Test.
///:0xXX	ESH Admin unable to decode port state XX.

Hub statistic

The following table lists and describes the hub statistic responses.

Table 10. Hub statistic responses

Hub statistic	Description	Common values	Failure?
Loop up Count	Number of times this port saw the loop come up or transition to up.	Depends on the number of insertions and removals of disks and LIPs that occur in the loop.	No
Invalid CRC Count	Number of times this port saw a CRC error.	Is zero under normal operation. Removal and addition of disks, and a reset of the adapter, might generate some CRC errors. CRC errors on a port pinpoint the failure location. Excessive CRC errors for a continuous time period causes the ESH2 firmware to bypass this port.	Yes, if drive was bypassed.
Invalid Word Count	Number of times this port saw invalid FC-AL words transmitted.	Is zero under normal operation. Removal and addition of disks, and a reset of the adapter, might generate some word errors. Word errors on a port pinpoint the failure location. Excessive word errors for a continuous time period causes the ESH2 firmware to bypass this port.	Yes, if drive was bypassed.

Table 10. Hub statistic responses (continued)

Hub statistic	Description	Common values	Failure?
Clock Delta	The clock delta between this port in respect to the ESH2 clock and seven other ports.	It is normal for the FC-AL sync clocks to drift with respect to each other. This is a signed drift value. A value exceeding 6,400 PPM causes the ESH2 firmware to bypass this port.	Yes, if drive was bypassed.
Insert Count	Number of times this port was inserted into the loop.	Depends on the number of insertions and removals of disks and LIPs that occur in the loop.	No
Stall Count	Number of times this port exceeded the open/close (OPN/CLS) maximum threshold.	Is zero under normal operation. Removal and addition of disks, and a reset of the adapter, might generate some stall errors. Excessive stall errors for a continuous time period causes the ESH2 firmware to bypass this port.	Yes, if drive was bypassed.
Utilization %	Relative use of this port versus other ports in the ESH2.	This value does not reflect the real-time use of what the ports are currently achieving and is only obtained when extended status is available from the ESH2. It indicates the relative use from the last time extended status was available.	No

Monitoring the power supply

The power supply has four LEDs. The LEDs indicate whether the power supply or the integrated fan module is functioning normally or there are problems with the hardware. You can also identify any hardware failure associated with the power supplies from the error messages displayed on your N series storage system console.

Location of LEDs

Each power supply, which contains four LEDs, is encased in a device carrier and housed at the rear of the EXN2000 expansion unit. The following illustration shows the location of the power supply LEDs.

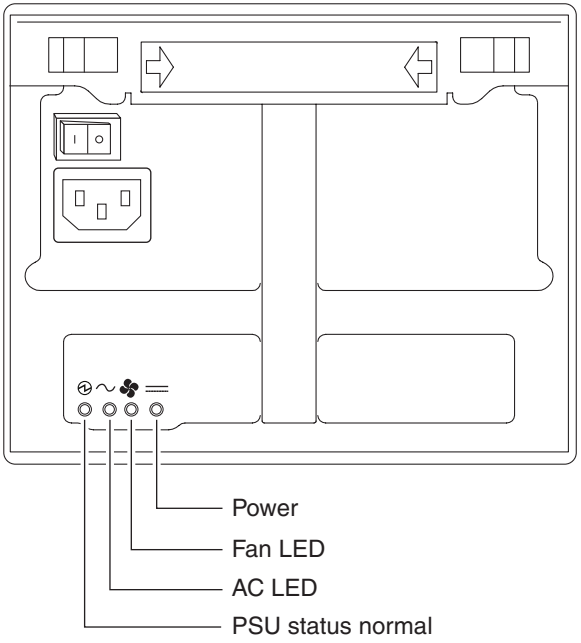


Figure 8. Location of power supply LEDs

Note: The PSU status LED is green. The other three LEDs are amber. See Figure 7 on page 24 for an illustrated explanation of how the LEDs function.

Power supply console error messages

The following error messages appear on your N series storage system console if an SES element on the power supply fails. For information about replacing the power supply, see "Replacing a power supply in an EXN2000 expansion unit" on page 37.

Table 11. Power supply console error messages

Error message	Action required
`Power supply Element 1: failed`	The power supply unit on the left at the back of the EXN2000 expansion unit failed. Contact IBM customer service to replace the power supply.
`Power supply Element 2: failed`	The power supply unit on the right at the back of the EXN2000 expansion unit failed. Contact IBM customer service to replace the power supply.

Table 11. Power supply console error messages (continued)

Error message	Action required
`Cooling element` `Element 1: failed`	The integrated fan module in the power supply unit on the left at the back of the EXN2000 expansion unit failed. Contact IBM customer service to replace the power supply.
`Cooling element` `Element 2: failed`	The integrated fan module in the power supply unit on the right at the back of the EXN2000 expansion unit failed. Contact IBM customer service to replace the power supply.

Monitoring the Fibre Channel disk

The Fibre Channel disk has two LEDs. The LEDs indicate whether the disk is functioning normally or there are problems with the hardware.

Location of LEDs

The following illustration shows the Fibre Channel disk, which has two LED indicators on the front.

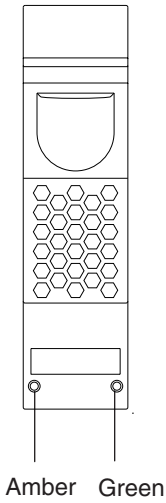


Figure 9. Fibre Channel disk

LED status on the Fibre Channel disks

The following figure shows the third sheet of the quick reference cards that come with your EXN2000 expansion unit.

Note: Drives that are idle perform a media scan in the background resulting in the LEDs pulsing every half-second.

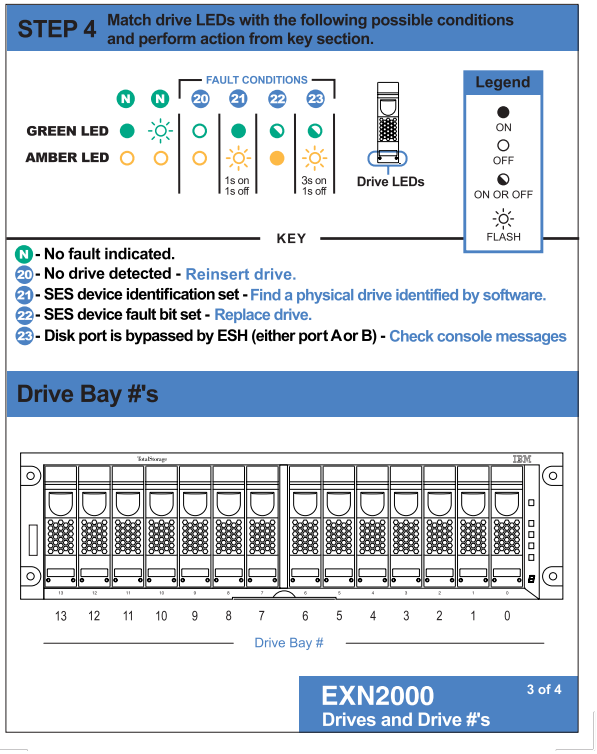


Figure 10. Third sheet of the quick reference cards

Chapter 4. Replacing EXN2000 expansion unit devices

This chapter describes how to replace EXN2000 expansion units in a rack, disks in an EXN2000 expansion unit, and other devices, in the following sections:

- "Removing an EXN2000 expansion unit"
- "Replacing a disk in an EXN2000 expansion unit" on page 36
- "Replacing a power supply in an EXN2000 expansion unit" on page 37
- "Replacing an ESH2 module" on page 39

Attention: Return failed parts to IBM. Contact IBM Service and Support at 1-800-IBM-SERV (1-800-426-7378) for more information on the return procedure.

Removing an EXN2000 expansion unit

This section discusses how to disconnect an EXN2000 expansion unit from an N series storage system and how to remove an EXN2000 expansion unit from a daisy-chain configuration. It does not discuss how to install an EXN2000 expansion unit or how to hot-add an EXN2000 expansion unit. For information about installing an EXN2000 expansion unit in a rack, see "Guide to the installation process" on page 5. For information about hot-adding a disk-shelf, see "Hot-adding an EXN2000 expansion unit to an existing loop" on page 15.

CAUTION:
Hot removal or hot-swapping of an EXN2000 expansion unit is not supported.

For detailed information about removing an EXN2000 expansion unit from a rack, see the following topics:

- "Removing an EXN2000 expansion unit from a single EXN2000 expansion unit configuration "
- "Removing an EXN2000 expansion unit from a loop" on page 34

Removing an EXN2000 expansion unit from a single EXN2000 expansion unit configuration

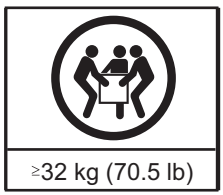
To remove an EXN2000 expansion unit from a single EXN2000 expansion unit configuration, complete the following steps:

1. Put on the antistatic ESD strap and grounding leash.

2. Shut down the N series storage system by entering the following command at the console:

   ```
   halt
   ```

   CAUTION:
   Disable the cluster first and then use the `halt` command to shut down all controllers to which the loop is connected.
3. Turn off the power switches on the EXN2000 expansion unit.
4. Disconnect the two EXN2000 expansion unit power cords from the EXN2000 expansion unit.
5. Disconnect the Fibre Channel cable connecting the EXN2000 expansion unit and N series storage system.
6. Disconnect the grounding strap connecting the EXN2000 expansion unit and N series storage system.
7. Use a Phillips screwdriver to remove the screws securing the EXN2000 expansion unit to the rack.



CAUTION:
Use safe practices when lifting.

8. With the help of at least two people, remove the EXN2000 expansion unit from the rack.

   DANGER

   The EXN2000 expansion unit is very heavy when fully loaded and requires at least three people to remove it.

Removing an EXN2000 expansion unit from a loop

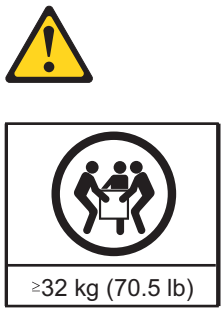
To remove an EXN2000 expansion unit from a loop of EXN2000 expansion units, complete the following steps:

1. Put on the antistatic ESD strap and grounding leash.
2. Shut down the N series storage system by entering the following command at the console:

   ```
   halt
   ```

CAUTION:
Disable the cluster first and then use the `halt` command to shut down all controllers to which the loop is connected.

3. Turn off the power switches on the EXN2000 expansion unit.
4. Disconnect the two EXN2000 expansion unit power cords from the EXN2000 expansion unit that you are going to remove.
5. Disconnect the Fibre Channel cables connecting the EXN2000 expansion unit to the other EXN2000 expansion units and/or the N series storage system.
6. Disconnect the grounding strap connecting the EXN2000 expansion unit to the other EXN2000 expansion units and/or the N series storage system.
7. Use a Phillips screwdriver to remove the screws from the flanges of the EXN2000 expansion unit retention bracket.



CAUTION:
Use safe practices when lifting.

8. With the help of at least two people, remove the EXN2000 expansion unit from the rack.

   DANGER

   The EXN2000 expansion unit is very heavy when fully loaded and requires at least three people to remove it.

9. Do one of the following:
   - If you are not installing a replacement EXN2000 expansion unit, then reestablish the loop by connecting the disconnected EXN2000 expansion units or by connecting the unconnected EXN2000 expansion unit to the N series storage system.
   - If you are installing a replacement EXN2000 expansion unit, then see “Guide to the installation process” on page 5.

Replacing a disk in an EXN2000 expansion unit

You can replace a disk in an EXN2000 expansion unit for any reason. However, the most common reason is disk failure. If a disk fails, the N series storage system logs a warning message to the system console indicating which disk on which loop failed.

In addition, an EXN2000 expansion unit with an ESH2 module identifies any one of the following situations as disk failure:

- A disk is bypassed.
- The filer system boots with the presence of bypassed disks.
- The filer system detects an eminent threshold bypass.

Preparing to replace a disk

Before you replace a disk in an EXN2000 expansion unit, you must first check the EXN2000 expansion unit to ensure that after you remove the disk you still have enough disks installed to meet the enclosure services requirements. For information about these requirements, see "Drive bay requirements" on page 10.

Replacing a disk in an EXN2000 expansion unit consists of the following procedures:

- "Removing a disk"
- "Installing a disk" on page 37

Removing a disk

To remove a disk, complete the following steps:

1. Do one of the following:
   - If you are removing a disk that is a member of a volume, then enter:
     ```
     disk fail disk_name
     ```
   - If you are removing a disk that is a spare disk, then enter:
     ```
     disk remove disk_name
     ```

     Note: To display the status of the disk, enter the following command:
     ```
     disk show -b
     ```

     Note: Either command causes the amber fault LED on the disk to illuminate. For more information about LEDs, see "Monitoring the Fibre Channel disk" on page 31.

     For more information about disk commands, see the *System Administrator's Guide*.
2. Put on the antistatic ESD strap and grounding leash.

3. To remove the disk, press down on its release mechanism with one hand while grasping the top flange of the EXN2000 expansion unit with the other hand.
4. Gently slide the disk until it disengages. Wait 30 seconds for the disk to stop spinning; then continue removing the disk from the chassis.

   CAUTION:
   When removing a disk, always use two hands to support its weight.

Installing a disk

To install a disk in an EXN2000 expansion unit, complete the following steps:

1. Put on the antistatic ESD strap and grounding leash.
2. Orient the device carrier so that the release mechanism is at the top.
3. Insert the device carrier into the guide slot in the EXN2000 expansion unit and firmly push it in until it engages the backplane and you see the release mechanism click into place.

   Note: If the device carrier does not fully seat in the drive bay, you may be trying to install an unsupported disk drive in the EXN2000 expansion unit.

   CAUTION:
   Do not slam the device carrier into place.
4. Make sure that disks are installed in drive bays 0 and 1 for Enclosure Services to work.

Replacing a power supply in an EXN2000 expansion unit

Replacing a power supply in an EXN2000 expansion unit consists of the following procedures:

- " Removing a power supply" on page 38
- "Installing a power supply" on page 38

Rules for replacing power supplies

When replacing a power supply on your EXN2000 expansion unit, observe the following rules:

- You do not need to turn off the power to the expansion unit when you replace one power supply, only the power supply being replaced.
- If you are replacing both power supplies in the same EXN2000 expansion unit, replace them one at a time to avoid powering down the EXN2000 expansion unit.
- Although a single fan failure in one of the power supplies is not a critical event, it is recommended that you install a new power supply when one of the two fans in either power supply stops working.

- When hot-swapping power supplies, remove and install the power supplies within two minutes.

Attention: Your EXN2000 can run with one power supply removed for a maximum of two minutes. The airflow through your EXN2000 is degraded when only one power supply is present and operating. Therefore, if the power supplies are not replaced within two minutes, the system halts and no data is accessible.

- Have the replacement power supply close by and ready to install before removing the old one.

CAUTION:
Never remove the cover on a power supply fan unit. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

Removing a power supply

To remove a power supply, complete the following steps:

1. Put on the antistatic ESD strap and grounding leash.
2. Turn off the switch on the power supply that you are replacing.
3. Lift up the clip lock and unplug the power cord from the N series storage system power supply.
4. Using your thumb and index finger, press the cam mechanism levers toward each other to release the power supply handle. The following figure shows how to press the levers on the cam mechanism and release the power supply handle.

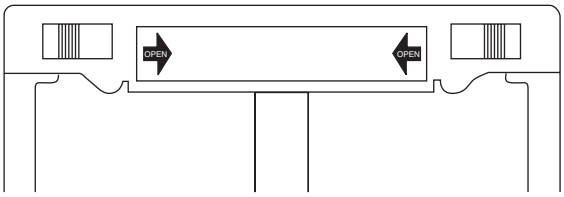


Figure 11. Cam mechanism

5. Use the handle to pull the power supply out of the EXN2000 expansion unit.

   CAUTION:
   When removing a power supply, always use two hands to support its weight.

Installing a power supply

To install a power supply in an EXN2000 expansion unit, complete the following steps:

CAUTION:
Do not use excessive force when sliding the power supply into the EXN2000 expansion unit. You can damage the connector.

1. Put on the antistatic ESD strap and grounding leash.
2. Slide the power supply in the power supply bay until you hear the power supply connect with the connector inside the EXN2000 expansion unit chassis.
3. Raise the handle and push it into place.
4. Using your thumb and index finger, press the cam mechanism levers toward each other to engage the power supply into place.
5. Plug the power cord into the power receptacle and fasten it with the clamp.
6. Plug the other end of the power cord into a grounded AC power source.
7. Turn on the power switch.

Replacing an ESH2 module

The ESH2 module in an EXN2000 expansion unit includes a SCSI-3 Enclosure Services Processor. It maintains the integrity of the loop when disks are swapped and provides signal retiming for enhanced loop stability. There are two ESH2 modules in the middle of the rear of the EXN2000 expansion unit, one for Channel A and one for Channel B.

Note: The Input and Output ports on module A on the EXN2000 expansion unit are inverted from module B.

Connectors in an ESH2

The ESH2 module has the following connectors:

Input Provides the interface between the EXN2000 expansion unit and the N series storage system.

Output
Provides the interface between two EXN2000 expansion units to create a loop of daisy-chained EXN2000 expansion units.

For detailed information

This section provides information about the following topics:

- "Removing a module"
- "Installing a module " on page 40
- "Hot-swapping a module" on page 40

Removing a module

To remove a module that is connected to the Fibre Channel loop, complete the following steps:

1. Put on the antistatic ESD strap and grounding leash.
2. Shut down the N series storage system by entering the following command at the console:

   ```
   halt
   ```

   CAUTION:
   Disable the cluster first and then use the `halt` command to shut down all controllers to which the loop is connected.
3. Disconnect the Fibre Channel cables from the ESH2 module. If you are using optical cables, remove the associated SFPs from the input and output ports of the ESH2 module..
4. Using the thumb and index finger of both hands, press the levers on the cam mechanism on the module to release it.
5. Pull the module out of the EXN2000 expansion unit.
6. Go to "Installing a module ."

Installing a module

To install a module into the EXN2000 expansion unit, complete the following steps:

CAUTION:
Observe the "EXN2000 expansion unit cabling requirements" on page 14.

1. Put on the antistatic ESD strap and grounding leash.
2. Push apart the levers on the cam mechanism and slide the module into the slot at the rear of the EXN2000 expansion unit, then push the levers of the cam mechanism into place.

   CAUTION:
   Do not use excessive force when sliding the module into the EXN2000 unit; you might damage the connector.
3. If you are using optical cables, insert SFPs into the input and output ports of the ESH2 module.
4. Reconnect the Fibre Channel cabling.
5. Verify that the speed setting for the ESH2 module meets the requirements for your N series storage system. See "Speed setting" on page 9.
6. Turn on the power to the EXN2000 expansion units.
7. Reboot the N series storage system.

Hot-swapping a module

Note: This procedure assumes that ESH2 modules on the EXN2000 expansion unit have multipath connections to any N series storage system.

CAUTION:
If you attempt to hot-swap the ESH2 on an EXN2000 expansion unit that does not have multipath connections, you lose all access to the drives on this EXN2000 expansion unit as well as those below it.

To hot-swap a module, complete the following steps:

Note: To hot-swap a module on an EXN2000 expansion unit in a cluster, see the *Cluster Guide* for your filer.

1. Put on the antistatic ESD strap and grounding leash.
2. From the console of the N series storage system, enter the following command to disable the loop in which the failed module is a connection:

   `storage disable adapter` *`adaptername`*

   The *System Administrator's Guide* provides more information about these commands.
3. Disconnect the module that you are removing from the Fibre Channel cabling.
4. Using the thumb and index finger of both hands, press the levers on the cam mechanism on the module to release it and pull it out of the EXN2000 expansion unit.
5. If you are using optical cables, remove the SFPs from the input and output ports of the ESH2 module you have removed. Plug the SFPs into the input and output ports of the replacement ESH2.
6. Slide the replacement module into the slot at the rear of the EXN2000 expansion unit and push the levers of the cam into place.

   CAUTION:
   Do not use excessive force when sliding the ESH2 into the EXN2000 unit; you might damage the connector.
7. Reconnect the Fibre Channel cabling.
8. Verify that the speed setting for the replacement ESH2 module meets the requirements for your N series storage system. See "Speed setting" on page 9.
9. From the console of the filer, enter the following command to enable the loop in which the replacement ESH2 is a connection:

   `storage enable adapter` *`adaptername`*

Appendix A. Recommended power line sizes

This appendix describes the recommended AC power line lengths running from the N series storage system to the power source.

Recommended AC power line sizes

Longer AC power feeds need to be properly designed to preserve voltage levels to the equipment. The wiring from the breaker panel to the power strip, which supplies power to the N series storage system and EXN2000 expansion units, can often exceed 50 feet.

Note: Total AC wire length = breaker to wall or ceiling outlet + extension cable or ceiling drop.

The following table lists the recommended conductor size for 2% voltage drop for a particular distance in feet (taken from the *Radio Engineer's Handbook*).

Table 12. Recommended conductor size for 2% voltage drop

110V, single-phase	20A circuit	30A circuit	40A circuit	50A circuit
25 feet	12 AWG	10 AWG	8 AWG	8 AWG
50 feet	8 AWG	6 AWG	6 AWG	4 AWG
75 feet	6 AWG	4 AWG	4 AWG	2 AWG

220V, single-phase	20A circuit	30A circuit	40A circuit	50A circuit
25 feet	14 AWG	12 AWG	12 AWG	10 AWG
50 feet	12 AWG	10 AWG	8 AWG	8 AWG
75 feet	10 AWG	8 AWG	6 AWG	6 AWG

The following table lists the approximate equivalent wire gauge (American Wire Gauge (AWG) to Harmonized Cordage).

Table 13. American Wire Gauge (AWG) to Harmonized Cordage

AWG	8	10	12
Harmonized, mm-mm mm-mm = millimeter squared	4.0	2.5	1.5

Appendix B. Power cord list for the EXN2000

The following list details the feature codes for the EXN2000 power cords.

IBM FC 9000 (All countries)
Power cord, Rack PDU

- 27 inches
- Rated 250 V/15 A, C13

IBM FC 9001 Europe and others
Provides power cords for Austria, Belgium, Bolivia, Bulgaria, Chile, Croatia, Czech Republic, Egypt, Estonia, European Union, Finland, France, Germany, Greece, Hungary, Iceland, Indonesia, Latvia, Lebanon, Lithuania, Luxemburg, Morocco, Netherlands, Norway, Peru, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, Spain, Suriname, Sweden, Turkey

- Nine feet (2.5M), unshielded, rated 250 V/10 A.
- Attached plug (CEE 7-VII) designed for 200-240 V ac input.

IBM FC 9002 United Kingdom and others
Provides power cords for United Kingdom, Costa Rica, Cyprus, Guyana, Hong Kong, Ireland, Kuwait, Malta, Oman, Singapore, Sri Lanka

- Nine feet (2.5M), unshielded, rated 250 V/10 A.
- Attached plug (BS 1363/A) designed for 200-240 V ac input.

IBM FC 9003 Japan
Provides power cords for Japan

- Six feet (2M), unshielded, rated 125 V/7 A.
- Attached plug (JIS 8303) designed for 100-110 V ac input.

IBM FC 9004 U.S. Six Feet (2 m), 120 V
Provides power cords for U.S., Canada, Mexico, Belize, Columbia, Ecuador, El Salvador, Guatemala, Honduras, Korea, Nicaragua, Panama, Philippines, Puerto Rico, Saudi Arabia, Thailand, Venezuela

- Six feet (2M), unshielded, rated 125V/10 A.
- Attached plug (Nema 5-15) designed for 100-120 V ac input.

IBM FC 9005 Australia, New Zealand
Provides power cords for Australia, New Zealand, Uruguay

- Nine feet (2.5M), unshielded, rated 250 V/10 A.
- Attached plug (AS/NZS C112) designed for 200-240 V ac input.

IBM FC 9006 Switzerland, Liechtenstein

Provides power cords for Switzerland, Liechtenstein

- Nine feet (2.5M), unshielded, rated 250 V/10 A.
- Attached plug (SEV 1011) designed for 200-240 V ac input.

IBM FC 9007 Argentina

Provides power cords for Argentina

- Nine feet (2.5M), unshielded, rated 250 V/10 A.
- Attached plug (IRAM 2073) designed for 200-240 V ac input.

IBM FC 9008 China

Provides power cords for China

- Nine feet (2.5M), unshielded, rated 250 V/10 A.
- Attached plug (GB 2099.1) designed for 200-240 V ac input.

IBM FC 9009 Denmark

Provides power cords for Denmark

- Nine feet (2.5M), unshielded, rated 250 V/10 A.
- Attached plug (afsnit 107-2-D1) designed for 200-240 V ac input.

IBM FC 9010 Pakistan, South Africa

Provides power cords for India, Macau, Pakistan, South Africa

- Nine feet (2.5M), unshielded, rated 250 V/10 A.
- Attached plug (BS 546) designed for 200-240 V ac input.

IBM FC 9011 Israel

Provides power cords for Israel

- Nine feet (2.5M), unshielded, rated 250 V/10 A.
- Attached plug (SI 32) designed for 200-240 V ac input.

IBM FC 9012 Italy

Provides power cords for Italy

- Nine feet (2.5M), unshielded, rated 250 V/10 A.
- Attached plug (CEI 23-16) designed for 200-240 V ac input.

IBM FC 9013 North America

Provides power cords for U.S.

- 94 ½ inches (1.83M), unshielded, rated 250 V/15 A.
- Attached plug (NEMA 6-15P) designed for 200-240 V ac input.

IBM FC 9014 Brazil

Provides power cords for Brazil

- Nine feet (2.5M), unshielded, rated 250 V/10 A.
- Attached plug (CEE7) designed for 200-240 V ac input

IBM FC 9015 Taiwan

Provides 125 V power cords for Taiwan

- Nine feet (2.5M), unshielded, rated 125 V/10 A.
- Attached plug (TW15CS3) designed for 100-120 V ac input.

IBM FC 9016 Taiwan

Provides 250 V power cords for Taiwan

- Six feet (1.8M), unshielded, rated 250 V/10 A.
- Attached plug CNS10917 and connector IEC 60320/C13 designed for 125-300V input.

Appendix C. Parts list for the EXN2000

This appendix lists the FRU part numbers and descriptions for the EXN2000 expansion unit.

Subassemblies and parts

This table lists the subassembly and part FRUs and descriptions for the EXN2000.

Table 14. Subassembly and part FRUs and descriptions

FRU	Description
23R3464	ESH2 Controller
23R4613	EXN2000 Bezel Frame
23R4544	Redundant Power Supply (AC) with Fans
23R3471	Short-wave SFP
23R2969	EXN2000 Service Card
23R4543	Drive blank cover

Hard disk drives

This table lists the FRUs and descriptions of hard disk drives for the EXN2000.

Table 15. HDD FRUs and descriptions

FRU	Description
23R2964	72GB 10k FC HDD
23R2965	144GB10k FC HDD
23R2966	300GB 10k FC HDD
23R2967	72GB 15k FC HDD
23R2968	144BG 15k FC HDD

Cables

This table lists the cable FRUs and descriptions for the EXN2000.

Table 16. Cable FRUs and descriptions

FRU	Description
23R3463	FC Copper SFP to SFP Patch Cable, 0.5M
23R3465	FC Copper SFP to SFP Patch Cable, 3M
23R4601	FC copper NAS to EXP Cable, 0.5M
23R4602	FC copper NAS to EXP Cable, 3M
23R6217	1M Optical Cable, Pair, LC/LC Ends
23R5834	2M Optical Cable, Pair, LC/LC Ends
23R5835	5M Optical Cable, LC/LC Ends

Power cords

This table lists the power cord FRUs and descriptions for the EXN2000.

Table 17. Power cord FRUs and descriptions

FRU	Description
23R3487	PDU Cable for rack
23R3488	Power Cord, EU, 2.5m, 250V/10A, to EU1-16P
23R3489	Power Cord, UK, 2.5m, 250V/10A, to UK1-13P
23R3490	Power Cord, Japan, 2.0m, 125V/7A, to JA1-15P
23R3491	Power Cord, US, 1.83m, 125V/10A, to NEMA 5-15
23R3492	Power Cord, ANZ, 2.5m, 250V/10A, to AU1-10P
23R3493	Power Cord, Swiss, 2.5m, 250V/10A, to SW1-10P
23R3494	Power Cord, Argentina, 2.5m, 250V/10A, to AR1-10P
23R3495	Power Cord, China, 2.5m, 250V/10A, to CH1-10P
23R3496	Power Cord, Denmark, 2.49m, 250V/10A, to DE1-10P
23R3497	Power Cord, India/SAfrica, 2.5m, 250V/16A, to C6
23R3498	Power Cord, Israel 2.5m, 250V/10A, to IS1-16P
23R3499	Power Cord, Italy 2.5m, 250V/10A, to IT1-10P
23R3500	Power Cord, US 94″, 250V/10A, NEMA 6-15P
23R3418	Power Cord, Brazil 2m, 250V/10A, BR10S3
23R3420	Power Cord, Taiwan 2.5m, 125V/10A, TW15CS3
23R5897	Power Cord, Taiwan 1.8m, 250V/10A, EL610A

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Important notes

Processor speeds indicate the internal clock speed of the microprocessor; other factors also affect application performance.

CD-ROM drive speeds list the variable read rate. Actual speeds vary and are often less than the maximum possible.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for approximately 1000 bytes, MB stands for approximately 1 000 000 bytes, and GB stands for approximately 1 000 000 000 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1 000 000 bytes, and GB stands for 1 000 000 000 bytes. Total user-accessible capacity may vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard disk drive bays with the largest currently supported drives available from IBM.

Maximum memory may require replacement of the standard memory with an optional memory module.

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Electronic emission notices

The following statements apply to this product. The statements for other products intended for use with this product will appear in their accompanying manuals.

Federal Communications Commission (FCC) Class A Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

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

Industry Canada Class A Emission Compliance Statement

This Class A digital apparatus complies with Canadian ICES-003.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A est conform à la norme NMB-003 du Canada.

European Union (EU) Electromagnetic Compatibility Directive

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

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

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Australia and New Zealand Class A statement

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Germany Electromagnetic Compatibility Directive

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) vom 18. September 1998 (bzw. der EMC EG Richtlinie 89/336)

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen.

Verantwortlich für die Konformitätserklärung nach Paragraph 5 des EMVG ist die: IBM Deutschland Informationssysteme GmbH 70548 Stuttgart.

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Power cords

For your safety, IBM provides a power cord with a grounded attachment plug to use with this IBM product. To avoid electrical shock, always use the power cord and plug with a properly grounded outlet.

IBM power cords used in the United States and Canada are listed by Underwriter's Laboratories (UL) and certified by the Canadian Standards Association (CSA).

For units intended to be operated at 115 volts: Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a parallel blade, grounding-type attachment plug rated 15 amperes, 125 volts.

For units intended to be operated at 230 volts (U.S. use): Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a tandem blade, grounding-type attachment plug rated 15 amperes, 250 volts.

For units intended to be operated at 230 volts (outside the U.S.): Use a cord set with a grounding-type attachment plug. The cord set should have the appropriate safety approvals for the country in which the equipment will be installed.

IBM power cords for a specific country or region are usually available only in that country or region.

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Hardware and Service Guide

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