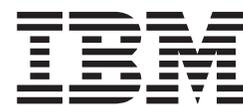
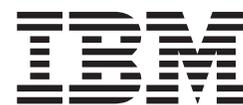


IBM Storage Servers - FAStT200, Type
3542, FAStT200 HA, Type
3542



Hardware Maintenance Manual

IBM Storage Servers - FAStT200, Type 3542,
FAStT200 HA, Type
3542



Hardware Maintenance Manual

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Note: Before using this information and the product it supports, be sure to read the general information under “Notices” on page 123.

First Edition (September 2000)

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IBM Storage Servers FAStT200, Type 3542, FAStT200 HA, Type 3542 Hardware Maintenance Manual

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About this manual

This manual contains service and reference information for the IBM® Type 3542 FAST200 Storage Server and FAST200 HA Storage Server, models 1RU, 1RX and 2RU, 2RX

This manual is divided into product service sections and a related service section, as follows:

- The product service sections include procedures for isolating problems to a FRU, a Symptom-to-FRU Index, additional service information and an illustrated parts catalog.
- The related service section includes safety notices and safety information, and problem determination tips.

This manual should be used with the Hardware Maintenance Manual for the system you are servicing.

Note

This manual is intended for trained servicers who are familiar with IBM PC Server and IBM Netfinity Server products.

Before servicing an IBM product, be sure to review the “Safety notices (multi-lingual translations)” on page 85 and “Safety information” on page 111.

Important safety information

Be sure to read all caution and danger statements in this book before performing any of the instructions.

Prenez connaissance de toutes les consignes de type Attention et Danger avant de procéder aux opérations décrites par les instructions.

Lesen Sie alle Sicherheitshinweise, bevor Sie eine Anweisung ausführen.

주의 및 위험 경고문(한글)

중요:

이 책에 나오는 모든 주의 및 위험 경고문은 번호로 시작됩니다. 이 번호는 *Safety Information* 책에 나오는 영문판 주의 및 위험 경고문과 한글판 주의 및 위험 경고문을 상호 참조하는데 사용됩니다.

예를 들어 주의 경고문이 번호 1로 시작되면 *Safety Information* 책에서 이 주의 경고문은 경고문 1번 아래에 나옵니다.

지시를 따라 수행하기 전에 먼저 모든 주의 및 위험 경고문을 읽도록 하십시오.

Accertarsi di leggere tutti gli avvisi di attenzione e di pericolo prima di effettuare qualsiasi operazione.

Leia todas as instruções de cuidado e perigo antes de executar qualquer operação.

Lea atentamente todas las declaraciones de precaución y peligro ante de llevar a cabo cualquier operación.

注意和危险声明 (简体中文)

重要事项:

本书中的所有注意和危险声明之前都有编号。该编号用于英语的注意或危险声明与 *Safety Information* 一书中可以找到的翻译版本的注意或危险声明进行交叉引用。

例如，如果一个注意声明以编号 1 开始，那么对该注意声明的翻译出现在 *Safety Information* 一书中的声明 1 中。

在按说明执行任何操作前，请务必阅读所有注意和危险声明。

注意及危險聲明 (中文)

重要資訊：

本書中所有「注意」及「危險」的聲明均以數字開始。此一數字是用來作為交互參考之用，英文「注意」或「危險」聲明可在「安全資訊」(Safety Information) 一書中找到相同內容的「注意」或「危險」聲明的譯文。

例如，有一「危險」聲明以數字 1 開始，則該「危險」聲明的譯文將出現在「安全資訊」(Safety Information) 一書的「聲明」1 中。

執行任何指示之前，請詳讀所有「注意」及「危險」的聲明。

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Chapter 1. General checkout

Use the status LEDs, Symptom-to-FRU list, and the storage management software to diagnose problems. Refer to “Monitoring status through software” on page 11 and “Checking the LEDs” on page 12

To diagnose a cluster system, use the cluster problem determination procedure. The cluster problem determination procedure is used for diagnosing clustering systems. To download the problem determination procedure for clustering systems, [click here](#)....

Note: If power was just applied to the controller unit, the green and amber LEDs might turn on and off intermittently. Wait until the controller unit finishes powering up before you begin checking for faults.

Chapter 2. General information

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Thank you for purchasing an IBM® FAStT product. IBM FAStT (Fibre Array Storage Technology) solutions support the large and growing data storage requirements of business-critical applications. These scalable IBM FAStT solutions offer you data access and protection to meet your existing enterprise storage requirements and prepare for the future.

The IBM FAStT Storage Server is available in two models. The IBM FAStT200 HA Storage Server (Model 3542-2RU) comes with two RAID controllers, two power supplies, and two cooling units and provides dual, redundant controllers, redundant cooling, redundant power, and battery backup of the RAID controller cache.

The IBM FAStT200 Storage Server ((Model 3542-1RU) comes with one RAID controller, two power supplies, and two cooling units and provides battery backup of the RAID controller cache. A FAStT200 Redundant RAID Controller option is available for purchase. Contact your IBM reseller or IBM marketing representative.

The IBM FAStT200 HA Storage Server is designed to provide maximum host and drive side redundancy. Each RAID controller supports direct attachment of one host containing one or two host adapters. Using external managed hubs and switches in conjunction with the storage server, you can build even larger configurations. (Throughout this book, the use of hub or external hub refers to a managed hub.)

Fibre Channel is a new technology, similar to a high-speed network, that you can use to connect large amounts of disk storage to a server or cluster of servers. Fibre Channel technology supports increased performance, scalability, availability, and distance for attaching storage subsystems to network servers. The storage server provides for the attachment of Fibre Channel disk drives to give superior performance and redundancy.

Fibre Channel technology supports applications that require large amounts of disk storage that is shared by two or more servers. With Fibre Channel, you can see a higher throughput rate over longer distances than is possible with small computer system interface (SCSI) or with serial storage architecture (SSA) technology.

Note: Throughout this book, the term *storage server* refers to both the IBM FAStT200 Storage Server (Model 3542-1RU) and the IBM FAStT200 HA Storage Server (Model 3542-2RU). Model-specific information is noted where applicable.

Features at a glance

The following table summarizes the features of the storage server. For a list of the operating specifications, such as weight, height, and heat output, see “Operating specifications” on page 9.

Table 1. Features at a glance

<p>General</p> <ul style="list-style-type: none"> • Modular components: <ul style="list-style-type: none"> - High-capacity disk drives - RAID controllers - Power supplies - Cooling fans • Technology: <ul style="list-style-type: none"> - Support for disk arrays - Support for clustering - Fibre Channel host interface - Redundant data storage, cooling system, power system, and RAID controllers - Hot-swap technology for drives, power supplies, fans, and RAID controllers 	<ul style="list-style-type: none"> • User interface: <ul style="list-style-type: none"> - Built-in power, activity, and fault Light Emitting Diodes (LEDs) - Identification labeling on customer replaceable units (CRUs), rear LEDs, switches, and connectors - Easy-to-replace drives, power supplies, RAID controllers, and fans <p>Disk drive storage</p> <p>Maximum drives per storage server: 10</p>	<p>RAID controllers</p> <ul style="list-style-type: none"> • Technology and interfaces: <ul style="list-style-type: none"> - Fibre Channel: 40-pin FC disk drives - Fibre Channel interface: Four Gigabit Interface Converter (GBIC) connectors for incoming and outgoing FC cables (two GBICs on each RAID controller)
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Clustering support

Clustering is a means of sharing array groups among controllers to provide redundancy of controllers and servers. This redundancy is important if a hardware component fails. If a hardware component failure occurs in a cluster, another server takes ownership of the array group.

Clustering requires additional hardware and specialized software. For more information about clustering, visit the following IBM Web site:
<http://www.ibm.com/pc/us/netfinity/clustering>

Getting help on the World Wide Web

You can obtain up-to-date information about your storage server, a complete listing of the options that are supported on your model, and information about other IBM server products by accessing the IBM Web page at the following address:
<http://www.ibm.com/pc/us/netfinity>

Inventory checklist

After you unpack your storage server, verify that you have the following items:

Hardware

IBM FAStT200 HA Storage Server (Machine Type 3542, Model 2RU) comes with the following components:

- Two RAID controllers
- Two fan units
- Two power supplies
- Two power cords

IBM FAStT200 Storage Server (Machine Type 3542, Model 1RU) comes with the following removable components:

- One RAID controller
- Two fan units
- Two power supplies
- Two power cords

The following hardware comes with Models 1RU and 2RU:

- One RS-232 cable (for performing diagnostic operations)
- Rack-mounting hardware kit (1)
 - Two rails (right and left assembly)
 - Ten M6 screws
 - Ten M6 cage nuts
 - Ten M6 clip nuts

Software and documentation (both models):

- IBM FAStT Storage Manager Version 7.02 CD including:
 - Netfinity FAStT200 Storage Manager Version 7.02
 - Publications and online help in Adobe Acrobat Portable Document Format (PDF)
- Rack Mounting Assembly kit, including:
 - Rack mounting installation instructions
 - Rack mounting template (for aligning the rails properly)
 - White tape dots for marking the holes in the rack
- Fibre Channel cabling instructions

If an item is missing or damaged, contact your IBM reseller or your IBM marketing representative.

Storage server components

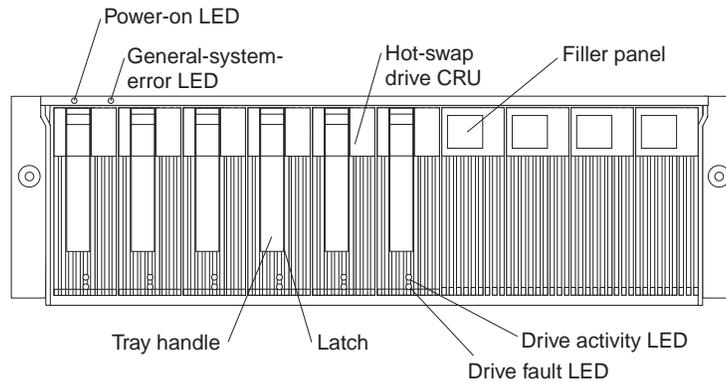
The following sections show the components of the storage server.

The hot-swap features of the storage server enable you to remove and replace hard disk drives, power supplies, RAID controllers, and fans without turning off the storage server. Therefore, you can maintain the availability of your system while a hot-swap device is removed, installed, or replaced.

Front view

The following illustration shows the components and controls on the front of the storage server.

The following illustration shows the components and controls on the front of the storage server.



Power-on LED

When on, this green light indicates that the unit has good dc power.

General-system-error LED

When on, this amber LED indicates that the storage server has a fault, such as in a power supply, fan unit, or hard disk drive.

Note: If the General-system-error LED is on continuously (not flashing), there is a problem with the storage server. Use the storage-management software to diagnose and repair the problem. For more information, see “Checking the LEDs” on page 12

Hot-swap drive CRU

You can install up to 10 hot-swap drive *customer replaceable units* (CRUs) in the storage server. Each drive CRU consists of a hard disk drive and tray.

Filler panel

The storage server comes without drives installed and contains filler panels in the unused drive bays. Before installing new drives, you must remove the filler panels and save them. Each of the 10 bays must always contain either a filler panel or a drive CRU. Each filler panel contains a filler piece for use with a slim drive.

Drive activity LED

Each drive CRU has a green Drive activity LED. When flashing, this green LED indicates drive activity. When on continuously, this green LED indicates that the drive is properly installed.

Drive fault LED

Each drive CRU has an amber Drive fault LED. When on, this amber LED indicates a drive failure. When flashing, this amber LED indicates that a drive identify or rebuild process is in progress.

Latch This multipurpose blue latch releases or locks the drive CRU in place.

Tray handle

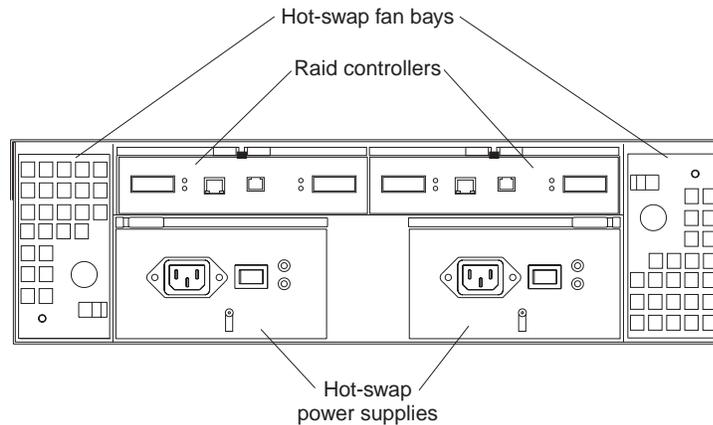
You can use this multipurpose handle to insert and remove a drive CRU in the bay.

For information on installing and replacing drive CRUs, see “Working with hot-swap drives” on page 17. For more information about the LEDs, see “Checking the LEDs” on page 12.

Back view

The following illustration shows the components at the back of the IBM FASTt200 HA Storage Server.

Note: If your storage server is a Model 1RU, there is only one RAID controller. There is a blank panel in the second RAID controller opening. The blank panel must remain in place to maintain proper cooling.



RAID controller

The storage server comes with one or two hot-swap RAID controllers. Each RAID controller contains two ports for Gigabit Interface Converters (GBICs) which connect to the Fibre Channel cables. One GBIC connects to a host system. The other GBIC is used to connect additional expansion units to the storage server.

Each RAID controller also contains a battery to maintain cache data in the event of a power failure. For more information, see “Cache memory and RAID controller battery” on page 78.

Hot-swap fans

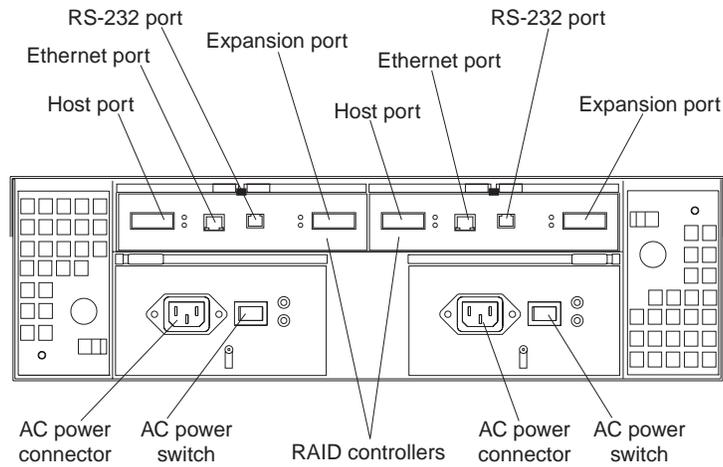
The storage server has two interchangeable hot-swap and redundant fan CRUs. Each fan CRU contains two fans. If one fan CRU fails, the second fan CRU continues to operate. Both fan CRUs must be installed to maintain proper cooling within your storage server, even if one fan CRU is not operational.

Hot-swap power supplies

The storage server comes with two hot-swap power supplies. Both power supplies must be installed to maintain proper cooling.

Interface ports and switches

The following illustration shows the ports and switches on the back of the storage server.



RAID controller

Each RAID controller contains several connectors and LEDs. Each controller has one host port and one expansion port for connecting the storage server to hosts or expansion units. You first insert a GBIC into the port and then connect the Fibre Channel cables.

Host port

The host port is used to connect Fibre Channel cables from the host systems. You first insert a GBIC into the port and then connect the Fibre Channel cables.

Ethernet port

The Ethernet port is for an RJ-45 10 BASE-T or 100 BASE-T Ethernet connection. Use the Ethernet connection to directly manage storage subsystems.

Expansion port

The expansion port is used to connect additional expansion units to the RAID controllers. You can connect one expansion unit to each RAID controller. You first insert a GBIC into the port and then connect the Fibre Channel cables.

RS-232 port

The RS-232 port is a TJ-6 modular jack and is used for an RS-232 serial connection. The RS-232 port is used by service personnel to perform diagnostic operations on the RAID controllers. An RS-232 cable comes with the storage server.

Operating specifications

The following table summarizes the operating specifications of the controller unit.

Table 2. Model 3542-2RU storage server operating specifications

<p>Size (with front panel and without mounting rails)</p> <ul style="list-style-type: none"> • Depth: 57.5 cm (22.6 in) • Height: 13.2 cm (5.2 in) • Width: 48 cm (18.9 in) <p>Weight</p> <ul style="list-style-type: none"> • Standard storage server as shipped: 25.74 kg (56.7 lb) • Typical storage server fully configured: 37.65 kg (83 lb) <p>Electrical input</p> <ul style="list-style-type: none"> • Sine-wave input (50 to 60 Hz) is required • Input voltage: <ul style="list-style-type: none"> – Low range: <ul style="list-style-type: none"> - Minimum: 90 V ac - Maximum: 136 V ac – High range: <ul style="list-style-type: none"> - Minimum: 198 V ac - Maximum: 264 V ac – Input kilovolt-amperes (kVA) approximately: <ul style="list-style-type: none"> - Minimum configuration: 0.06 kVA - Maximum configuration: 0.37 kVA 	<p>Environment</p> <ul style="list-style-type: none"> • Air temperature: <ul style="list-style-type: none"> – Storage server on: 10° to 35° C (50° to 95° F) Altitude: 0 to 914 m (3000 ft) – Storage server on: 10° to 32° C (50° to 90° F) Altitude: 914 m (3000 ft) to 2133 m (7000 ft.) • Humidity: <ul style="list-style-type: none"> – 8% to 80% 	<p>Acoustical noise emissions valuesFor open bay (0 drives installed) and typical system configurations (8 hard disk drives installed).</p> <ul style="list-style-type: none"> • Sound power (idling): <ul style="list-style-type: none"> – 6.3 bels (open bay) – 6.5 bels (typical) • Sound power (operating): <ul style="list-style-type: none"> – 6.3 bels (open bay) – 6.8 bels (typical) • Sound pressure (idling): <ul style="list-style-type: none"> – 47 dBA (open bay) – 65 dBA (typical) • Sound pressure (operating): <ul style="list-style-type: none"> – 47 dBA (open bay) – 68 dBA (typical) <p>These levels are measured in controlled acoustical environments according ISO 7779 and are reported in accordance with ISO 9296. The declared sound power levels indicate an upper limit, below which a large portion of machines operate. Sound pressure levels in your location might exceed the average 1-meter values stated because of room reflections and other nearby noise.</p>
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Chapter 3. Diagnostics

Cluster Problem determination procedure	11	Checking the LEDs	12
Monitoring status through software	11		

To diagnose a cluster system, use the cluster problem determination procedure:

To diagnosed the Type 3542 storage system, us the following diagnostics tools:

- Storage-management software
- Checking LEDs

Cluster Problem determination procedure

The problem determination procedure is used for diagnosing clustering systems. To download the problem determination procedure for clustering systems, click [here](#).....

Monitoring status through software

Use the storage-management software to monitor the status of the storage server. Run the software constantly, and check it frequently.

The storage-management software provides the best way to diagnose and repair storage-server failures. The software can help you:

- Determine the nature of the failure
- Locate the failed component
- Determine the recovery procedures to repair the failure

Although the storage server has fault LEDs, these lights do not necessarily indicate which component has failed or needs to be replaced, or which type of recovery procedure that you must perform. In some cases (such as loss of redundancy in various components), the fault LED does not turn on. Only the storage-management software can detect the failure.

For example, the recovery procedure for a Predictive Failure Analysis[®] (PFA) flag (impending drive failure) on a drive varies depending on the drive status (hot spare, unassigned, RAID level, current logical drive status, and so on). Depending on the circumstances, a PFA flag on a drive can indicate a high risk of data loss (if the drive is in a RAID 0 volume) or a minimal risk (if the drive is unassigned). Only the storage-management software can identify the risk level and provide the necessary recovery procedures.

Note: For PFA flags, the General-system-error LED and Drive fault LEDs do not turn on, so checking the LEDs will not notify you of the failure, even if the risk of data loss is high.

Recovering from a storage-server failure might require you to perform procedures other than replacing the component (such as backing up the logical drive or failing a drive before removing it). The storage-management software gives these procedures.

Attention: Not following the software-recovery procedures can result in data loss.

Checking the LEDs

The LEDs display the status of the storage server and components. Green LEDs indicate a normal operating status; amber LEDs indicate a possible failure.

It is important to check all the LEDs on the front and back of the storage server when you turn on the power. In addition to checking for faults, you can use the LEDs on the front of the storage server to determine if the drives are responding to I/O transmissions from the host.

For information about the LEDs on the front of the storage server, see:

- Figure 1
- Table 3

For information about the LEDs on the back of the storage server, see:

- Figure 3 on page 14
- Table 4 on page 13
- Table 5 on page 14

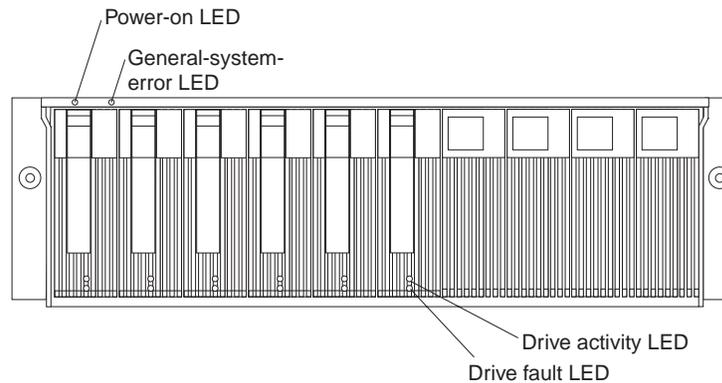


Figure 1. Storage server LEDs (front)

Table 3. Storage server LEDs (front)

LED	Color	Operating states ¹
Drive active	Green	<ul style="list-style-type: none"> • On - Normal operation. • Flashing - The drive is reading or writing data. • Off- One of the following situations has occurred: <ul style="list-style-type: none"> - The storage server has no power. - The storage subsystem has no power. - The drive is not properly seated in the storage server. - The drive has not spun up.
Drive fault	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • Flashing - The storage-management software is locating a drive, logical drive, or storage subsystem. • On- The drive has failed, or a user failed the drive.

Table 3. Storage server LEDs (front) (continued)

LED	Color	Operating states ¹
Power	Green	<ul style="list-style-type: none"> • On - Normal operation. • Off- One of the following situations has occurred: <ul style="list-style-type: none"> - The storage server has no power. - The storage subsystem has no power. - The power supply has failed. - There is an overtemperature condition.
General-system-error	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • On- A storage server component has failed².

¹Always use the storage-management software to identify the failure. ² Not all component failures turn on this LED. For more information, see “Monitoring status through software” on page 11.

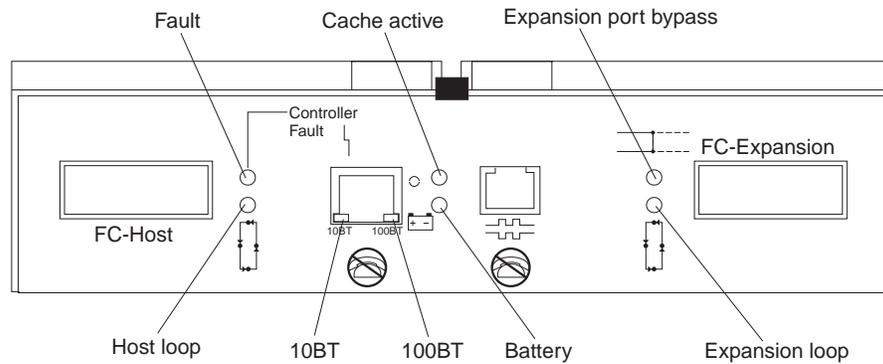


Figure 2. RAID controller LEDs

Table 4. RAID Controller LEDs

Icon	LED	Color	Operating states ¹
	Fault	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • On- The RAID controller has failed.
	Host loop	Green	<ul style="list-style-type: none"> • On - Normal operation • Off- One of the following situations has occurred: <ul style="list-style-type: none"> - The host loop is down, not turned on, or not connected. - A GBIC has failed, or the host port is not occupied. - The RAID controller circuitry has failed, or the RAID controller has no power.
	Cache active	Green	<ul style="list-style-type: none"> • On - There is data in the RAID controller cache. • Off- One of the following situations has occurred: <ul style="list-style-type: none"> - There is no data in cache. - There are no cache options selected for this array. - The cache memory has failed, or the battery has failed.
	Battery	Green	<ul style="list-style-type: none"> • On - Normal operation. • Flashing - The battery is recharging or performing a self-test. • Off- The battery or battery charger has failed.

Table 4. RAID Controller LEDs (continued)

Icon	LED	Color	Operating states ¹
	Expansion port bypass	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • On- One of the following situations has occurred: <ul style="list-style-type: none"> - The expansion port is not occupied. - The Fibre Channel cable is not attached to an expansion unit. - The attached expansion unit is not turned on. - A GBIC has failed, a Fibre Channel cable has failed, or a GBIC has failed on the attached expansion unit.
	Expansion loop	Green	<ul style="list-style-type: none"> • On - Normal operation. • Off- The RAID controller circuitry has failed, or the RAID controller has no power.
No icon	10BT	Green	<ul style="list-style-type: none"> • If the Ethernet connection is 10BASE-T:The 10BT LED is on, 100BT LED flashes faintly. • If the Ethernet connection is 100BASE-T:10BT LED is off, 100BT LED is on. • If there is no Ethernet connection- Both LEDs are off.
No icon	100BT		

¹Always use the storage-management software to identify the failure.

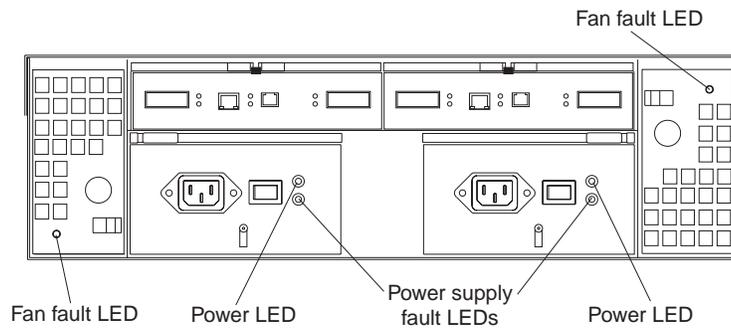


Figure 3. Fan and power supply LEDs

Table 5. Fan LED

LED	Color	Operating states ¹
Fault	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • On- The fan CRU has failed.

¹Always use the storage-management software to identify the failure.

Table 6. Power supply LEDs

LED	Color	Operating states ¹
Fault	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • On- One of the following situations has occurred: <ul style="list-style-type: none"> - The power supply has failed. - An overtemperature condition has occurred. - The power supply is turned off.

Table 6. Power supply LEDs (continued)

LED	Color	Operating states ¹
Power	Green	<ul style="list-style-type: none">• On - Normal operation.• Off- One of the following situations has occurred:<ul style="list-style-type: none">- The power supply is disconnected.- The power supply is seated incorrectly.- The storage server has no power.

¹Always use the storage-management software to identify the failure.

Chapter 4. Installing and replacing options

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Handling static-sensitive devices

Attention: Static electricity can damage storage server components or options. To avoid damage, keep static sensitive devices in their static protective bag until you are ready to install them.

To reduce the possibility of electrostatic discharge (ESD) when you handle options and storage server components, observe the following precautions:

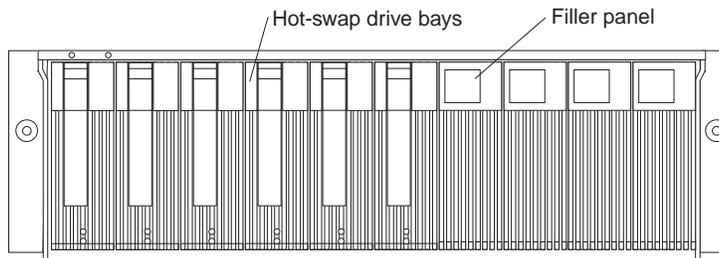
- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed printed circuitry.
- Do not leave the device where others can handle and possibly damage the device.
- While the device is still in its anti-static package, touch it to an unpainted metal part of the storage server 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 storage server without setting it down. If it is necessary to set the device down, place it on its static-protective package. Do not place the device on your storage server cover or any metal surface.
- Take additional care when handling devices during cold weather as heating reduces indoor humidity and increases static electricity.

Working with hot-swap drives

Drives are devices that the system uses to store and retrieve data. This section explains how you can increase the storage-server capacity by adding more drives or replacing existing drives with ones containing a larger capacity.

The following illustration shows the location of the hot-swap drive bays that are accessible from the front of the storage server. In this illustration, six of the 10 bays contain drive CRUs and four bays contain filler panels. To maintain proper cooling within the storage server, always keep a filler panel in each drive bay that does not

contain a drive CRU.



Attention: Never hot-swap a drive CRU when its green Activity LED is flashing. Hot-swap a drive CRU only when its amber Fault LED is completely on and not flashing or when the drive is inactive with the green Activity LED on and not flashing.

Before you install or remove drive CRUs, review the following information:

Filler panels

Storage servers without a full set of drives (10) contain filler panels in the unused drive bays. Before installing new drives, you must remove the filler panels. Save the filler panels for future use. Each of the 10 bays must always contain either a filler panel or a drive CRU. Each filler panel contains a filler piece for use with a slim drive.

Drive CRUs

The RAID controller supports up to 10 (half-high or slim) 40-pin Fibre Channel hard disk drives. These drives come preinstalled in drive trays. This drive-and-tray assembly is called a *drive CRU* (customer replaceable unit). You can install the drive CRUs in the 10 drive bays on the front of the storage server.

Drive LEDs

Each drive CRU has two LEDs, which indicate the status for that particular drive. For information about the drive LED operating states and descriptions, see Figure 1 on page 12 and Table 3 on page 12.

Fibre Channel loop IDs

When you install a drive CRU in the storage server, the drive CRU connects into a printed circuit board called the *midplane*. The midplane automatically sets the Fibre Channel loop ID to the default value 00.

Hot-swap hardware

The storage server contains hardware that you can use to replace a failed hard disk drive without turning off the storage server. Therefore, you can continue operating the system while a hard disk drive is removed or installed. These drives are known as *hot-swap* drives.

Slim drives

You can install slim, hot-swap drive CRUs, which are slightly smaller than the standard disk drive. These drive CRUs do not fill the entire drive bay. To maintain proper airflow and cooling when you install a slim drive, you must also install one of the filler pieces that are provided in the filler panels.

Installing hot-swap drives

Before you begin

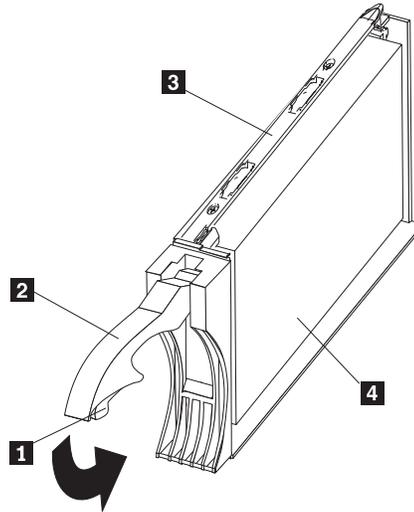
- Read the safety and handling guidelines provided in “Electrical safety” on page 111 and “Handling electrostatic discharge-sensitive devices” on page 113.
- Ensure that the current system configuration is working properly.
- Back up all important data before you make changes to storage devices, such as hard disk drives.

Use the following procedure to install drives in the Storage Server. You can install additional drives while the Storage Server is powered up and running.

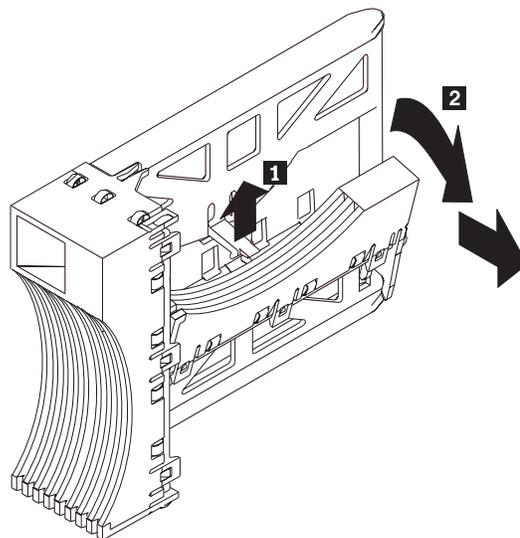
Note: If you are replacing a drive, see “Replacing hot-swap drives” on page 21.

1. Read the instructions that come with the drive CRU.
2. Check for Fault LEDs. If any amber LEDs are lit, see “Checking the LEDs” on page 12 and “Chapter 5. Symptom-to-FRU index” on page 53.
3. Determine the bay into which you want to install the drive.
4. Remove the filler panel.
 - a. Insert a finger into the square hole at the top of the filler panel to grip and pull the tray out of the drive bay.
 - b. Save the filler panel for later use.
5. Install the drive CRU:

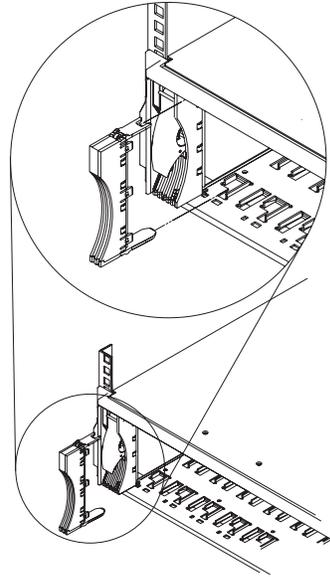
Note: The hard disk drive comes with a tray already attached. Do not attempt to detach the drive **4** from the tray **3**.



- a. Release the blue latch **1** on the drive CRU by pressing on the inside of the bottom of the tray handle.
 - b. Pull the handle **2** on the tray out into the open position.
 - c. Slide the drive CRU into the empty bay until the tray handle **2** touches the Storage Server bezel.
 - d. Push the tray handle **2** down into the closed (latched) position.
6. If you are installing a slim-line drive, continue with step 6a. Otherwise, go to step 7 on page 21.
- a. Locate the filler piece on the inside of the filler panel.
 - b. Pull up on the small latch **1** inside the filler panel to release the filler piece.
 - c. Tilt the filler piece up from the filler panel **2**; then, remove it from the tray as shown in the following illustration.



- d. Insert the filler piece into the empty space left in the drive bay, as shown in the following illustration.



7. Check the drive LEDs.
 - a. When a drive is ready for use, the green Activity LED is on and the amber Fault LED is off.
 - b. If the amber Fault LED is completely on and not flashing, remove the drive from the unit and wait 10 seconds; then, reinstall the drive.
8. Use the storage-management software to configure the drive.

Replacing hot-swap drives

Drive problems include any malfunctions that delay, interrupt, or prevent successful I/O activity between the hosts and the hard disk drives. This includes transmission problems between the host controllers, the RAID controllers, and the drives. This section explains how to replace a failed drive.

Attention: Failure to replace the drives in their correct bays might result in loss of data. If you are replacing a drive that is part of a RAID level 1 or RAID level 5 logical drive, ensure that you install the replacement drive in the correct bay.

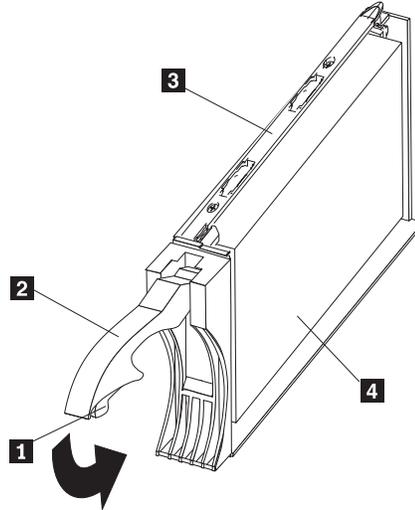
Use the following procedure to replace host-swap drives.

1. Check the hardware and software documentation that is provided with the system to see if there are restrictions regarding hard disk drive configurations. Some system Fibre Channel configurations might not allow mixing different drive capacities or types within an array.
2. Check the storage-management software for recovery procedures for a drive that has failed. Follow the steps in the software procedure before continuing with this procedure.
3. Determine the location of the drive that you want to remove.

Attention: Never hot-swap a drive CRU when its green Activity LED is flashing. Hot-swap a drive CRU only when its amber Drive fault LED is on and not flashing or when the drive is inactive with the green Activity LED on and not flashing.

4. Remove the drive CRU.
 - a. Press on the inside of the bottom of the tray handle to release the blue latch **1**.

- b. Pull the handle **2** on the tray **3** out into the open position.
- c. Lift the drive CRU partially out of the bay.
- d. To avoid possible damage to the drive **4**, wait at least 20 seconds before fully removing the drive CRU from the storage server to allow for the drive to spin down.



- e. Verify that there is proper identification (such as a label) on the drive CRU, and then slide it completely out of the storage server.
 - f. If you are replacing a slim drive, ensure that the filler piece remains in place for use with the new drive.
5. Install the new drive CRU.
 - a. Gently push the drive CRU into the empty bay until the tray handle **2** touches the storage-server bezel.
 - b. Push the tray handle **2** down into the closed (latched) position.

6. Check the drive LEDs.
 - a. When a drive is ready for use, the green Activity LED is on, and the amber Drive fault LED is off.
 - b. If the amber Drive fault LED is on and not flashing, remove the drive from the Storage Server and wait 10 seconds; then, reinstall the drive.
7. Return to normal operation.

Upgrading drives

You can upgrade drives in two ways:

- Adding drives to empty slots in the storage server (see “Installing hot-swap drives” on page 18).
- Replacing existing drives with larger capacity drives.

Adding larger capacity drives

This section provides guidelines for upgrading the drives in the storage server. Read the software documentation and this entire section to determine if you should use this procedure, use a modified version of this procedure, or use a different procedure that is provided by your operating system. *Instructions that are provided with your software should supersede anything stated in this book.*

There are two methods for upgrading drives:

Replacing all the drives at the same time

This method requires that you back up the data on the affected drives and then turn off the storage server. After replacing all the drives, you must reconfigure the new drives and restore data from backup. See the procedure in “Replacing all drives at the same time” on page 24.

This is the safest way to exchange drives without losing data. However, this method might take a long time to complete because of the backup, reconfiguration, and restoration processes. In addition, other users are not able to use the storage server (or any expansion units attached to the storage server) until you finish the procedure. You must use this method on RAID 0 logical drives.

Replacing the drives one at a time

In this method, you manually fail each drive, replace it, and wait for the system to restore data to the new drive before installing the next drive. After you install the new drives, you can configure them to make the additional drive space available. See the procedure in “Replacing the drives one at a time” on page 26.

Using this method, you can replace the drives while the storage server is running, eliminating the down time that is required if you replace all the drives at once. However, this method is more risky because you can lose data if the drive restoration or storage subsystem reconfiguration process fails. In addition, the reconstruction process might take a long time. This method works only on redundant logical drives (RAID 1, 3, or 5). You cannot use this method with any drives containing RAID 0 logical drives.

Consider backing up your data if you use this method. This safeguards your data if the restoration and reconfiguration process fails or the new drive malfunctions.

The method you use depends on the following considerations:

- Which method most closely matches the recommended drive upgrade procedure that is provided in the operating system or the storage-management software documentation
- Which RAID level is used on the affected drives (RAID 0 requires you to replace all the drives at the same time)
- How much downtime is acceptable as you swap the drives

Replacing all drives at the same time

Use this procedure to replace all drives at the same time. You must use this method if you are upgrading drives containing RAID 0 logical drives. All the data currently on the drives is lost when you replace the drives; therefore, you must back up all data that is currently on the drives. This procedure also requires you to turn off the storage server, which makes the storage server (and any attached expansion units) inaccessible to other users.

To replace all the drives at the same time, do the following.

1. Read the following:
 - The information in “Adding larger capacity drives” on page 23, particularly the paragraphs that discuss the differences between the two possible upgrade procedures.
 - The information in your software documentation regarding drive upgrades and installation.
 - The documentation that comes with the new drives.
Read all precautionary notes, kit instructions, and other information. Kit instructions often contain the most current information regarding the drives and their installation, plus upgrade or servicing procedures. Compare the kit instructions with this procedure to determine if you need to modify this procedure.
2. Use the storage-management software to check the status of the storage server. Correct any problems that are reported.
3. Perform a complete backup of the drives that you are replacing.
You need the backup to restore data on the drives later in this procedure.
Attention: When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, see “Handling static-sensitive devices” on page 17.
4. Unpack the new drives.
Set the drives on a dry, level surface away from magnetic fields. Save the packing material and documentation in case you need to return the drives.
5. Do the following:
 - a. Stop all I/O activity to the storage server and attached expansion units.
Make sure that:
 - 1) All of the green Drive activity LEDs on the front of the storage server (and on all attached expansion units) are not flashing.
 - 2) The green Cache active LEDs are off on the front of the RAID controllers.
 - b. If applicable, use the operating system software to disconnect the storage server logical drives from the host before the storage server is powered off.

Attention: To turn off all power to the storage server, you must turn off both power-supply switches and disconnect both power cords. Use the procedure in step 6 for the proper shutdown sequence.

6. Turn off the power to each device based on the following shutdown sequence:
 - a. Turn off power to the host before the storage server. If the host must stay powered on to support an existing network, refer to the operating system documentation for information about disconnecting the storage server logical drives from the host before the storage server is powered off.
 - b. Turn off power to the storage server before you turn off power to the expansion units. Turn off both power supply switches on the back of the storage server.
 - c. Turn off power to other supporting devices (for example, management stations, Fibre Channel switches, Fibre Channel managed hubs, or Ethernet switches).

Note: You do not need to perform this step if you are servicing only the storage server.

7. Use the procedures in “Replacing hot-swap drives” on page 21 to remove the drives that you want to replace. Use the procedures in “Installing hot-swap drives” on page 18 to install the new drives into the storage server.
8. After you install all the new drives, check the system documentation for the hardware devices that you intend to power up, and then determine the proper startup sequence. Use the following power-on sequence, where applicable:
 - a. Turn on the power to the supporting devices (for example, Ethernet switches, managed hubs, and management stations) before the storage server.
 - b. You must turn on the expansion units before the storage server. The controllers might not recognize the correct configuration if the drives are powered up after the storage server. For instructions on powering up the expansion units, refer to the expansion-unit documentation.
 - c. Turn on the power to the storage server; then, restart or turn on the power to the host.
9. Turn on the power to each device, based on the power-on sequence in step 8. To turn on power to the storage server, turn on the power-supply switches on the back of the storage server. You must turn on both power-supply switches to take advantage of the redundant power supplies.
10. Check the green Drive activity LED and the amber Drive fault LED below the new drive CRUs.

Make sure that the Drive activity LEDs are on and the Drive fault LEDs are off.

Note: The Drive fault LEDs might flash intermittently while the drives spin up.

- If the Drive activity LED is off, the drive CRU might not be installed correctly. Remove the drive CRU, wait 30 seconds, and then reinstall it.
 - If the Drive fault LED stays on or the Drive activity LED stays off, the new drive might be faulty. Refer to the storage-management software for problem determination.
11. Use the storage-management software to configure the new drives. See the storage-management software online Help for detailed instructions.
 12. Restore the data from backup to all the drives.

Replacing the drives one at a time

Use this procedure to replace all the drives one at a time. You cannot use this procedure on RAID 0 logical drives (use the procedure in “Replacing all drives at the same time” on page 24).

Note: If your storage subsystem has hot spares assigned, you might want to unassign the hot spares while you perform this procedure. If you do not, reconstruction might start on the hot spare before you insert the new drive. The data on the new drive is still rebuilt, but the process takes longer for each drive. Remember to reassign the hot spares when you are finished with this procedure.

To replace the drives one at a time, do the following:

1. Read the following:
 - The information in “Adding larger capacity drives” on page 23, particularly the paragraphs that discuss the differences between the two possible upgrade procedures.
 - The information in your software documentation regarding drive upgrades and installation.
 - The documentation that comes with the new drives.
Read all precautionary notes, kit instructions, and other information. Kit instructions often contain the most current information regarding the drives and their installation, plus upgrade or servicing procedures. Compare the kit instructions with this procedure to determine if you need to modify this procedure.
2. Use the storage-management software to check the status of the unit. Correct any problems that are reported.
3. Back up the data on the drives that you are replacing (optional).
Attention: When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, see “Handling static-sensitive devices” on page 17.
4. Unpack the new drives.
Set the drives on a dry, level surface away from magnetic fields. Save the packing material and documentation in case you need to return the drives.
5. Using the storage-management software, manually fail the first drive that you want to replace. Make sure that:
 - You fail only one drive
 - The software status display shows a failed status for the appropriate drive
 - The amber Drive fault LED (on the front bezel below the drive) is on
Attention: Removing the wrong drive can cause data loss. Make sure that you remove only the failed drive CRU. The Drive fault LED below the failed drive CRU should be on.

If you remove an active drive accidentally, wait at least 30 seconds and then reinstall it. Refer to the storage-management software for further recovery instructions.
6. Use the procedures in “Replacing hot-swap drives” on page 21 to remove the failed drive. Use the procedures in “Installing hot-swap drives” on page 18 to install the new drives into the storage server.

The new drive automatically reconstructs the data after you install it in the drive slot.

During data reconstruction, the amber Drive fault LED might come on for a few minutes, then turn off when the green Drive activity LED begins flashing. A flashing Drive activity LED indicates that data reconstruction is in progress.

Note: If your storage subsystem has active hot spares, data might not start copying to the new drive until the data is reconstructed on the hot spare. This increases the time that is required to complete the procedure.

7. Check the green Drive activity LED and the amber Drive fault LED below the new drive CRUs.

Make sure that the Drive activity LEDs are on and the Drive fault LEDs are off.

Note: The Drive fault LEDs might flash intermittently while the drives spin up.

- If the Drive activity LED is off, the drive CRU might not be installed correctly. Remove the drive CRU, wait 30 seconds, and then reinstall it.
 - If the Drive fault LED stays on or the Drive activity LED stays off, the new drive might be faulty. Refer to the storage-management software for problem determination.
8. Use the storage-management software to monitor the status of the new drive and the progress of the data reconstruction. Wait for data reconstruction to finish (the Drive activity LED stops flashing).

Note: The Drive activity LED will continue to flash after reconstruction is finished if there is I/O activity to that drive. In that case, use the host software to determine if the data reconstruction is finished.

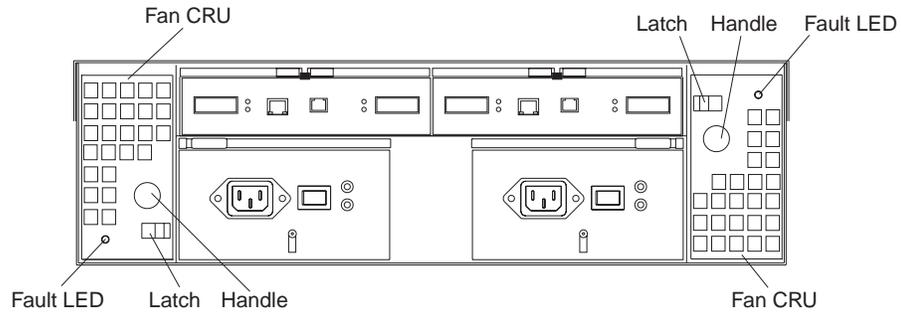
9. When reconstruction is finished on the new drive, repeat step 5 on page 26 through step 8 for each additional drive that you want to install.
10. Use the storage-management software to configure the additional space on the new drives.

Working with hot-swap cooling fans

The storage server cooling system consists of two fan CRUs, each containing two fans. The fan CRUs circulate air inside the unit by pulling in air through the vents on the front of the drive CRUs and pushing out air through the vents in the back of each fan CRU.

If two fans fail, or the fans cannot maintain an internal temperature below 70°C (158°F), the power supplies in the unit will automatically shut down (an overtemperature condition). If this occurs, you must cool the unit and restart it. See “Restoring power after an overtemperature shutdown” on page 73.

Attention: The fans in the storage server draw in fresh air and force out hot air. These fans are hot-swappable and redundant; however, when one fan fails, the fan CRU must be replaced within 48 hours to maintain redundancy and optimum cooling. When you replace the failed fan CRU, be sure to install the second fan CRU within 10 minutes to prevent any overheating due to the lack of the additional fan CRU.



Fan CRUs

The two fan CRUs are hot-swappable and redundant.

Fault LEDs

These amber LEDs light when a fan failure occurs.

Latches and handles

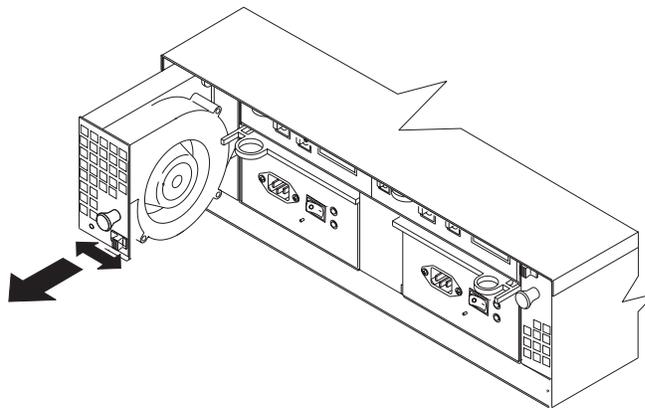
Use the latches and handles to remove or install the fan CRUs.

Attention: Do not run the storage server without adequate ventilation and cooling, because it might cause damage to the internal components and circuitry.

Both fan units must always be in place, even if one is not functioning properly, to maintain proper cooling.

Use the following procedure to replace a hot-swap fan:

1. Check the LEDs on the back of the storage server.
2. If the amber Fault LED is on, remove the fan CRU that has failed.
 - a. Slide the latch to unlock the fan CRU.
 - b. Use the handle (black knob) to pull the fan from the storage server.



3. Install the new fan unit.
 - a. Place the fan CRU in front of the fan slot.
 - b. Hold the latch open, and slide the fan all the way into the slot. If the fan does not go into the bay, rotate it 180°. Ensure that the latch is on the side closest to the center of the storage server.
 - c. Release the latch. If the lever remains open, pull back on the fan slightly, and then push it in again until the latch snaps into place.
4. Check the LEDs.

The Fault LEDs turn off after a few seconds; if they remain on, refer to “Chapter 3. Diagnostics” on page 11.

Working with hot-swap power supplies

The storage server power system consists of two power supply CRUs. The power supply CRUs provide power to the internal components by converting incoming ac voltage to dc voltage. One power supply CRU can maintain electrical power to the unit if the other power supply is turned off or malfunctions. The power supply CRUs are interchangeable (by reversing the locking levers).

Each power supply CRU has a built-in sensor that detects the following conditions:

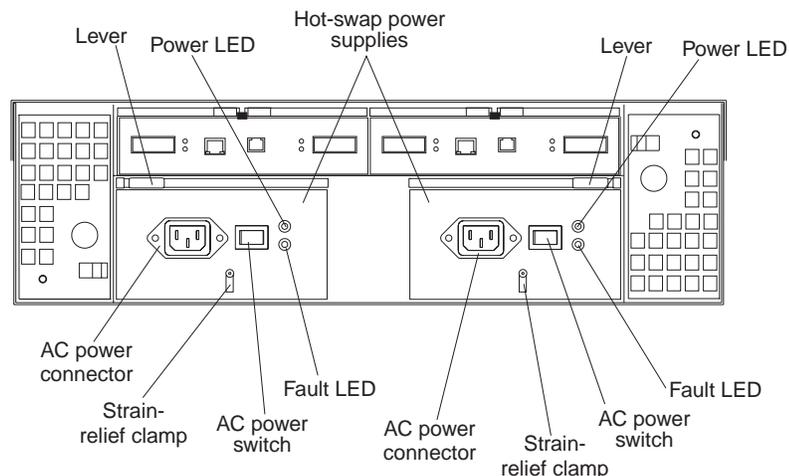
- Over-voltage
- Over-current
- Overheated power supply

If any of these conditions occurs, one or both power supplies will shut down. All power remains off until you cycle the power switches (turn the power switches off, wait at least 30 seconds, then turn the power switches on). For more information, see “Restoring power after an unexpected shutdown” on page 73 and “Restoring power after an overtemperature shutdown” on page 73.

The power supplies are customer replaceable units (CRUs) and do not require preventive maintenance.

- Always keep the power supplies in their proper places to maintain proper controller-unit cooling.
- Use only the supported power supplies for your specific storage server.

The power-supply controls on the rear of the storage server are shown in the following illustration.



Levers Use these locking handles to remove or install a power supply.

Power LED

These green LEDs light when the storage server is turned on and receiving ac power.

Fault LEDs

These amber LEDs light if a power supply failure occurs or if the power supply is turned off.

AC power switches

Use these switches to turn the power supplies on and off. You must turn on both switches to take advantage of the redundant power supplies.

AC power connectors

This is the connection for the ac power cord.

Strain-relief clamp

Use this clamp to provide strain relief on the power cord.

Removing a hot-swap power supply

Statement 8



CAUTION:

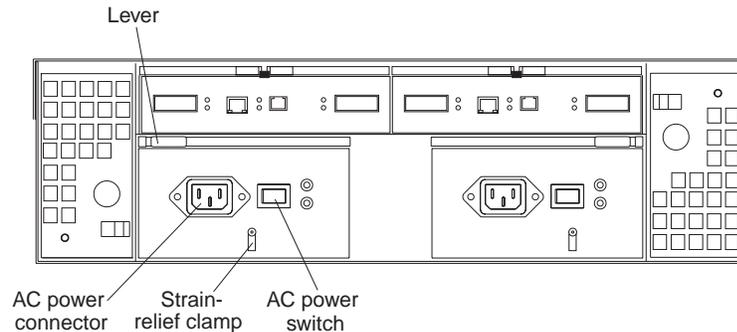
Never remove the cover on a power supply or any part that has the following label attached.



Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

To remove a hot-swap power supply:

1. Turn off the ac power switch.

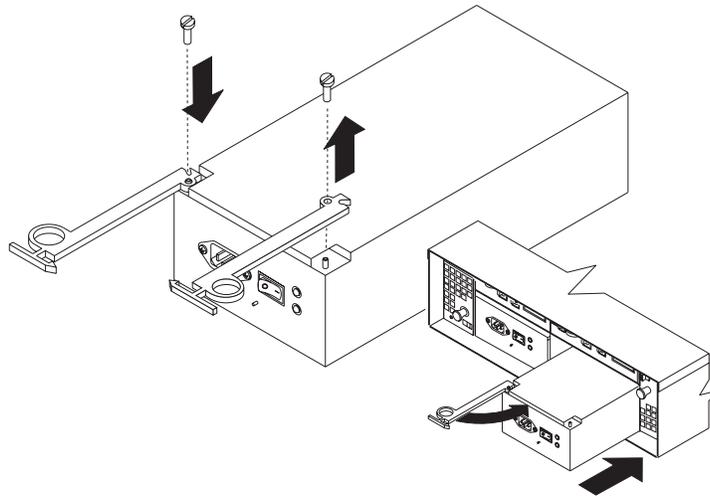


2. Unplug the power cord from the electrical outlet.
3. Disconnect the power cord from the ac power connector on the power supply.
4. Remove the nut and strain-relief clamp from the rear of the power supply.
5. Remove the power supply from the storage server, as follows:
 - a. Grasp the pull-ring on the power-supply lever, and squeeze the latch to release it.
 - b. Pull the lever open and remove the power supply.

Installing a hot-swap power supply

Note: When replacing a power supply that has failed, ensure that the power supply latch is mounted on the side of the power supply that faces the middle of the storage server. If it is not, remove the lever screw, flip the

lever over, and tighten the screw on the opposite side.



To install a hot-swap power supply:

Statement 8



CAUTION:

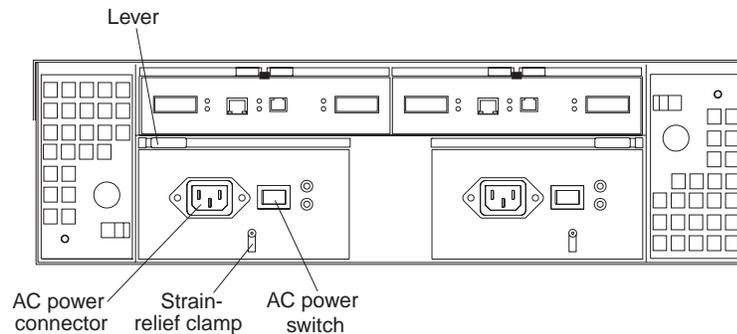
Never remove the cover on a power supply or any part that has the following label attached.



Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

1. Ensure that the ac power switch is off on the power supply that you are installing.

2. Install the power supply in the storage server, as follows:
 - a. Slide the power supply into the storage server. Make sure that the lever is pulled straight out as you slide the power supply into the storage server.
 - b. Close the lever until the pull-ring latch locks in place. Make sure that the lever locks into place in the storage-server chassis.
3. Wrap the strain-relief clamp around the power cord approximately 20 cm (8 in.) from the power-supply connection end.
4. Attach the power-supply nut, and tighten it securely.
5. Connect the power cord to the AC power connector.



6. Plug the power cord into a properly grounded electrical outlet.
7. Turn on the power-supply switch.
8. Make sure that the green Power LED on the new power-supply CRU is on and the amber Fault LED is off.
 - If the Power LED is off, the power-supply CRU might not be installed correctly. Remove it and then reinstall it.
 - If the Fault LED is on or the Power LED stays off, refer to the storage-management software for problem determination.

For more information about the LEDs, see “Checking the LEDs” on page 12.

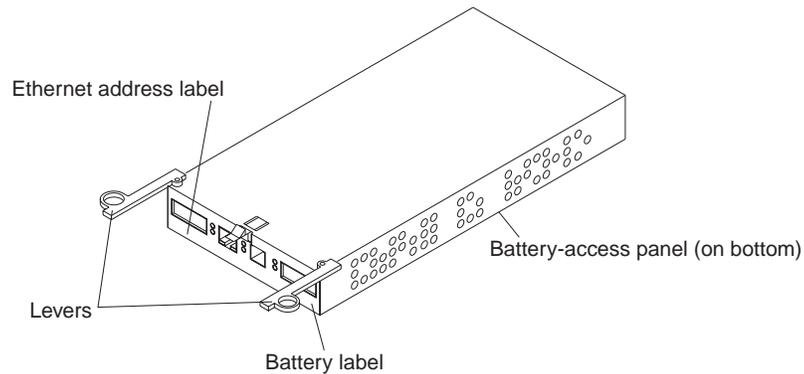
Working with hot-swap RAID controllers

Attention: To prevent overheating, replace the RAID controller or blank filler within 30 minutes of removal. If the RAID controller or filler is removed for more than 30 minutes, you might get a nominal overheating warning indication.

Each RAID controller fits into the back of the storage server and has the following components:

- Battery
- Cache memory
- One host port and one expansion port
- One Ethernet port
- One RS-232 port

Each RAID controller has a unique hardware Ethernet address, which is printed on a label on the front. There is also a label giving the installation and expiration date of the battery. The following illustration shows the location of these items.



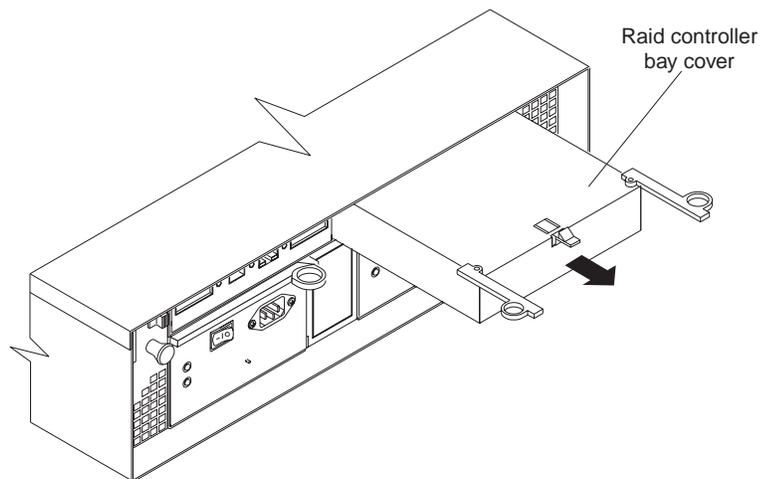
For information about the RAID controller cache memory and rechargeable battery, see “Cache memory and RAID controller battery” on page 78.

Adding a second RAID controller

Use the following procedure to install a second RAID controller if you have Model 3542-1RU storage server and have purchased the FAST200 Redundant RAID Controller option.

Note: The FAST200 Redundant RAID Controller option comes with a RAID controller cache battery installed.

1. To remove the RAID controller bay cover, use the following illustration and procedure:



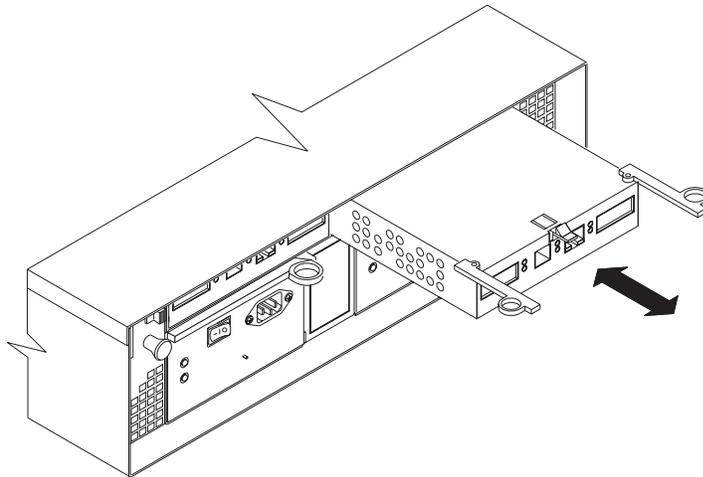
- a. Push down on the latch (centered above the RAID controller bay cover). The levers pop out of the locked position.
- b. Grasp the pull-rings; then, pull on the levers and remove the RAID controller bay cover.

Attention: When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, see “Handling static-sensitive devices” on page 17.

2. Unpack the new RAID controller.

Set the RAID controller on a dry, level surface away from magnetic fields. Save the packing material and documentation in case you need to return the RAID Controller CRU.

3. Review all documentation that comes with the new RAID controller for updated replacement procedures and other information.
4. Write the battery replacement information on the label on the front of the new RAID controller CRU.
 - Date of Installation – Write today’s date
 - Replacement Date – Write the date three years from now
5. Install the new RAID controller, as shown in the following illustration.



- a. Slide the RAID controller all the way into the empty slot.
- b. Close both levers until the latch locks into place.

Attention: When you add a second RAID controller, the storage-management software automatically synchronizes the firmware between the existing controller and the new controller. After adding a second RAID controller, always use the storage-management software to verify the firmware levels and non-volatile static random access memory (NVS RAM) files.

6. Insert the GBICs according to the instructions in “Installing GBICs and Fiber Optic Cables” on page 44.
7. Connect the Fibre Channel cables, using the instructions in “Installing GBICs and Fiber Optic Cables” on page 44. For information about connecting the storage server to other devices, see “Fibre Channel loop configurations” on page 60 and “Cabling the storage server” on page 64.

8. Wait approximately one minute, and then check the green Host Loop LED, the green Expansion Loop LED, and the amber Fault LED on the new RAID controller CRU.
 - If the Host loop LED or the Expansion Loop LED is off, the RAID controller CRU might not be inserted correctly. Remove the CRU and reinsert it.
 - If the Fault LED is on, the Host loop LED and the Expansion loop LED stay off, or any other Fault LED is on, refer to the storage-management software for problem determination.
9. Refer to the storage-management software online help for instructions about downloading the redundant 3542-2RU NVSRAM files and bringing the controller online.

Replacing a RAID controller

When instructed to do so by the storage-management software, replace a RAID controller that has failed.

Note: The replacement RAID controller CRU does not come with a RAID controller cache battery installed. You must remove the cache battery that is inside the existing RAID controller that you are replacing, and install that battery inside the replacement RAID controller CRU. The steps to remove and replace the battery are included in the following procedure.

To replace a RAID controller, do the following:

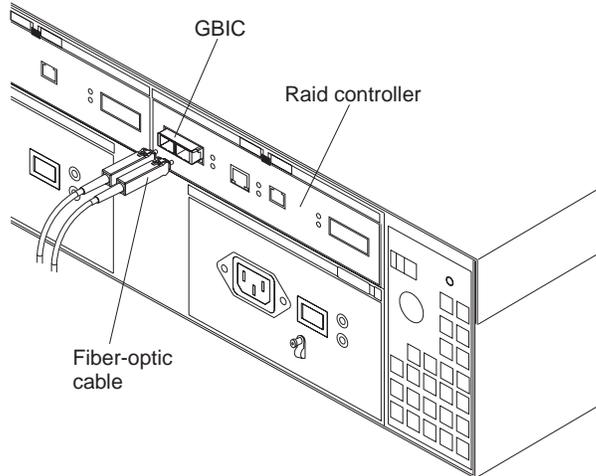
1. Check the storage-management software for instructions on RAID controller failure-recovery procedures. Follow the steps provided in the software documentation before continuing with step 2.
2. If you have redundant RAID controllers (dual-controller configuration), use the storage-management software to take the RAID controller that has failed offline.

Attention: To prevent data loss if you have a single controller configuration, you must shutdown your system before you can replace the RAID controller. For the proper shutdown sequence, see “Turning off the storage server” on page 71.

3. Label each cable that connects to the RAID controller that has failed. This ensures that all cables will be properly reconnected to the new RAID controller.

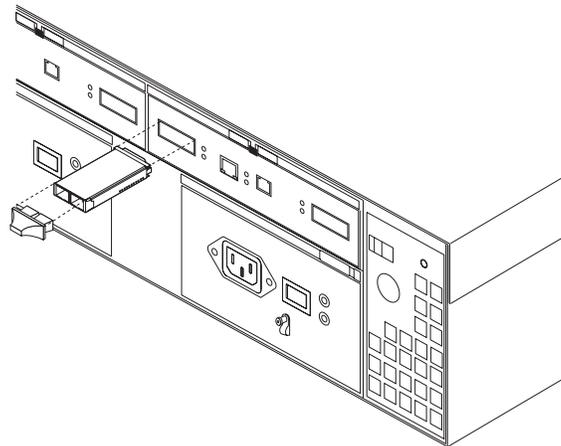
Attention: Handle and install fiber-optic cables properly to avoid degraded performance or loss of communications with devices. When working with fiber-optic cables, do not pinch them, step on them, or locate them in aisles or walkways. Do not overtighten the cable straps or bend the cables to a radius smaller than 76 mm (3 in.).

4. From the RAID controller that has failed, remove the Fibre Channel cables from the GBICs. The location of these components is shown in the following illustration.



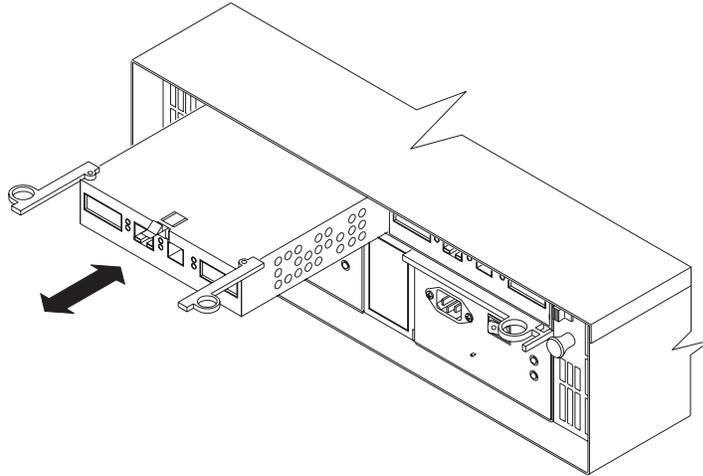
After removing the Fibre Channel cables, insert the protective caps.

5. Use the following procedure to remove the GBICs from the RAID controller that has failed.
 - a. Move the metal latch on the GBIC to the unlocked (center) position.



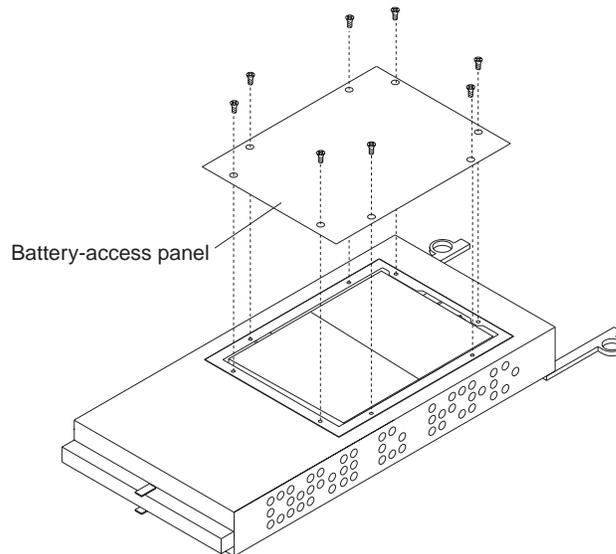
- b. Pull the GBIC out of the port.
 - c. Insert the protective cap on the GBIC.
6. Remove the failed RAID controller (the Fault LED is on), as follows:

- a. Push down on the latch (centered above the RAID controller). The levers pop out of the locked position.



- b. Grasp the pull-rings; then, pull on the levers and remove the RAID controller.

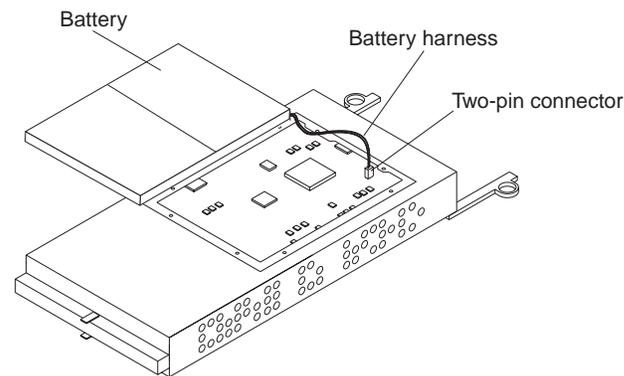
7. To remove the cache battery, using a Phillips head screwdriver, remove the eight screws from the battery access panel on the bottom of the RAID controller that you just removed, as shown in the following illustration.



8. Lift the battery out of the RAID controller.

Note: If you cannot lift out the battery, turn over the RAID controller and hold it upside-down so that the battery is close above a flat surface and let it fall out. Do not let the battery pull on the battery harness.

9. Disconnect the battery harness on the battery from the two-pin connector on the controller board, and remove the battery, as shown in the following illustration.



Set the battery on a dry, level surface.

Attention: When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, see “Handling static-sensitive devices” on page 17.

10. Unpack the new RAID controller.

Set the RAID controller on a dry, level surface away from magnetic fields. Save the packing material and documentation in case you need to return the RAID controller.

11. Using a Phillips head screwdriver, remove the eight screws from the battery access panel on the bottom of the replacement RAID controller CRU.
12. Connect the battery harness on the battery to the two-pin connector on the controller board.
13. Position the battery inside the replacement RAID controller, and replace the battery-access panel.
14. Copy the battery replacement information from the label on the front of the failed RAID controller to the label on the front of the replacement RAID controller CRU.
15. Install the new RAID controller, as follows:
 - a. Slide the RAID controller all the way into the empty slot.
 - b. Close both levers until the latch locks into place.

Attention: When you replace the failed RAID controller, the storage-management software automatically synchronizes the firmware between the existing controller and the new controller. After replacing a controller, always use the storage-management software to verify the firmware levels and NVSRAM files.

16. Insert the GBICs according to the instructions in “Installing GBICs” on page 65.
17. Connect the Fibre Channel cables to their original locations, according to the instructions in “Installing fiber-optic cables” on page 66.
18. If you have a single-controller configuration, turn on power to the storage server and attached devices. For the proper power-on sequence, see “Turning on the storage server” on page 78.
19. Wait approximately one minute, and then check the green Host Loop LED, green Expansion Loop LED, and amber Fault LED on the new RAID controller.
 - If the Host Loop LED or the Expansion Loop LED is off, the RAID controller might not be inserted correctly. Remove the CRU and reinsert it.
 - If the Fault LED is on, the Host Loop LED and the Expansion Loop LED stay off, or any other Fault LED is on, refer to the storage-management software for problem determination.
20. Refer to the storage-management software online help for instructions on bringing the controller online.

Replacing the battery in the RAID controller

Attention: To prevent overheating, replace the RAID controller or blank filler within 30 minutes of removal. If the RAID controller or filler is removed for more than 30 minutes, you might get a nominal overheating warning indication.

Each RAID controller contains a rechargeable battery that maintains the data in the cache memory.

Use the following procedure if the storage-management software instructs you to replace the battery because the current battery has failed or is nearing its expiration date.

1. Check the storage-management software for instructions on battery replacement procedures. If you are not using write-cache mirroring, this might involve clearing cache memory on the RAID controller that contains the battery that has failed. Follow the steps given in the software procedure before continuing with this procedure.

Attention: When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, see “Handling static-sensitive devices” on page 17.

2. Unpack the new battery.

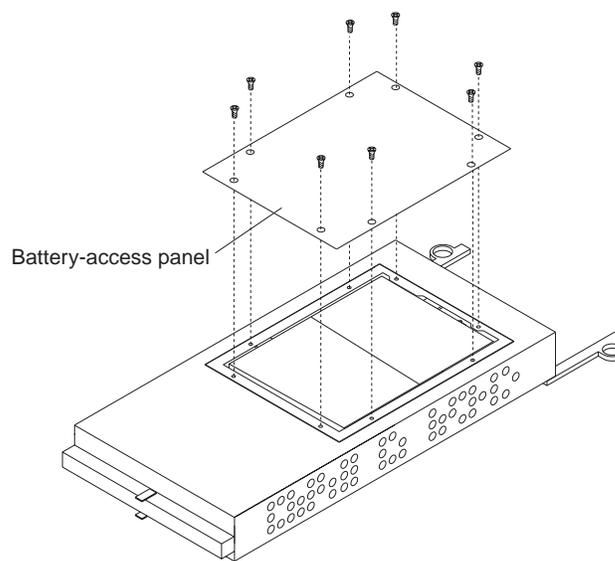
Set the new battery on a dry, level surface. Save all packing materials in case you need to return the battery.

Note: The battery comes with a new battery label. You will need this label later in the procedure.

3. Review all documentation that comes with the new battery for updated replacement procedures and other information.
4. Use the storage-management software to locate the RAID controller containing the failed battery (the RAID controller Fault LED might be on).
5. Label each cable that connects to the RAID controller that contains the battery that has failed. This ensures that all cables will be properly reconnected to the RAID controller after you replace the battery.
6. If you have redundant RAID controllers (dual-controller configuration), use the storage-management software to take offline the RAID controller that contains the battery that has failed.

Attention: To prevent data loss if you have a single-controller configuration, you must shutdown your system before you can replace the RAID controller battery. For the proper shutdown sequence, see “Turning off the storage server” on page 79.

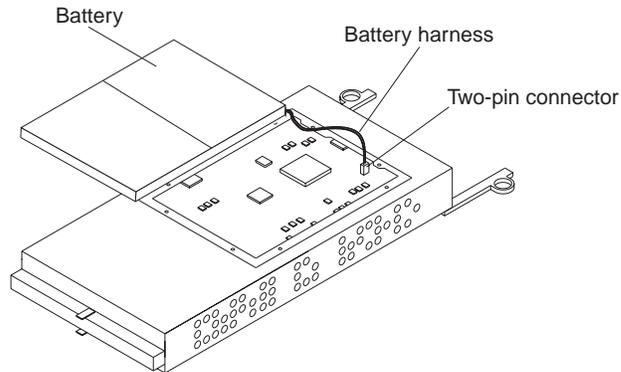
7. From the RAID controller that contains the battery that has failed, remove the Fibre Channel cables and then the GBICs. For more information, see “Working with GBICs and fiber-optic cables” on page 65.
8. Remove the RAID controller as described in “Replacing a RAID controller” on page 36.
9. Using a Phillips head screwdriver, remove the eight screws from the battery access panel on the bottom of the RAID controller CRU, as shown in the following illustration.



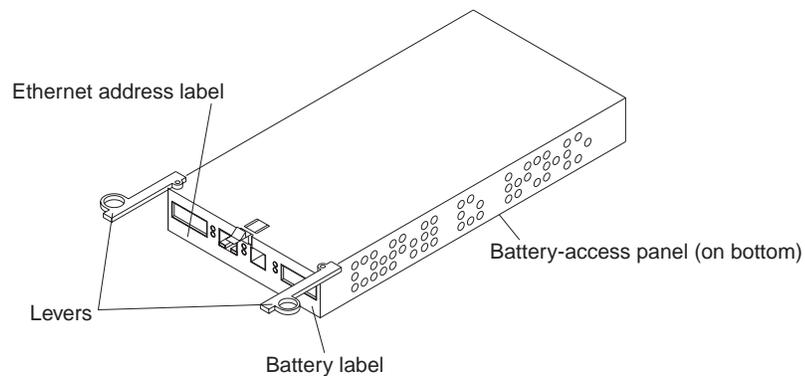
10. Lift the old battery out of the RAID controller CRU.

Note: If you cannot lift out the battery, turn over the RAID controller and hold it upside-down so that the battery is close above a flat surface and let it fall out. Do not let the battery pull on the battery harness.

11. Disconnect the battery harness on the old battery from the two-pin connector on the controller board, and remove the battery, as shown in the following illustration.



12. Connect the battery harness on the new battery to the two-pin connector on the controller board.
13. Position the battery inside the RAID controller, and replace the battery-access panel.
14. Put the new battery label on the front of the RAID controller, over the old battery label. The location of the battery label is shown in the following illustration.



15. Write the battery replacement information on the label on the front of the new RAID controller CRU.
 - Date of Installation – Write today's date
 - Replacement Date – Write the date three years from now



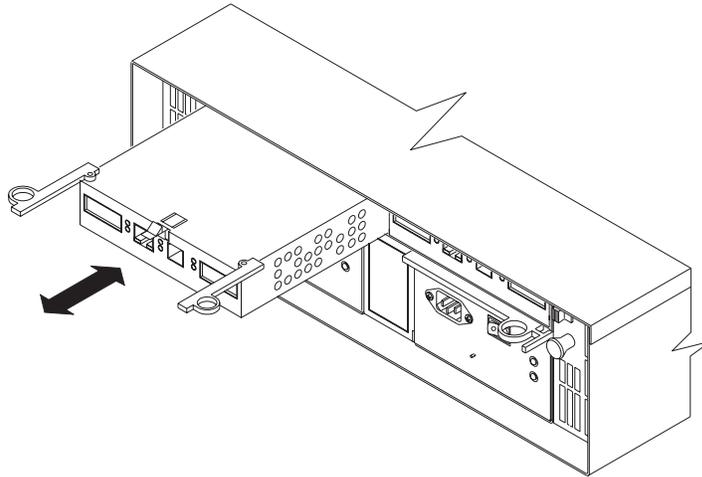
Pb

CONTAINS
SEALED LEAD
BATTERY.
BATTERY
MUST BE
RECYCLED.

CAUTION:

Use proper facilities to recycle the used battery CRU. If the battery CRU is physically damaged or leaking electrolyte gel, *do not* ship it to a recycling center. The battery contains sealed lead-acid batteries that might be considered hazardous material. You must handle this unit in accordance with all applicable local and federal regulations.

16. Dispose of the used battery CRU according to local and federal regulations, which might include hazardous material handling procedures.
17. Install the RAID controller, as shown in the following illustration.



- a. Slide the RAID controller all the way into the empty slot.
 - b. Close both levers until the latch locks into place.
18. Install the GBICs and then connect the Fibre Channel cables to their original locations.
 19. If you have a single-controller configuration, turn on power to the storage server and attached devices. For the proper power-on sequence, see “Turning on the storage server” on page 70.
 20. Wait approximately one minute, and then check the green Host Loop LED, the green Expansion Loop LED, and the amber Fault LED on the new RAID controller.
 - If the Host Loop LED or the Expansion Loop LED is off, the RAID controller might not be inserted correctly. Remove the RAID controller and reinsert it.
 - If the Fault LED is on, the Host Loop LED and Expansion Loop LED stay off, or any other Fault LED is on, refer to the storage-management software for problem determination.
 21. Refer to the storage-management software online help for instructions on bringing the controller online and resetting the battery age.

Note: There are two cache batteries in the unit (one for each controller). Make sure that you reset the age for the correct battery. Also, you might get a software message indicating that the new battery has failed or is nearing its expiration date. This message will disappear after you reset the battery age through the software and battery charging is completed.

Installing GBICs and Fiber Optic Cables

Each RAID Storage Server has one host port and one expansion unit port. Gigabit Interface Converters (GBICs) are inserted into the ports, and then Fibre Channel cables are connected to the GBICs. This section provides information on installing GBICs. The GBICs are laser products.

Statement 3



CAUTION:

When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.
- Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.



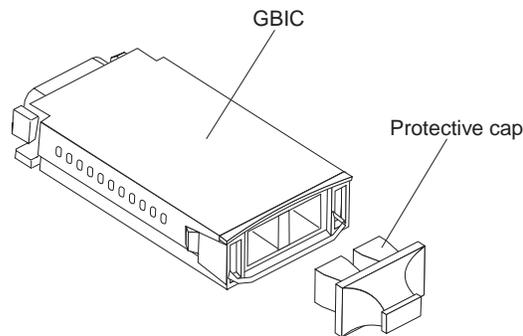
Danger

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

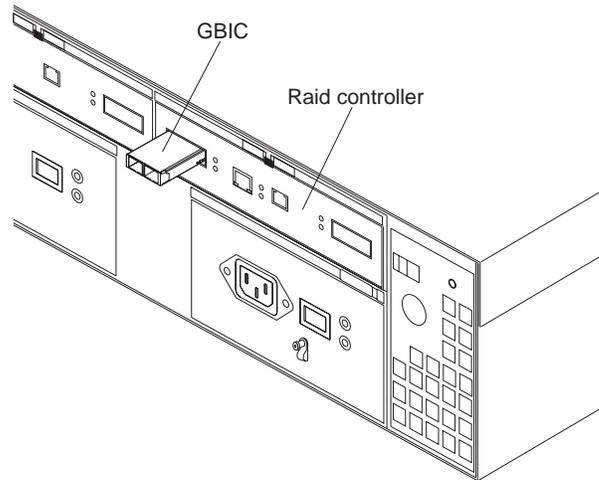
To install a GBIC, do the following:

1. Remove the protective cap from the GBIC, as shown in the following illustration.



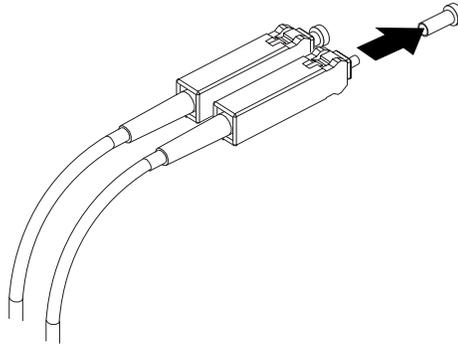
2. If the GBIC that you are installing has a metal latch, move the latch to the unlocked (center) position.

3. Insert the GBIC into the host or expansion port on the RAID controller, as shown in the following illustration.

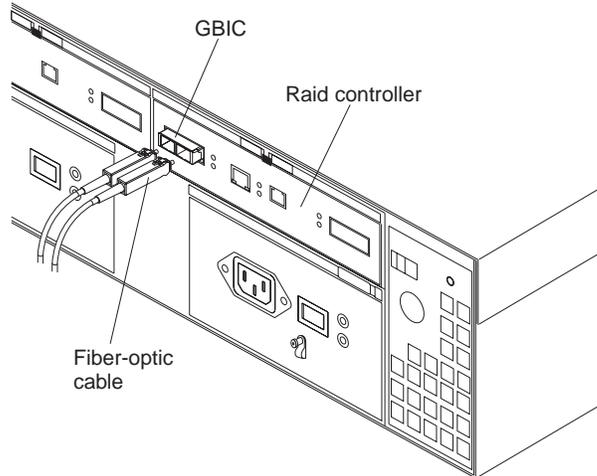


4. After the GBIC is inserted all the way into the port, rotate the GBIC latch outward to the locked position (flush with the rear of the GBIC).
5. Move the GBIC latch to the unlocked (center) position.
6. Insert the GBIC into the GBIC port on the RAID controller.
7. Move the GBIC latch back to the locked position (flush with the rear of the GBIC).

8. Remove the protective caps from the fiber-optic cable.



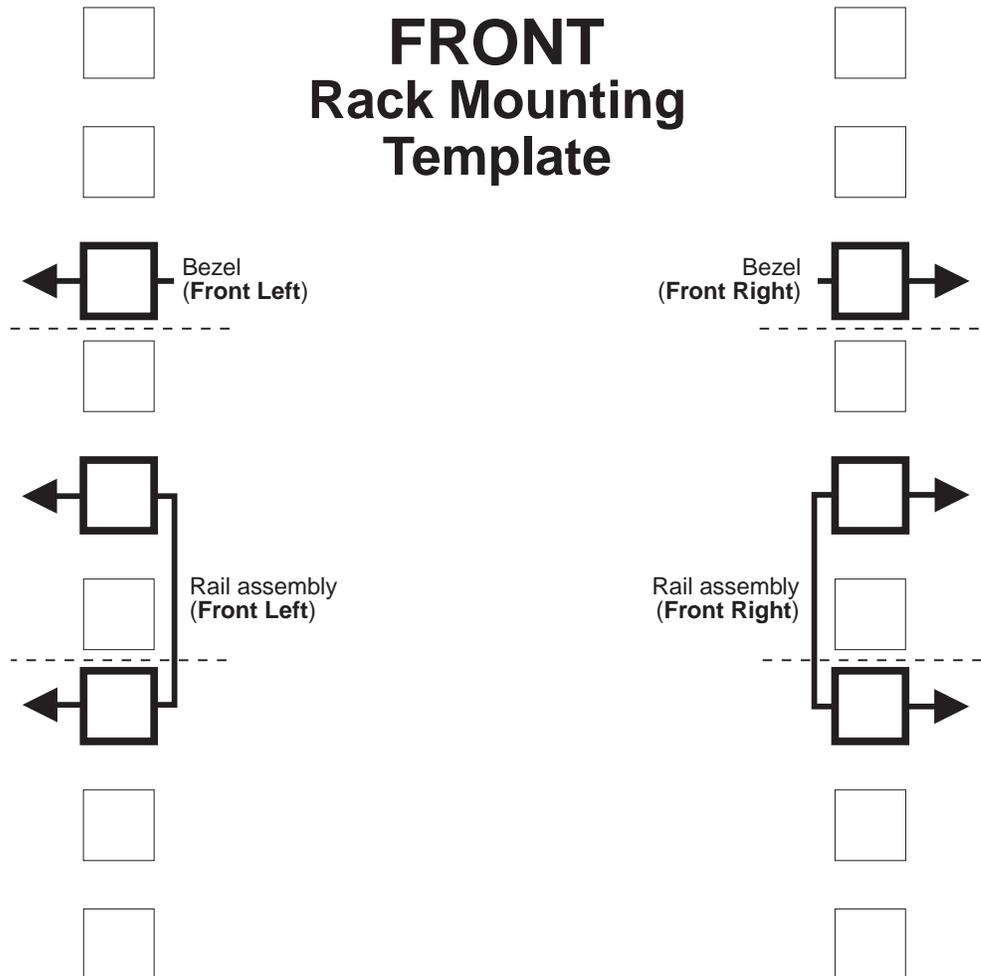
9. Connect the fiber-optic cable to the installed GBIC, as shown in the following illustration.



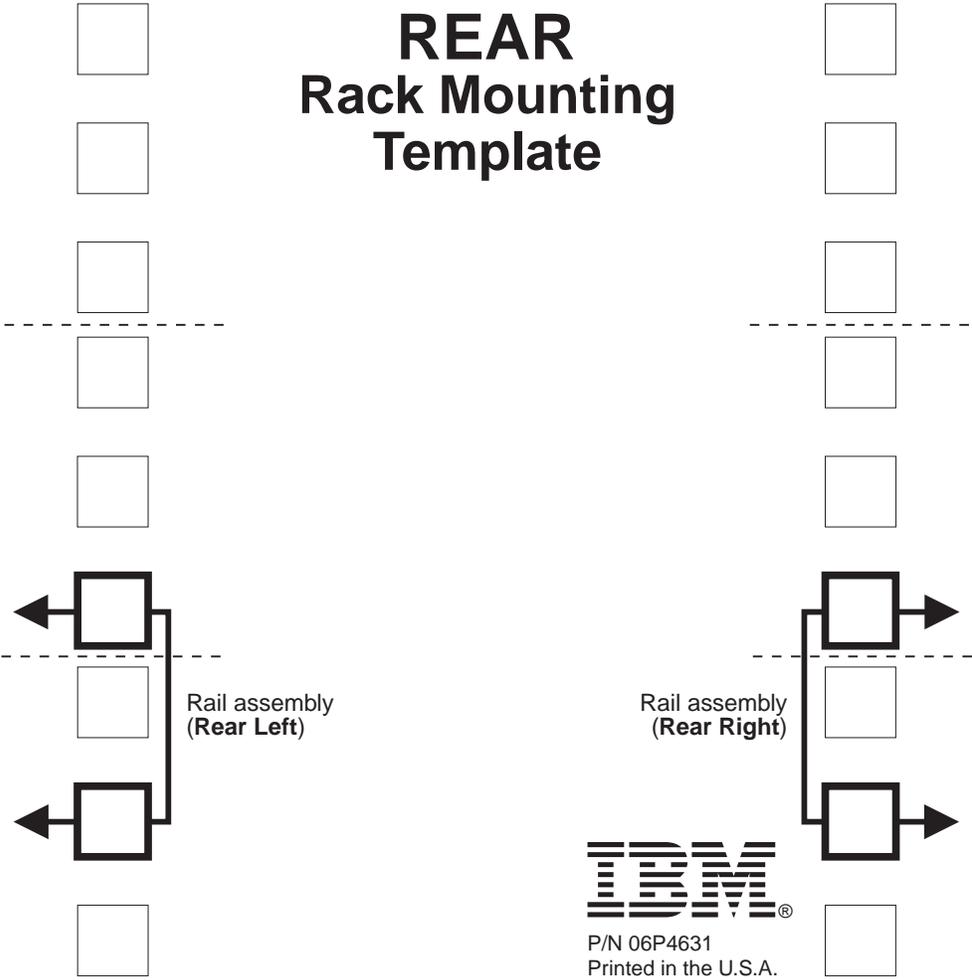
Note: The fiber-optic cable connection is keyed for proper insertion.

Rack mounting template and instructions

A rack mounting template and instructions come with the storage server. If you have misplaced these items, use the following template and instructions.



REAR Rack Mounting Template



Rack Mounting Instructions

Review the documentation that comes with your rack cabinet for safety and cabling information. When installing your storage server in a rack, consider the following:

- Ensure the room air temperature is below 35°C (95°F).
- Do not block any air vents, usually 15 cm (6 in.) of air space provides proper airflow.
- Plan the device installation starting from the bottom of the rack.
- Install the heaviest device in the bottom of the rack.
- Do not extend more than one device out of the rack at the same time.
- Remove the rack doors and side panels to provide easier access during installation.
- Connect all power cords to properly wired and grounded electrical outlets.
- Take precaution to prevent overloading the power outlets when you install multiple devices in a rack.



Use safe practices when lifting.



≥18 kg (37 lbs)



≥32 kg (70.5 lbs)

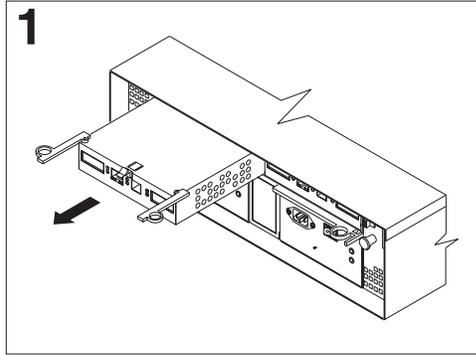


≥55 kg (121.2 lbs)

You will need a flat-blade and a Phillips screwdriver during the installation. The following is a list of items that come with your option. If any items are missing or damaged, contact your place of purchase.

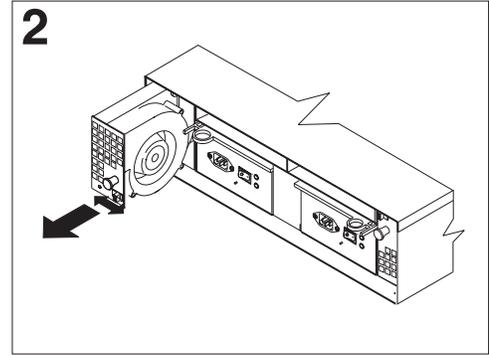
- Cage nuts (10)
- Clip nuts (10)
- M6 screws (10)
- Side rails (2)

Note: Refer to your storage server documentation for handling guidelines before removing any ESD-sensitive devices. The first four steps of the installation procedure involve removing some components from the storage server in order to reduce the weight of the storage server for easier installation.



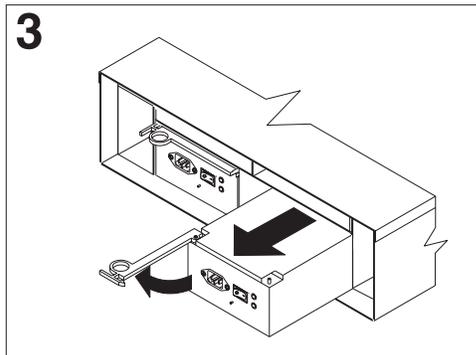
To remove a RAID controller, push down on the latch centered above the controller; then, grasp the pull-rings on the levers and pull them to remove the RAID controller and set it aside for later installation.

If you have a second RAID controller, repeat this step for the second controller.



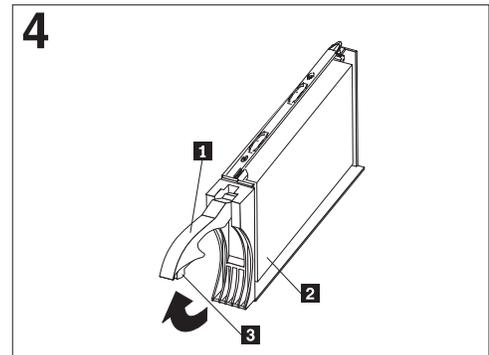
To remove a hot-swap fan, slide the latch on the fan to unlock it; then, pull the handle and remove the fan from the storage server.

Repeat this step for the other fan and set both fans aside for later installation.



To remove a power supply, grasp the pull-ring on the power supply lever and squeeze to release it; then, pull the lever fully open and remove the power supply from the storage server.

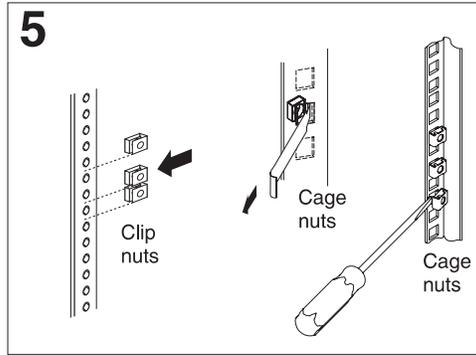
Repeat this step for the other power supply; then, set both power supplies aside for later installation.



To remove a hard disk drive **2**, press the blue latch **3** and pull the handle **1** upwards; then, carefully pull the drive from the storage server.

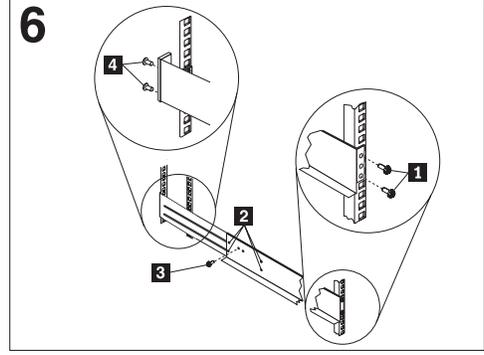
Note: Before you remove any hard disk drives, make sure that you mark their location so that you can reinstall them in the same location.

Repeat this step for all hard disk drives.



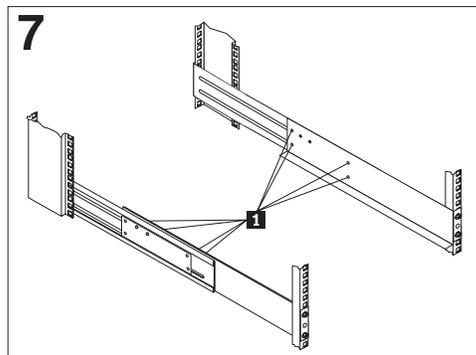
Use the attached template and stickers to mark the appropriate holes on your rack; then, install clip nuts or cage nuts as required for your rack cabinet.

Note: Use the cage-nut-insertion tool or a flat-blade screwdriver to install cage nuts.

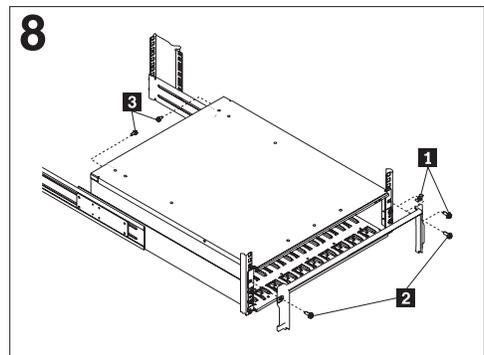


On the rail marked **R**, remove the 6-32 in. screw **3** and loosen the four screws **2**; then, hold the front of the rail against the outside of the right rack-mounting-flange and loosely install two M6 screws **1**.

Extend the rear of the rail outside of the rear rack-mounting-flange; then, install and tighten two M6 screws **4**. Tighten the front screws **1** and repeat this step for the other rail.



Tighten the rail adjustment screws **1** on both rails.



Remove the white screws and nuts **1** from the storage server bezel; then, slide the storage server into the rack. Align the bezel locator pins and attach the bezel with two M6 screws **2**; then, install and tighten the 6-32 in. screws **3**.

9 Reverse step 1 through step 4 to reinstall the components that you removed; then, refer to your storage server documentation to complete your installation. Store this information with your storage server documentation for future use.

Chapter 5. Symptom-to-FRU index

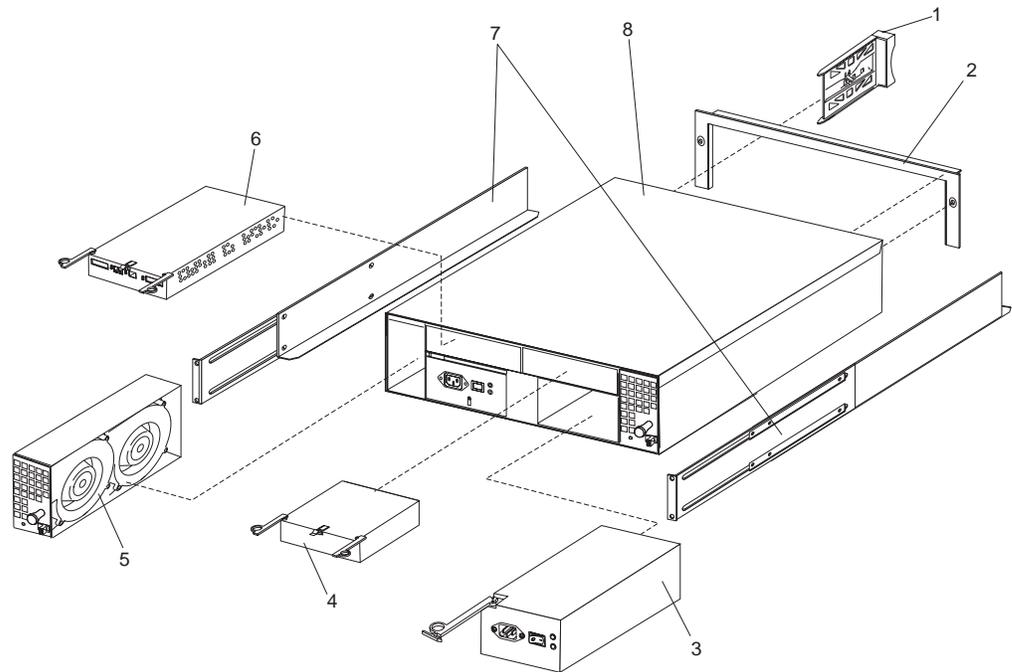
Use the storage-management software to diagnose and repair controller unit failures. Use this table also to find solutions to problems that have definite symptoms.

Problem Indicator	Action/FRU
Amber LED on - Drive CRU	1. Replace the drive that has failed.
Amber LED on - Fan CRU	1. Replace the fan that has failed.
Amber LED on - RAID controller Fault LED	1. If the RAID controller Fault LED is lit, replace the RAID controller.
Amber LED on - Expansion port Bypass LED	<ol style="list-style-type: none"> 1. No corrective action needed if system is properly configured and no attached expansion units. 2. Reattach the GBICs and Fibre Channel cables. Replace input and output GBICs or cables as necessary. 3. Expansion unit
Amber LED on - Front panel	1. Indicates that a Fault LED somewhere on the storage server has turned on. (Check for amber LEDs on CRUs).
Amber LED on and green LED off - Power supply CRU	<ol style="list-style-type: none"> 1. Turn on all power supply power switches 2. Check ac power
Amber and green LEDs on - Power-supply CRU	1. Replace the failed power-supply CRU
All green LEDs off - All CRUs	<ol style="list-style-type: none"> 1. Check that all storage-server power cords are plugged in and the power switches are on 2. check that the main circuit breakers for the rack are turned on. 3. Power supply 4. Midplane
Amber LED flashing - Drive CRUs	1. No corrective action is needed. (Drive rebuild or identity is in process)
One or more green LEDs off - Power supply CRUs	1. Make sure that the power cord is plugged in and the power-supply switches are turned on.
One or more green LEDs off - All drive CRUs	1. Midplane
One or more green LEDs off - Front panel	<ol style="list-style-type: none"> 1. Make sure that the cords are plugged in and power supplies are turned on 2. Midplane
One or more green LEDs off - Battery	1. Battery
One or more green LEDs off - Cache active	<ol style="list-style-type: none"> 1. Use the storage-management software to enable the cache. 2. RAID controller 3. Battery
One or more green LEDs off - Host Loop	<ol style="list-style-type: none"> 1. Check if host managed hub or switch is on. Replaced attached devices that have failed. 2. Fibre Channel cables 3. GBIC 4. RAID controller
One or more green LEDs off - Expansion Loop	<ol style="list-style-type: none"> 1. Ensure drives are properly seated 2. RAID controller 3. Drive 4. GBIC or Fibre Channel cable

Intermittent or sporadic power loss to the storage server - Some or all CRUs	<ol style="list-style-type: none"> 1. Check the ac power source 2. Reseat all installed power cables and power supplies 3. Replace defective power cords 4. Check for a Fault LED on the power supply, and replace the failed CRU 5. Midplane
Unable to access drives on Drives and Fibre Channel loop	<ol style="list-style-type: none"> 1. Ensure that the Fibre Channel cables are undamaged and properly connected. 2. RAID controller
Random errors on Subsystem	<ol style="list-style-type: none"> 1. Midplane

Note: If you cannot find the problem in the troubleshooting table, test the entire system.

Chapter 6. Parts Listing



System

This parts listing supports these models: 1RU, 1RX, 2RU, 2RX

Index	Type 3542- IBM FAStT200, FAStT200 HA Storage Server	FRU No.
1	DASD Bezel Filler Asm (all models)	37L0198
2	Decorative Bezel (all models)	09N7307
3	Power Supply Asm (350 W) (all models)	19K1164
4	Blank, controller (model 1RU, 1RX)	19K1229
5	Blower Asm (all models)	09N7285
6	FC Controller, (all models)	19K1115
7	Rail Kit Left/Right (all models)	37L0067
8	Midplane/Frame (all models)	19K1220
	Misc. Hardware Kit (all models)	09N7288
	Short Wave GBIC (all models)	03K9206
	Long Wave GBIC (all models)	03K9208
	FAStT Storage Manager Software CD (all models)	19K1230
	Cable, 5M Optical (all models)	03K9202
	Cable, 25M Optical (all models)	03K9204
	Cable, Serial (all models)	19K1179
	Cable, 1M Optical (all models)	37L0083
	9' Line Cord (all models)	6952300
	Battery, Cache (all models)	19K1219
	Line Cord Jumper, High Voltage (model 1RX, 2RX)	36L8886

Power cords

IBM power cord part number	Used in these countries and regions
13F9940	Argentina, Australia, China (PRC), New Zealand, Papua New Guinea, Paraguay, Uruguay, Western Samoa
13F9979	Afghanistan, Algeria, Andorra, Angola, Austria, Belgium, Benin, Bulgaria, Burkina Faso, Burundi, Cameroon, Central African Rep., Chad, Czech Republic, Egypt, Finland, France, French Guiana, Germany, Greece, Guinea, Hungary, Iceland, Indonesia, Iran, Ivory Coast, Jordan, Lebanon, Luxembourg, Macau, Malagasy, Mali, Martinique, Mauritania, Mauritius, Monaco, Morocco, Mozambique, Netherlands, New Caledonia, Niger, Norway, Poland, Portugal, Romania, Senegal, Slovakia, Spain, Sudan, Sweden, Syria, Togo, Tunisia, Turkey, former USSR, Vietnam, former Yugoslavia, Zaire, Zimbabwe
13F9997	Denmark
14F0015	Bangladesh, Burma, Pakistan, South Africa, Sri Lanka
14F0033	Antigua, Bahrain, Brunei, Channel Islands, Cyprus, Dubai, Fiji, Ghana, Hong Kong, India, Iraq, Ireland, Kenya, Kuwait, Malawi, Malaysia, Malta, Nepal, Nigeria, Polynesia, Qatar, Sierra Leone, Singapore, Tanzania, Uganda, United Kingdom, Yemen, Zambia
14F0051	Liechtenstein, Switzerland
14F0069	Chile, Ethiopia, Italy, Libya, Somalia
14F0087	Israel
1838574	Thailand
6952300	Bahamas, Barbados, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Korea (South), Liberia, Mexico, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, Suriname, Taiwan, Trinidad (West Indies), United States of America, Venezuela

Chapter 7. Additional service information

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Installing the storage server

This chapter contains information about installing the storage subsystem configuration and preparing to install the storage server in a rack.

Storage subsystem configuration

You must set up your storage subsystem configuration before you can install the storage server in a rack. Use the information in the following sections to install the storage subsystem configuration.

Storage subsystem management methods

Before you install the storage subsystem configuration, determine which method of storage subsystem management you want to use. You can manage the storage subsystems in either of two ways.

Host-agent management method

This method uses host-agent software that is installed on the host server. You must install at least one management station and a software-agent host. The management station can be the host or a workstation on the Ethernet network. A management station will have the client software installed. The following illustration shows the host-agent management method.

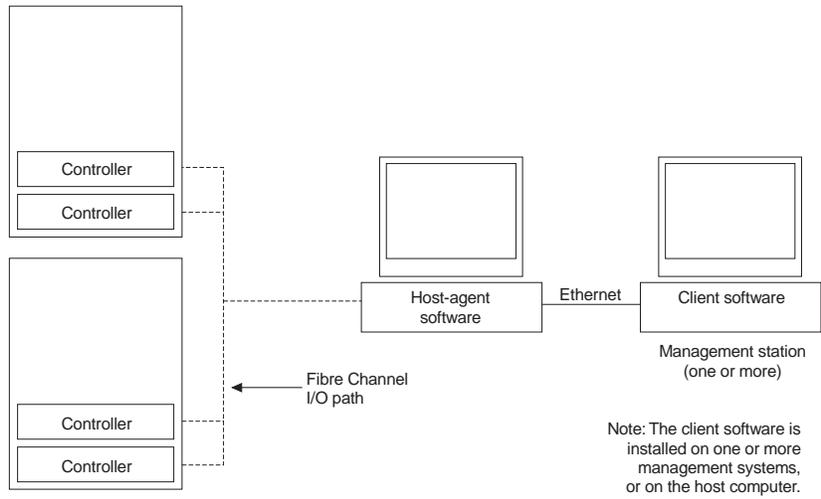


Figure 4. Host-agent managed storage subsystems

Direct management method

This method uses Ethernet connections from a management station to each controller. You must install at least one management station. The management station can be the host or a workstation on the Ethernet network. A management station will have the client software installed. Attach Ethernet cables to each management station (one pair per storage server). You will connect the cables to each controller later when you install the storage server. The following illustration shows the direct management method.

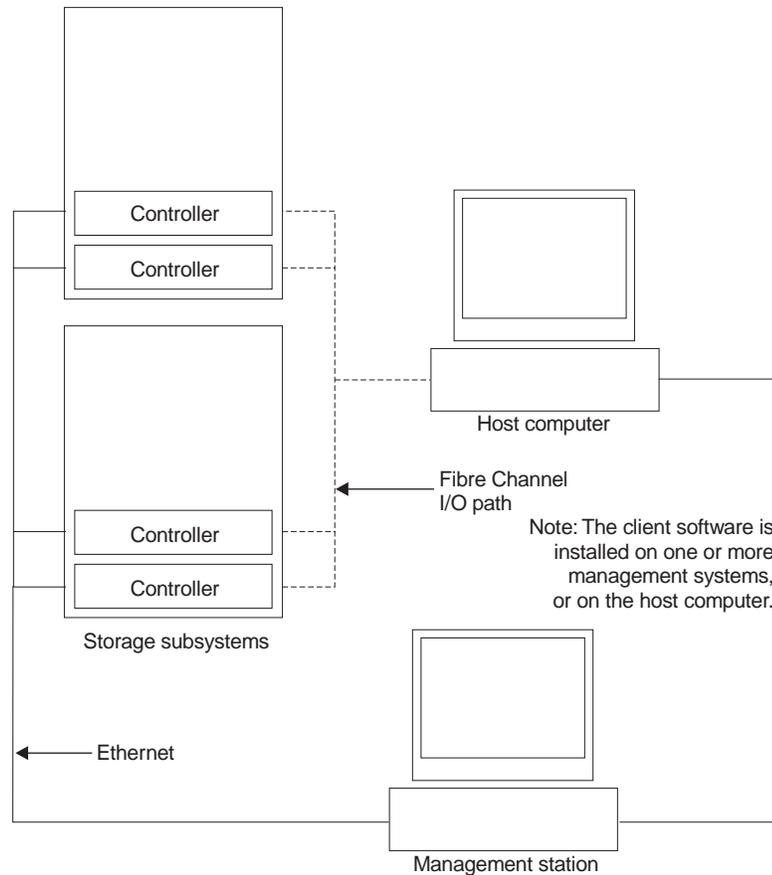


Figure 5. Directly managed storage subsystems

Fibre Channel connections

The storage server Fibre Channel consists of a host Fibre Channel loop and a drive Fibre Channel loop. The host Fibre Channel loop provides the fibre path for host attachment. It can consist of Fibre Channel cables, GBICs, host bus adapters, Fibre Channel switches, Fibre Channel managed hubs, and RAID controllers. The drive Fibre Channel loop provides the fibre path to the hard disk drives (HDDs). The drive Fibre Channel loop consists of Fibre Channel HDDs and optional drive expansion units, Fibre Channel cables, and GBICs.

The Model 3542-2RU storage server supports redundant disk-drive-loop configurations. Each RAID controller has two GBIC ports. These GBIC ports are labeled FC-Host and FC-Expansion Units. You can build a redundant drive loop by connecting one or more expansion units to the redundant RAID controllers. Then, use dual fiber-optic cables to connect one expansion unit to another in a daisy-chain. For more information about adding expansion units, see “Connecting additional expansion units” on page 69.

Note: The Model 3542-1RU storage server supports a single Fibre Channel host and drive loop.

Fibre Channel loop configurations

You must determine how the host systems will connect to the storage server. You can connect one host system directly to the storage server or connect multiple hosts to the storage server through managed hubs and switches. The illustrations in the following sections show common host system configurations.

Redundant host and drive loops

The following illustration shows examples of redundant host and drive loop Fibre Channel configurations.

Note: These configurations have host and drive path failover protection and are recommended for high availability.

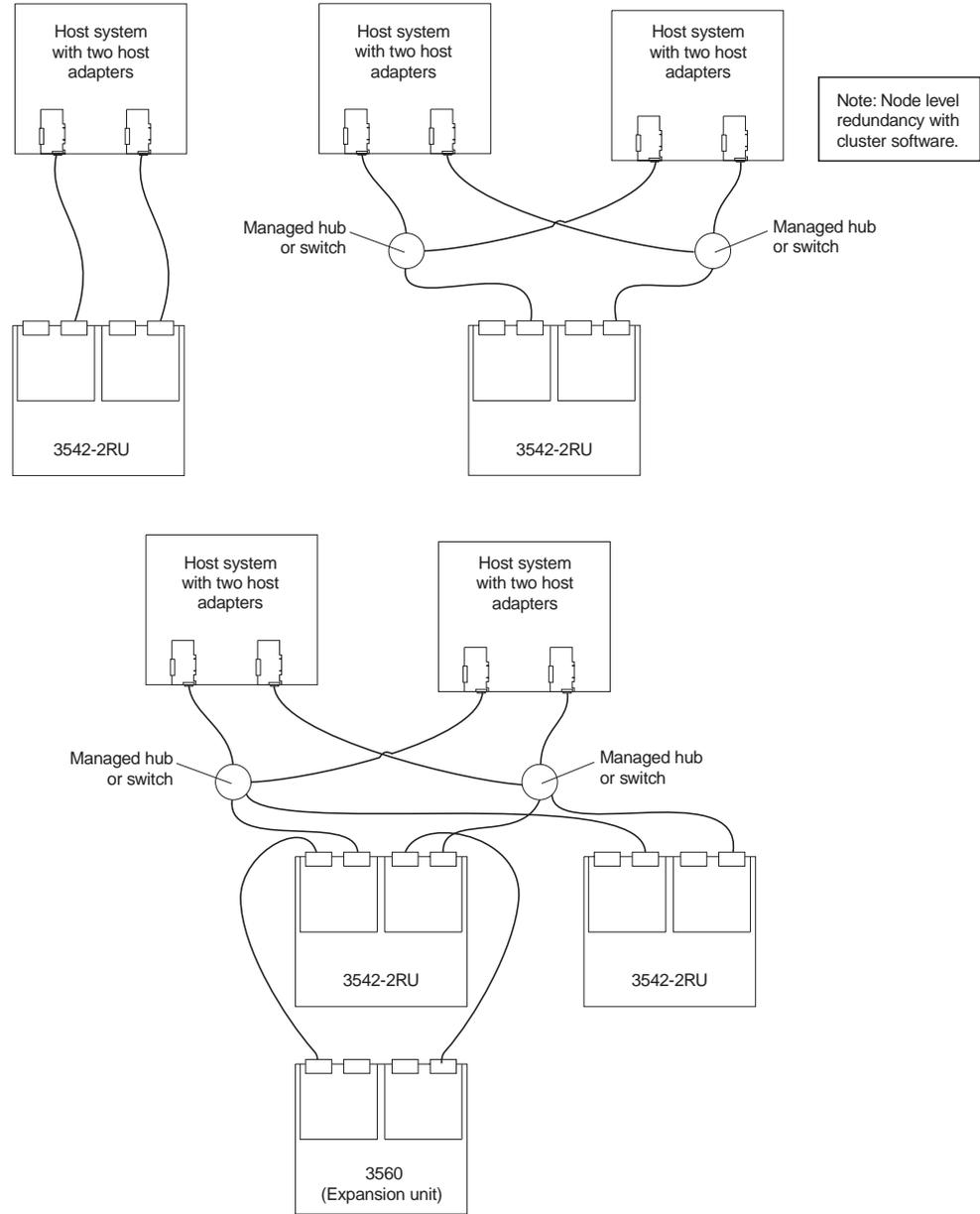


Figure 6. Redundant host and drive Fibre Channel loop configurations

Partially-redundant host and redundant drive loops

The following illustration shows examples of configurations that have partially-redundant host loops. Partially-redundant host loops have a single link or device in the path between the host and the RAID controller. The single links and devices on the host Fibre Channel loop are single points of failure. If the single link or device fails, the host is not able to access storage until the link is repaired. The host links that have multiple paths to the storage server have path failover protection.

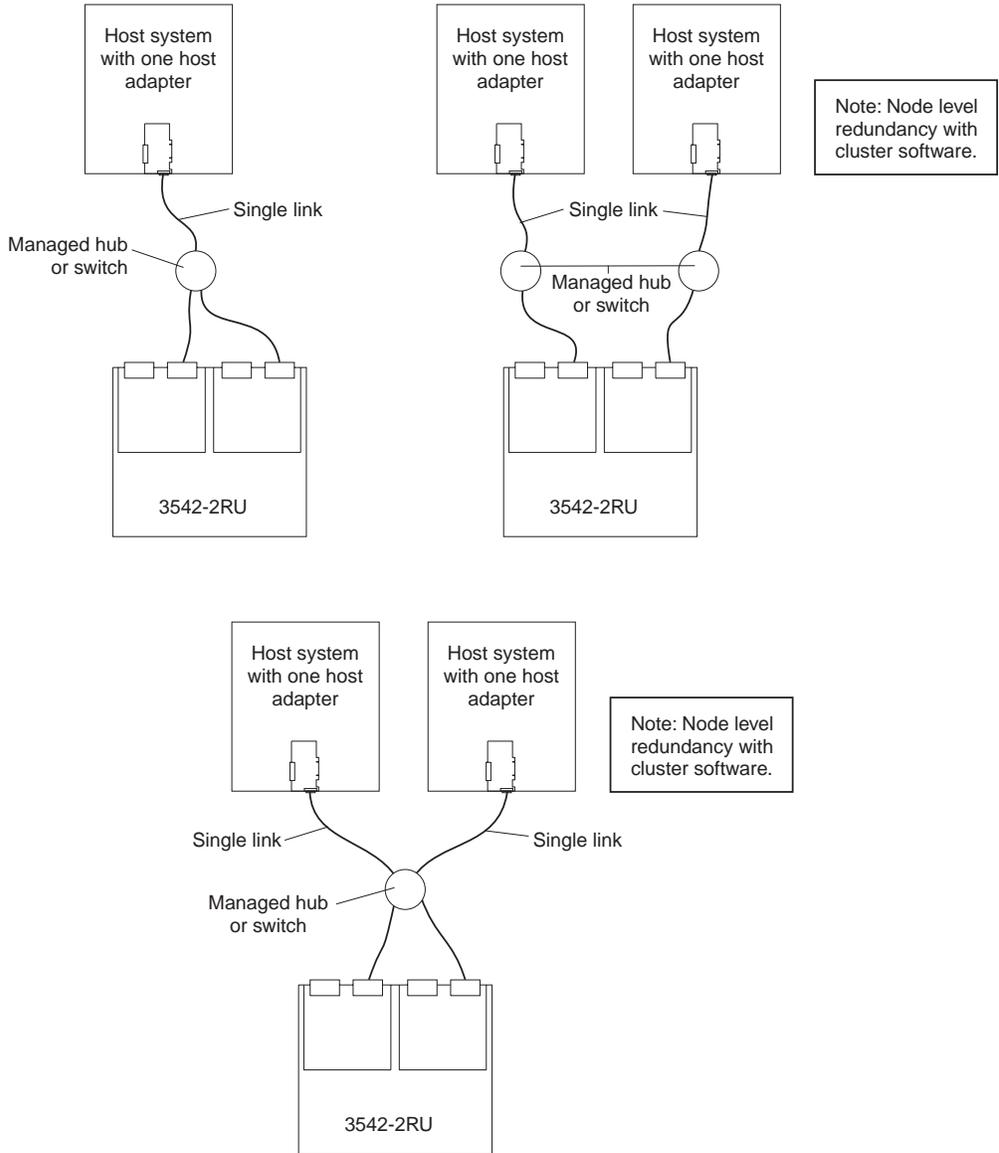


Figure 7. Partially-redundant host Fibre Channel loop, and redundant drive Fibre Channel loop configurations

Non-redundant host and drive loops

The following illustration shows examples of configurations that have non-redundant host and drive Fibre Channel. These configurations have a single path on the host and drive Fibre Channel loop. If either path fails, the host is not able to access storage until the path is repaired. The single controller (Model 3542-1RU) configurations have a single Fibre Channel loop to the hard disk drives. These configurations have no path failover protection.

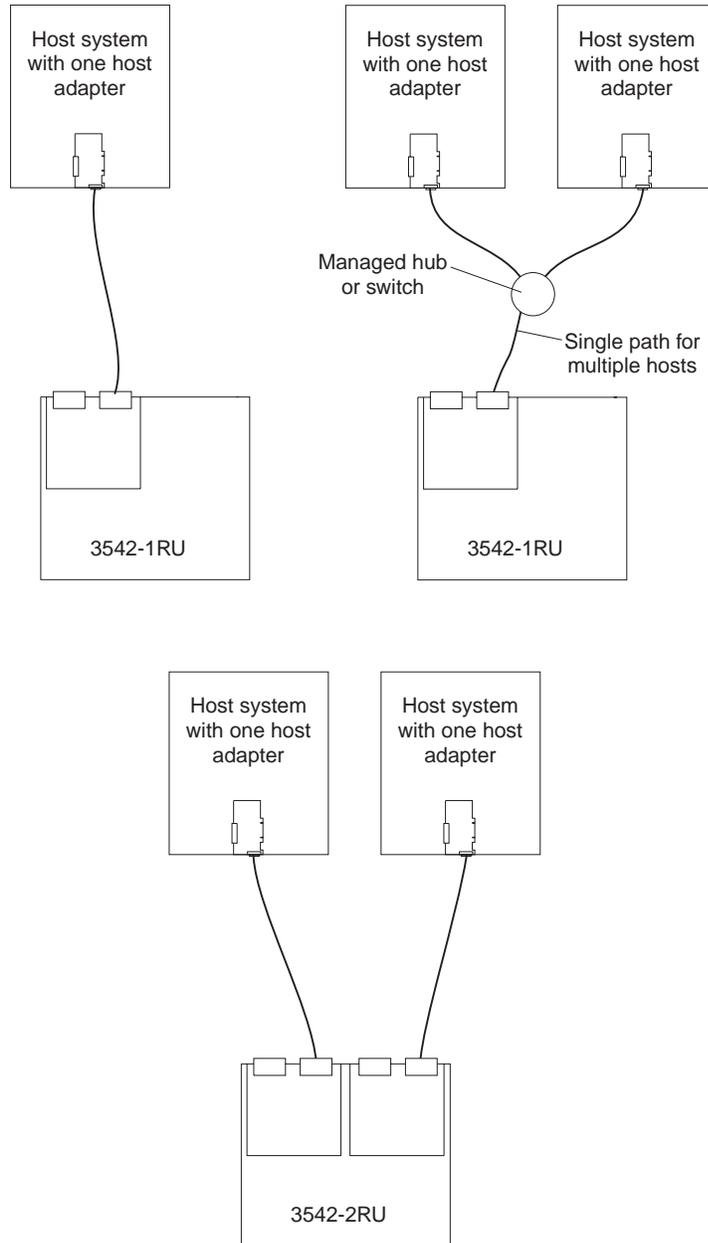


Figure 8. Non-redundant host and drive Fibre Channel loop configurations

Installing the storage subsystem configuration

Using the information gathered in the previous sections, install the host systems and host adapters.

Notes:

1. Refer to the documentation provided with your host adapters for installation requirements and procedures.
2. Use the correct host adapter driver. For the latest supported host adapters and drivers, go to the following Web site: <http://www.ibm.com/pc/support>

Attach fiber-optic interface cables to each host adapter. You will connect the other end of the cables to the controller later in the installation process. For more information about handling fiber-optic cables, see “Installing fiber-optic cables” on page 66.

Note: Do not install the storage-management software at this time, if it is not already installed. Install the storage server completely before installing the software, because you cannot test the software installation until the hardware is connected.

Getting started

Use the following list to prepare a storage server for installation:

1. Prepare the site to meet all area, environmental, power, and site requirements. For more information, see “Operating specifications” on page 9.
2. Move the storage server and its rack cabinet to the site.
3. Remove the storage server from its shipping container and check the contents. If any items are missing, contact your IBM reseller before proceeding.
4. Assemble the tools and equipment that you will need for installation. These might include:
 - Power cords (come with the storage server)
 - Screwdrivers (various sizes)
 - Antistatic protection (such as a grounding wrist strap)
 - Gigabit Interface Converters (GBICs)
 - Fibre Channel and Ethernet interface cables and cable straps
 - Rack-mounting hardware (comes with the storage server)
 - Storage-management software to configure the storage subsystems (comes with the storage server on the *Netfinity FAStT Storage Manager Version 7.02* installation CD.)
5. Install the storage server in the rack. Rack mounting instructions and a template for aligning the holes in the rails and the rack, come with the storage server. If you have misplaced these items, see “Rack mounting template and instructions” on page 47.
6. After you install the storage server in the rack, go to “Cabling the storage server”.

Cabling the storage server

This chapter provides the storage server Fibre Channel and power cabling information. After you attach your storage server power cables, use the instructions that are provided in “Turning the storage server on and off” on page 78 for the initial startup of the storage server.

Working with GBICs and fiber-optic cables

Each RAID controller has one host port and one expansion port. A Gigabit Interface Converter (GBIC) is used to connect each host port and expansion port to hosts and expansion units. The GBIC is inserted into the port, and then a fiber-optic cable is inserted into the GBIC. The other end of the fiber-optic cable connects to an external device.

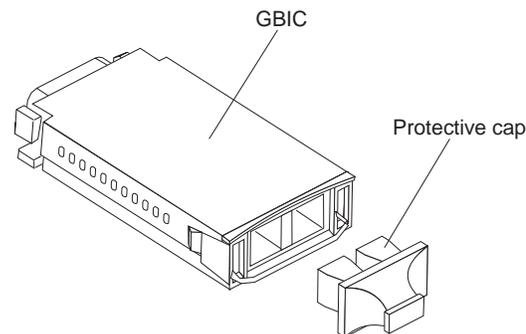
Installing GBICs

Observe the following GBIC installation tips:

- The GBIC module housing has an integral guide key to prevent you from inserting the GBIC improperly.
- Use minimal pressure when inserting the GBIC into a port. Forcing the GBIC into a port could cause damage to the GBIC or the port.
- GBICs are hot pluggable. You can insert or remove the GBIC while the storage server is powered on.
- The operational loop performance is not affected when you install or remove a GBIC.
- You must connect the fiber-optic interface cable to the GBIC module after you insert the GBIC into the port.

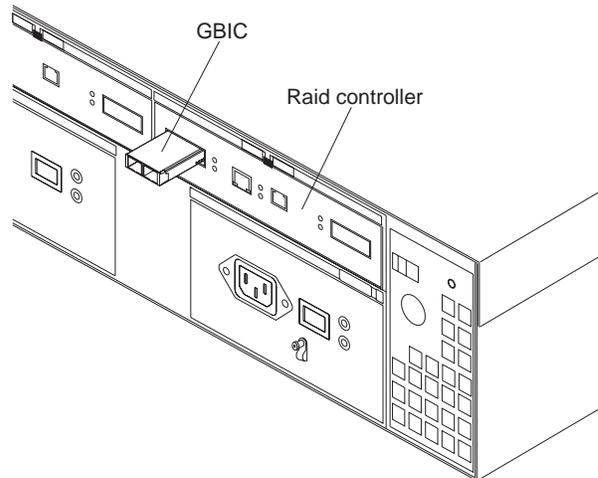
To install a GBIC, do the following:

1. Remove the protective cap from the GBIC, as shown in the following illustration.



2. If the GBIC that you are installing has a metal latch, move the latch to the unlocked (center) position.

3. Insert the GBIC into the host or expansion port on the RAID controller, as shown in the following illustration.



4. After the GBIC is inserted into the port completely, rotate the GBIC latch outward to the locked position (flush with the rear of the GBIC).

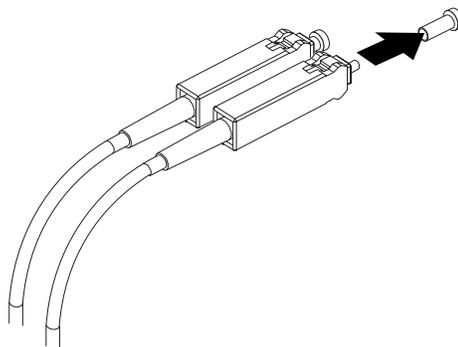
Installing fiber-optic cables

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

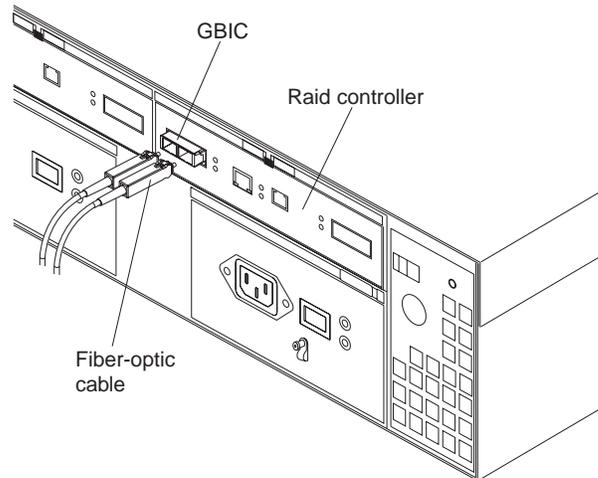
- Do not route the cable along a folding cable-management arm.
- When attaching fiber-optic cables to a device on slide rails, leave enough slack in the cable so that it does not bend to a radius smaller than 76 mm (3 in.) when extended or become pinched when retracted.
- Route the cable away from places where it can snag on other devices in the rack.
- Do not overtighten the cable straps or bend the cables to a radius smaller than 76 mm (3 in.).
- Do not put excess weight on the cable at the connection point and be sure that it is well supported.

To connect the fiber-optic cables, do the following.

1. Remove the protective caps from the fiber-optic cable.



2. Connect the fiber-optic cable to the installed GBIC, as shown in the following illustration.



3. Check the LEDs on the RAID controller. When the RAID controller is operating properly, the amber Fault LED is off. For information about the status of the RAID controller LEDs, see Table 8 on page 76.

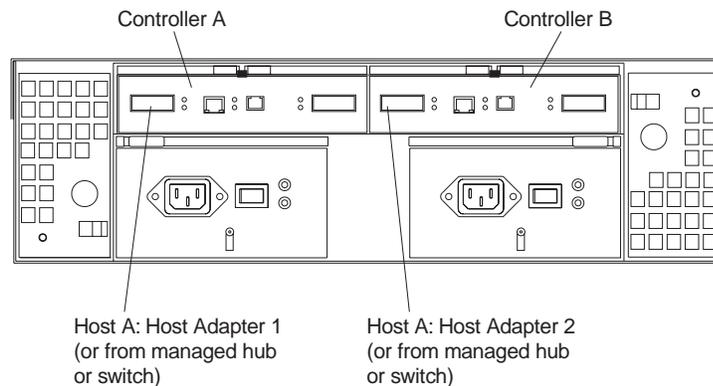
To remove the fiber-optic cables and GBICs, do the following:

1. Gently pull the fiber-optic cable from the GBIC; then, replace the protective caps.
2. Move the metal latch on the GBIC to the unlocked (center) position.
3. Gently pull the GBIC out of the port; then, replace the protective cap.

Connecting hosts to the RAID controllers

To connect a host adapter to the RAID controller, do the following:

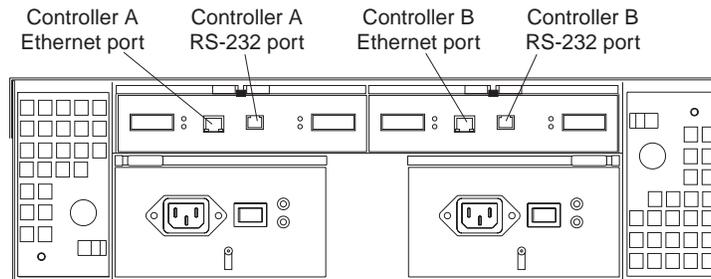
1. Install a GBIC in the host port on the RAID controller.
2. Connect the host-system cables to the RAID controller or to managed hubs and switches. The following illustration shows the location on the RAID controllers where the host-system cables connect.



For examples of redundant, partially-redundant, and non-redundant host and drive loop configurations, see “Fibre Channel loop configurations” on page 60.

Connecting secondary interface cables

Use the Ethernet interface ports on the back of the storage server to connect the controllers for direct management of the storage subsystems. Connect a pair of Ethernet cables from the storage-management station to the Ethernet ports for Controller A (located on the left) and Controller B (located on the right) on the back of the storage server. The following illustration shows the location of the ports.



Note: The serial (RS-232) interface ports are intended to be used by service technicians to perform diagnostic operations on the storage server.

Installing the storage-management software

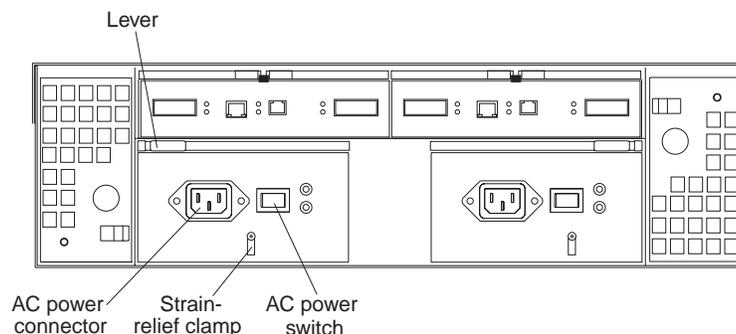
Install the storage-management software using the procedures in the software Installation and Support Guide for your operating system. Use that book and the online help to configure the logical drives, partitions and so on for the RAID controllers. Use your operating system documentation to make the new logical drives accessible to the operating system.

Note: Make sure that you start the storage-management software to continuously monitor the status of the storage server. For information about the importance of this information, see “Monitoring status through software” on page 11.

Power cabling

The storage server uses two standard power cords. You can connect the power cords to a primary power unit inside the rack, such as a properly grounded ac distribution unit, or to an external source, such as a properly grounded electrical outlet.

If you have not already done so, attach the power cords, using the following illustration for the location of the component parts.



1. Wrap the strain-relief clamp around the power cord approximately 20 cm (8 in.) from the power supply connection end.
2. Attach the power-supply nut, and tighten it securely.
3. Connect the power cord to the power supply.
4. Plug the power cord into a properly grounded electrical outlet.
5. Go to “Turning the storage server on and off” on page 70 for the initial startup of the storage server.

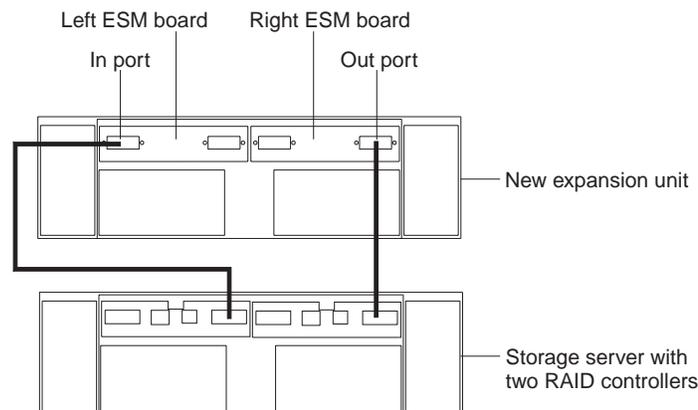
Connecting additional expansion units

After you install the storage server, you can connect additional expansion units. You can do this at any time after you install the storage server, even while it is turned on and processing data. You can even install one expansion unit now, and an additional expansion unit later.

Attention: You can add only *new* expansion units to the storage server. This means that there must be no existing configuration information on the expansion unit you want to install. If the expansion unit that you want to install currently contains logical drives or configured hot spares, you must delete them before connecting the expansion unit to the storage server.

To connect an additional expansion unit, do the following:

1. Follow the instructions in your expansion unit installation manual to set up and mount the new expansion unit.
2. Use the following procedure and illustration to connect a single expansion unit to the storage server:
 - a. Use a fiber-optic cable to connect to the FC-Expansion Units port on the left RAID controller in the storage server to the In port on the left ESM board of the expansion unit.
 - b. Use a second fiber-optic cable to connect the FC-Expansion Units port on the right RAID controller in the storage server to the Out port on the right ESM board of the expansion unit.
 - c. Ensure that the left and right ESM board IDs (switch settings) are set to an identical value.

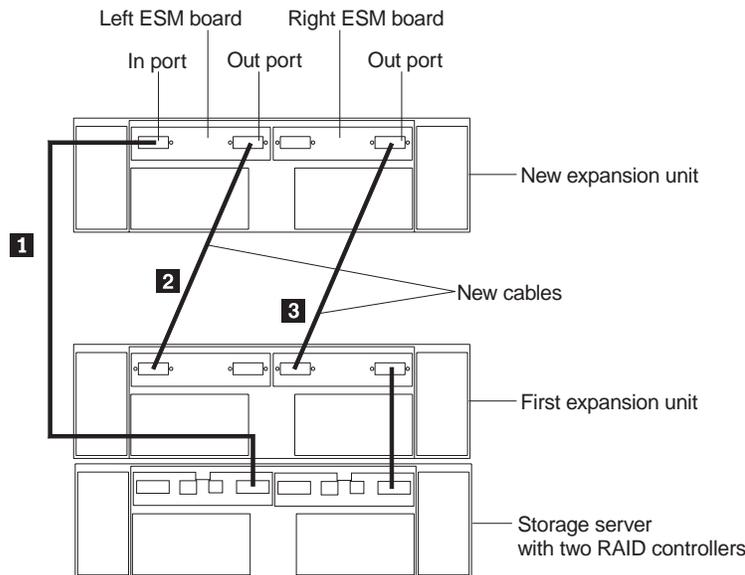


After you complete all connections, the storage server locates the new drives.

3. Use the storage-management software to check the status of the new drives, correct any errors found, and configure the new drives.

Use the following procedure and illustration to connect a second expansion unit to the storage server after previously adding the first expansion unit.

1. Disconnect cable **1** from its current connection and connect it to the In port on the left ESM board on the new expansion unit.
2. Connect cable **2** to the In port you disconnected in step 1 and the Out port on the left ESM board on the new expansion unit.
3. Connect a third cable **3** to the In port on the right ESM board on the first expansion unit and the Out port on the right ESM board on the new expansion unit.
4. Make sure that each expansion unit has a unique ID (switch setting) and that the left and right ESM board switch settings on each expansion unit are set to an identical value.



After you complete all connections, the storage server locates the new drives.

5. Use the storage-management software to check the status of the new drives, correct any errors found, and configure the new drives.

For more detailed information about cabling the storage server and expansion units, refer to the IBM FAStT200 Fibre Channel Cabling Instructions that come with the storage server.

Operating the storage server

This chapter describes the tasks that are required to operate the storage server.

Turning the storage server on and off

This section contains instructions for turning the storage server on and off under normal and emergency situations.

If you are turning on the storage server after an emergency shutdown or power outage, refer to “Restoring power after an emergency shutdown” on page 81.

Turning on the storage server

Use this procedure to turn on the power for the initial startup of the storage server.

1. Verify that:

- a. All communication and power cables are plugged into the back of the storage server and a properly grounded ac electrical outlet
- b. All hard disk drives are locked securely in place. For more information, see “Installing hot-swap drives” on page 18.

Attention: If you are restarting the system after a normal shutdown, wait at least 10 seconds before you turn on the power using the power-on sequence in step 2.

2. Check the system documentation for the hardware devices that you intend to power up, and then determine the proper startup sequence. Use the following power-on sequence, where applicable:
 - a. Turn on the power to the supporting devices (for example, Ethernet switches, managed hubs, and management stations) before the storage server.
 - b. You must turn on the expansion units before the storage server. The controllers might not recognize the correct configuration if the drives are powered up after the storage server. For instructions on powering up the expansion units, refer to the expansion-unit documentation.
 - c. Turn on the power to the storage server; then, restart or turn on the power to the host.
3. Turn on the power to each device, based on the power-on sequence in step 2. To turn on power to the storage server, turn on the power-supply switches on the back of the storage server. You must turn on both power-supply switches to take advantage of the redundant power supplies.
4. Use the storage-management software and the Fault LEDs to check the overall status of the storage server and its components. All LEDs should be green on the front of the storage server. If they are not, use the storage-management software to diagnose the problem (see “Monitoring status through software” on page 11).

Note: The green Drive active LED and amber Drive fault LED below the drive CRUs might flash intermittently as the drives spin-up. Wait until the storage server is finished powering up before checking the LEDs on the front of the storage server. For more information, see “Checking the LEDs” on page 74.

Turning off the storage server

Attention: Except in an emergency, never turn off the power if any storage server Fault LEDs are on. Correct the fault before you turn off the power. This ensures that the storage server will power up correctly later. See “Chapter 3. Diagnostics” on page 11.

The storage server is designed to run continuously, 24 hours a day. After you turn on the storage server, do not turn it off. Turn off the power only when:

- Instructions in a hardware or software procedure require you to turn off the power.
- A service technician tells you to turn off the power.
- A power outage or emergency situation occurs (see “Performing an emergency shutdown” on page 81).

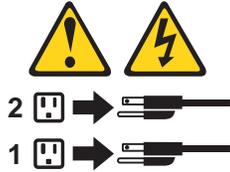
Statement 5



Statement 5

CAUTION:

The power control button on the device and the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



Use this procedure to turn off the power:

1. Before proceeding, use the storage-management software to determine the status of the system components and special instructions. The operating system software might require you to perform other procedures before you turn off the power.
2. Use the storage-management software to check the status of the storage server. Correct problems that are reported before you turn off the power.
3. Do the following:
 - a. Stop all I/O activity to the storage server and attached expansion units. Make sure that:
 - All of the green Drive active LEDs on the front of the storage server (and on all attached expansion units) are not flashing.
 - The green Cache active LEDs on the back of the storage server are off.
 - b. If applicable, use the operating-system software to disconnect the storage server logical drives from the host before the storage server is powered off.

Attention: To turn off all power to the storage server, you must turn off both power-supply switches and disconnect both power cords. Use the procedure in step 4 for the proper shutdown sequence.

4. Turn off the power to each device based on the following shutdown sequence:
 - a. Turn off power to the host before the storage server. If the host must stay powered on to support an existing network, refer to the operating system documentation for information about disconnecting the storage server logical drives from the host before the storage server is powered off.
 - b. Turn off power to the storage server before you turn off power to the expansion units. Turn off both power supply switches on the back of the storage server.
 - c. Turn off power to other supporting devices (for example, management stations, Fibre Channel switches, Fibre Channel managed hubs, or Ethernet switches).

Note: You do not need to perform this step if you are servicing only the storage server.

5. After you perform the necessary maintenance procedures, turn on the power using the procedure in “Turning on the storage server” on page 70.

Restoring power after an unexpected shutdown

The storage server might shut down unexpectedly under any of the following conditions.

Attention: There might be data loss in each of the following cases.

- The internal temperature of the storage server exceeds the maximum operating temperature (an overtemperature condition).

If both fan CRUs fail or are unable to maintain an internal temperature below 70°C (158°F), one or both of the power supplies in the storage server will shut down. If both power supplies shut down, the unit is inoperable.

The storage-management software warns you if the temperature of the unit is rising, before it has risen sufficiently to shut down the power supplies. The first warning comes when the storage server internal temperature exceeds 45°C (113°F). The storage server shuts down if the temperature rises to 70°C (158°F).

- There is a general power failure or a loss of power to the unit.
- You are forced to shut down the storage server without performing the normal shutdown procedures (listed in “Turning off the storage server” on page 71) because of an emergency situation.

Attention: To avoid damage to the hardware, take special care when restarting your system after an unexpected shutdown.

If the storage server shuts down unexpectedly, but there is still power to the site, use the storage-management software to determine if the storage server has overheated.

- If an overtemperature condition is indicated, use the procedure in “Restoring power after an overtemperature shutdown” on page 81 to restart the storage server.
- If the storage server has shut down because of a power failure or an emergency shutdown, use the procedure in “Restoring power after an emergency shutdown” on page 81 to restart the storage server.

Performing an emergency shutdown

Attention: Emergency situations might include fire, flood, extreme weather conditions, or other hazardous circumstances. If a power outage or emergency situation occurs, always turn off all power switches on all computing equipment. This will help safeguard your equipment from potential damage due to electrical surges when power is restored. If the storage server loses power unexpectedly, it might be due to a hardware failure in the power system or midplane (see “Chapter 3. Diagnostics” on page 11).

Use this procedure to shut down the storage server during an emergency:

1. If you have time, stop all I/O activity to the storage server by shutting down the host or disconnecting the storage server logical drives through the host.
2. Check the LEDs (front and back). Make note of any Fault LEDs that are on so you can correct the problem when you turn on the power again.
3. Turn off all power-supply switches; then, unplug the power cords from the storage server.

Restoring power after an overtemperature shutdown

Use this procedure to restart the storage server after an unexpected shutdown due to of an overtemperature condition:

1. Make sure that the power-supply switches on the back of the storage server are turned off.
2. Do whatever is necessary to cool the unit (replace the fans, use external fans to cool the room, and so on).
3. Check all components and cables for visible damage. *Do not start the storage server if you find evidence of damage.*
4. Complete step 2 on page 71 to determine the proper power-on sequence for your system.
5. When the internal temperature of the storage server is below 45°C (113°F), complete steps 3 on page 72 and 4 on page 71 to turn on power to the devices in your system and to check the status of the storage server.

Monitoring status through software

Use the storage-management software to monitor the status of the storage server. Run the software constantly, and check it frequently.

The storage-management software provides the best way to diagnose and repair storage-server failures. The software can help you:

- Determine the nature of the failure
- Locate the failed component
- Determine the recovery procedures to repair the failure

Although the storage server has fault LEDs, these lights do not necessarily indicate which component has failed or needs to be replaced, or which type of recovery procedure that you must perform. In some cases (such as loss of redundancy in various components), the fault LED does not turn on. Only the storage-management software can detect the failure.

For example, the recovery procedure for a Predictive Failure Analysis[®] (PFA) flag (impending drive failure) on a drive varies depending on the drive status (hot spare, unassigned, RAID level, current logical drive status, and so on). Depending on the circumstances, a PFA flag on a drive can indicate a high risk of data loss (if the drive is in a RAID 0 volume) or a minimal risk (if the drive is unassigned). Only the storage-management software can identify the risk level and provide the necessary recovery procedures.

Note: For PFA flags, the General-system-error LED and Drive fault LEDs do not turn on, so checking the LEDs will not notify you of the failure, even if the risk of data loss is high.

Recovering from a storage-server failure might require you to perform procedures other than replacing the component (such as backing up the logical drive or failing a drive before removing it). The storage-management software gives these procedures.

Attention: Not following the software-recovery procedures can result in data loss.

Checking the LEDs

Checking the LEDs

The LEDs display the status of the storage server and components. Green LEDs indicate a normal operating status; amber LEDs indicate a possible failure.

It is important to check all the LEDs on the front and back of the storage server when you turn on the power. In addition to checking for faults, you can use the LEDs on the front of the storage server to determine if the drives are responding to I/O transmissions from the host.

For information about the LEDs on the front of the storage server, see:

- Figure 9
- Table 7

For information about the LEDs on the back of the storage server, see:

- Figure 11 on page 77
- Table 8 on page 76
- Table 9 on page 77

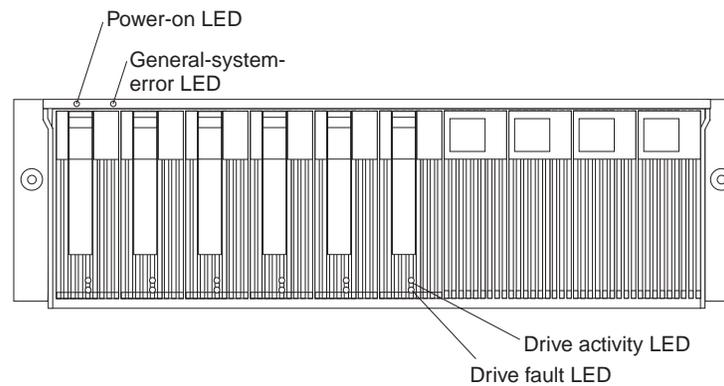


Figure 9. Storage server LEDs (front)

Table 7. Storage server LEDs (front)

LED	Color	Operating states ¹
Drive active	Green	<ul style="list-style-type: none"> • On - Normal operation. • Flashing - The drive is reading or writing data. • Off - One of the following situations has occurred: <ul style="list-style-type: none"> - The storage server has no power. - The storage subsystem has no power. - The drive is not properly seated in the storage server. - The drive has not spun up.
Drive fault	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • Flashing - The storage-management software is locating a drive, logical drive, or storage subsystem. • On - The drive has failed, or a user failed the drive.

Table 7. Storage server LEDs (front) (continued)

LED	Color	Operating states ¹
Power	Green	<ul style="list-style-type: none"> • On - Normal operation. • Off- One of the following situations has occurred: <ul style="list-style-type: none"> - The storage server has no power. - The storage subsystem has no power. - The power supply has failed. - There is an overtemperature condition.
General-system-error	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • On- A storage server component has failed².

¹Always use the storage-management software to identify the failure. ² Not all component failures turn on this LED. For more information, see “Monitoring status through software” on page 11.

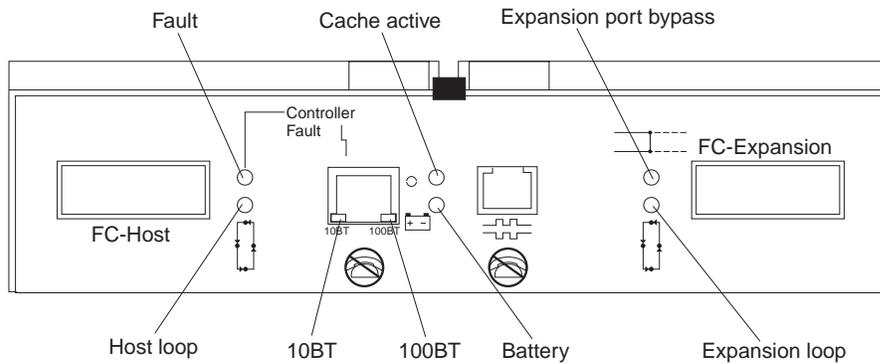


Figure 10. RAID controller LEDs

Table 8. RAID Controller LEDs

Icon	LED	Color	Operating states ¹
	Fault	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • On- The RAID controller has failed.
	Host loop	Green	<ul style="list-style-type: none"> • On - Normal operation • Off- One of the following situations has occurred: <ul style="list-style-type: none"> - The host loop is down, not turned on, or not connected. - A GBIC has failed, or the host port is not occupied. - The RAID controller circuitry has failed, or the RAID controller has no power.
	Cache active	Green	<ul style="list-style-type: none"> • On - There is data in the RAID controller cache. • Off- One of the following situations has occurred: <ul style="list-style-type: none"> - There is no data in cache. - There are no cache options selected for this array. - The cache memory has failed, or the battery has failed.

Table 8. RAID Controller LEDs (continued)

Icon	LED	Color	Operating states ¹
	Battery	Green	<ul style="list-style-type: none"> • On - Normal operation. • Flashing - The battery is recharging or performing a self-test. • Off- The battery or battery charger has failed.
	Expansion port bypass	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • On-One of the following situations has occurred: <ul style="list-style-type: none"> - The expansion port is not occupied. - The Fibre Channel cable is not attached to an expansion unit. - The attached expansion unit is not turned on. - A GBIC has failed, a Fibre Channel cable has failed, or a GBIC has failed on the attached expansion unit.
	Expansion loop	Green	<ul style="list-style-type: none"> • On - Normal operation. • Off- The RAID controller circuitry has failed, or the RAID controller has no power.
No icon	10BT	Green	<ul style="list-style-type: none"> • If the Ethernet connection is 10BASE-T:The 10BT LED is on, 100BT LED flashes faintly. • If the Ethernet connection is 100BASE-T:10BT LED is off, 100BT LED is on. • If there is no Ethernet connection- Both LEDs are off.
No icon	100BT		

¹Always use the storage-management software to identify the failure.

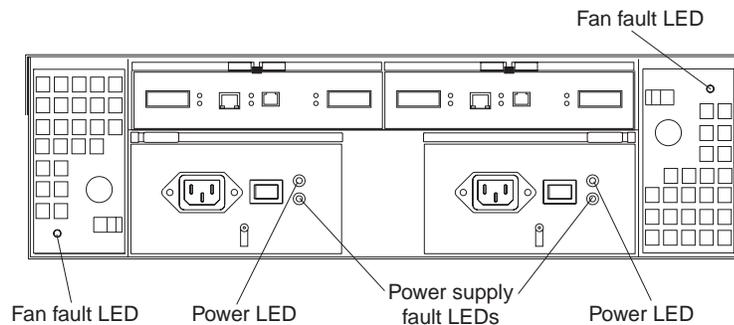


Figure 11. Fan and power supply LEDs

Table 9. Fan LED

LED	Color	Operating states ¹
Fault	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • On- The fan CRU has failed.

¹Always use the storage-management software to identify the failure.

Table 10. Power supply LEDs

LED	Color	Operating states ¹
Fault	Amber	<ul style="list-style-type: none"> • Off - Normal operation. • On- One of the following situations has occurred: <ul style="list-style-type: none"> - The power supply has failed. - An overtemperature condition has occurred. - The power supply is turned off.
Power	Green	<ul style="list-style-type: none"> • On - Normal operation. • Off- One of the following situations has occurred: <ul style="list-style-type: none"> - The power supply is disconnected. - The power supply is seated incorrectly. - The storage server has no power.

¹Always use the storage-management software to identify the failure.

Cache memory and RAID controller battery

This chapter describes the tasks that are required to operate the storage server.

Turning the storage server on and off

This section contains instructions for turning the storage server on and off under normal and emergency situations.

If you are turning on the storage server after an emergency shutdown or power outage, refer to “Restoring power after an emergency shutdown” on page 81.

Turning on the storage server

Use this procedure to turn on the power for the initial startup of the storage server.

1. Verify that:
 - a. All communication and power cables are plugged into the back of the storage server and a properly grounded ac electrical outlet
 - b. All hard disk drives are locked securely in place. For more information, see “Installing hot-swap drives” on page 18.

Attention: If you are restarting the system after a normal shutdown, wait at least 10 seconds before you turn on the power using the power-on sequence in step 2 on page 71.

2. Check the system documentation for the hardware devices that you intend to power up, and then determine the proper startup sequence. Use the following power-on sequence, where applicable:
 - a. Turn on the power to the supporting devices (for example, Ethernet switches, managed hubs, and management stations) before the storage server.
 - b. You must turn on the expansion units before the storage server. The controllers might not recognize the correct configuration if the drives are powered up after the storage server. For instructions on powering up the expansion units, refer to the expansion-unit documentation.
 - c. Turn on the power to the storage server; then, restart or turn on the power to the host.
3. Turn on the power to each device, based on the power-on sequence in step 2 on page 71. To turn on power to the storage server, turn on the power-supply switches on the back of the storage server. You must turn on both power-supply switches to take advantage of the redundant power supplies.

4. Use the storage-management software and the Fault LEDs to check the overall status of the storage server and its components. All LEDs should be green on the front of the storage server. If they are not, use the storage-management software to diagnose the problem (see “Monitoring status through software” on page 11).

Note: The green Drive active LED and amber Drive fault LED below the drive CRUs might flash intermittently as the drives spin-up. Wait until the storage server is finished powering up before checking the LEDs on the front of the storage server. For more information, see “Checking the LEDs” on page 74.

Turning off the storage server

Attention: Except in an emergency, never turn off the power if any storage server Fault LEDs are on. Correct the fault before you turn off the power. This ensures that the storage server will power up correctly later. See “Chapter 3. Diagnostics” on page 11.

The storage server is designed to run continuously, 24 hours a day. After you turn on the storage server, do not turn it off. Turn off the power only when:

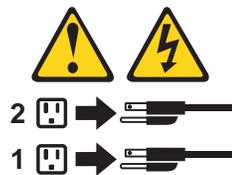
- Instructions in a hardware or software procedure require you to turn off the power.
- A service technician tells you to turn off the power.
- A power outage or emergency situation occurs (see “Performing an emergency shutdown” on page 81).

Statement 5



CAUTION:

The power control button on the device and the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



Use this procedure to turn off the power:

1. Before proceeding, use the storage-management software to determine the status of the system components and special instructions. The operating system software might require you to perform other procedures before you turn off the power.
2. Use the storage-management software to check the status of the storage server. Correct problems that are reported before you turn off the power.
3. Do the following:
 - a. Stop all I/O activity to the storage server and attached expansion units. Make sure that:
 - All of the green Drive active LEDs on the front of the storage server (and on all attached expansion units) are not flashing.

- The green Cache active LEDs on the back of the storage server are off.
- b. If applicable, use the operating-system software to disconnect the storage server logical drives from the host before the storage server is powered off.

Attention: To turn off all power to the storage server, you must turn off both power-supply switches and disconnect both power cords. Use the procedure in step 4 on page 72 for the proper shutdown sequence.

4. Turn off the power to each device based on the following shutdown sequence:
 - a. Turn off power to the host before the storage server. If the host must stay powered on to support an existing network, refer to the operating system documentation for information about disconnecting the storage server logical drives from the host before the storage server is powered off.
 - b. Turn off power to the storage server before you turn off power to the expansion units. Turn off both power supply switches on the back of the storage server.
 - c. Turn off power to other supporting devices (for example, management stations, Fibre Channel switches, Fibre Channel managed hubs, or Ethernet switches).

Note: You do not need to perform this step if you are servicing only the storage server.

5. After you perform the necessary maintenance procedures, turn on the power using the procedure in “Turning on the storage server” on page 70.

Restoring power after an unexpected shutdown

The storage server might shut down unexpectedly under any of the following conditions.

Attention: There might be data loss in each of the following cases.

- The internal temperature of the storage server exceeds the maximum operating temperature (an overtemperature condition).

If both fan CRUs fail or are unable to maintain an internal temperature below 70°C (158°F), one or both of the power supplies in the storage server will shut down. If both power supplies shut down, the unit is inoperable.

The storage-management software warns you if the temperature of the unit is rising, before it has risen sufficiently to shut down the power supplies. The first warning comes when the storage server internal temperature exceeds 45°C (113°F). The storage server shuts down if the temperature rises to 70°C (158°F).

- There is a general power failure or a loss of power to the unit.
- You are forced to shut down the storage server without performing the normal shutdown procedures (listed in “Turning off the storage server” on page 71) because of an emergency situation.

Attention: To avoid damage to the hardware, take special care when restarting your system after an unexpected shutdown.

If the storage server shuts down unexpectedly, but there is still power to the site, use the storage-management software to determine if the storage server has overheated.

- If an overtemperature condition is indicated, use the procedure in “Restoring power after an overtemperature shutdown” on page 81 to restart the storage server.

- If the storage server has shut down because of a power failure or an emergency shutdown, use the procedure in “Restoring power after an emergency shutdown” to restart the storage server.

Performing an emergency shutdown

Attention: Emergency situations might include fire, flood, extreme weather conditions, or other hazardous circumstances. If a power outage or emergency situation occurs, always turn off all power switches on all computing equipment. This will help safeguard your equipment from potential damage due to electrical surges when power is restored. If the storage server loses power unexpectedly, it might be due to a hardware failure in the power system or midplane (see “Chapter 3. Diagnostics” on page 11).

Use this procedure to shut down the storage server during an emergency:

1. If you have time, stop all I/O activity to the storage server by shutting down the host or disconnecting the storage server logical drives through the host.
2. Check the LEDs (front and back). Make note of any Fault LEDs that are on so you can correct the problem when you turn on the power again.
3. Turn off all power-supply switches; then, unplug the power cords from the storage server.

Restoring power after an emergency shutdown

Use this procedure to restart the storage server if you turned off the power-supply switches during an emergency shutdown, or if a power failure or a power outage occurred:

1. After the emergency situation is over or power is restored, check the storage server for damage. If there is no visible damage, continue with Step 2; otherwise, have your system serviced.
2. After you have checked for damage, ensure that the power-supply switches are off; then, plug in the storage-server power cords.
3. Complete step 2 on page 71 to determine the proper power-on sequence for your system.
4. Complete steps 3 on page 72 and 4 on page 72 to turn on power to the devices in your system and to check the status of the storage server.

Restoring power after an overtemperature shutdown

Use this procedure to restart the storage server after an unexpected shutdown due to of an overtemperature condition:

1. Make sure that the power-supply switches on the back of the storage server are turned off.
2. Do whatever is necessary to cool the unit (replace the fans, use external fans to cool the room, and so on).
3. Check all components and cables for visible damage. *Do not start the storage server if you find evidence of damage.*
4. Complete step 2 on page 71 to determine the proper power-on sequence for your system.
5. When the internal temperature of the storage server is below 45°C (113°F), complete steps 3 on page 72 and 4 on page 72 to turn on power to the devices in your system and to check the status of the storage server.

Cache memory and RAID controller battery

Each RAID controller contains 4 KB of cache data. It also contains a rechargeable battery that maintains data in the cache in the event of a power failure. The following sections describe these features and their associated LEDs.

Cache memory

Cache memory is memory on the RAID controller that is used for intermediate storage of read and write data. Using cache memory can increase system performance. The data for a read operation from the host might be in the cache memory from a previous operation (thus eliminating the need to access the drive itself), and a write operation is completed when it is written to the cache, rather than to the drives.

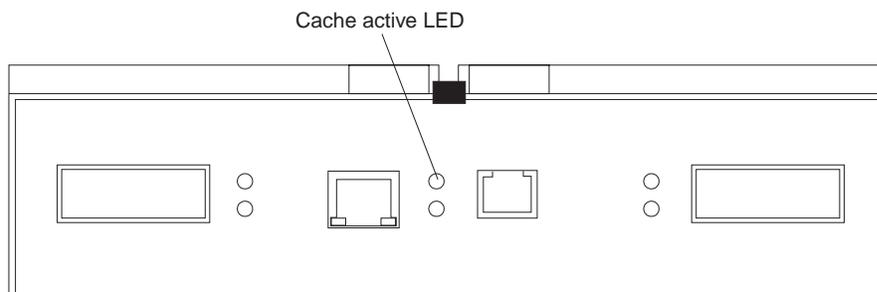
See the storage-management software documentation for information on setting cache memory options.

The RAID controller has a Cache active LED that displays the current status of the cache. The LED is on if there is data in the cache, and it is off if there is no data in the cache.

If caching is enabled and the Cache active LED never comes on during I/O activity, it indicates that the cache memory has failed or the battery has failed (the green Battery LED will be off).

Note: Always use the storage-management software to check your cache memory settings before assuming a hardware failure.

The following illustration shows the location of the Cache active LED on the front of the RAID controller.



RAID controller cache battery

Each RAID controller contains a sealed, rechargeable 4-volt lead-acid battery. This battery provides cache backup for up to three days in the event of a power loss.

The service life of the battery is three years, after which time the battery must be replaced. The battery is not customer replaceable. If it fails, must call a field service representative to replace it. Refer to the storage-management software for information on how to view and set the battery expiration date.

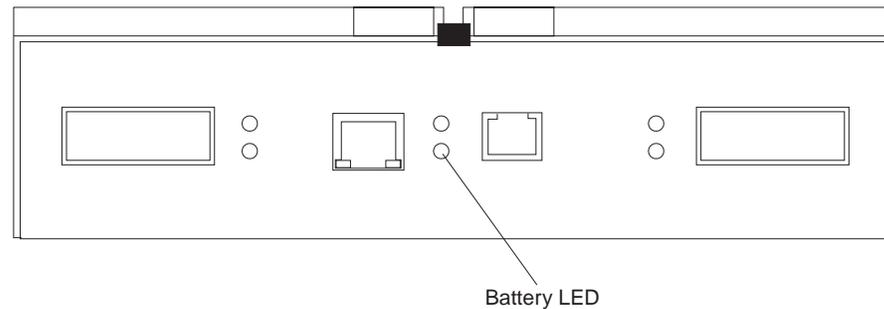
Each RAID controller has a green Battery LED on the back that indicates the battery status, as follows:

- The LED is on and remains steady when the battery is fully charged.
- The LED flashes when the battery is charging or performing a self-test.
- The LED is off if the battery or the battery charger has failed.

The battery performs a self-test at startup and every 25 hours thereafter (during which time the Battery LED flashes). If necessary, the battery begins recharging at that time. If the battery fails the self-test, the Battery LED turns off, indicating a battery fault.

Data caching starts after the battery completes the startup tests.

The following illustration shows the location of the Battery LED on the front of the RAID controller.



Chapter 8. Related service information

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Safety notices (multi-lingual translations)

The caution and danger safety notices in this section are provided in the following languages.

- English
- Portuguese (Brazil)
- Chinese
- French
- German
- Italian
- Korean
- Spanish



DANGER

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.

To avoid shock hazard:

- The power cord must be connected to a properly wired and earthed receptacle.
- Any equipment to which this product will be attached must also be connected to properly wired receptacles.

When possible, use one hand to connect or disconnect signal cables to prevent a possible shock from touching two surfaces with different electrical potentials.

Electrical current from power, telephone, and communications cables is hazardous. To avoid shock hazard, connect and disconnect cables as described following when installing, moving, or opening covers of this product or attached devices.

To Connect	To Disconnect
<ol style="list-style-type: none"> 1. Turn Everything OFF. 2. First, attach all cables to devices. 3. Attach signal cables to receptacles 4. Attach power cord(s) to outlet. 5. Turn device ON. 	<ol style="list-style-type: none"> 1. Turn Everything OFF. 2. First, remove power cord(s) from outlet. 3. Remove signal cables from receptacles. 4. Remove all cables from devices.
<p>Note: In the UK, by law, the telephone cable must be connected after the power cord.</p>	<p>Note: In the UK, the power cord must be disconnected after the telephone cable.</p>



CAUTION:

When replacing the battery, use only IBM Part Number 33F8354 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer.

The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- Throw or immerse into water
- Heat to more than 100°C (212°F)
- Repair or disassemble

Dispose of the battery as required by local ordinances or regulations.



CAUTION:

When a CD-ROM drive is installed, note the following.

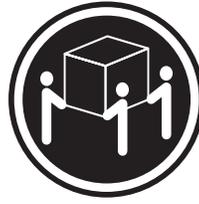
Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.

Removing the covers of the CD-ROM drive could result in exposure to hazardous laser radiation. There are no serviceable parts inside the CD-ROM drive. Do not remove the CD-ROM drive covers.

DANGER

Some CD-ROM drives contain an embedded Class 3A or Class 3B laser diode. Note the following.

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.



≥ 32 kg (70.5 lbs)



≥ 55 kg (121.2 lbs)

CAUTION:

Use safe lifting practices when lifting your machine.



CAUTION:

Electrical current from power, telephone, and communication cables can be hazardous. To avoid personal injury or equipment damage, disconnect the attached power cords, telecommunications systems, networks, and modems before you open the server covers, unless instructed otherwise in the installation and configuration procedures.

**PERIGO**

Para evitar choques elétricos, não conecte ou desconecte nenhum cabo, nem efetue instalação, manutenção ou reconfiguração deste produto durante uma tempestade com raios.

Para evitar choques elétricos:

- O cabo de alimentação deve ser conectado a um receptáculo corretamente instalado e aterrado.
- Todos os equipamentos aos quais este produto será conectado devem também ser conectados a receptáculos corretamente instalados.

Quando possível, utilize uma das mãos para conectar ou desconectar cabos de sinal, para evitar um possível choque ao tocar duas superfícies com potenciais elétricos diferentes.

A corrente elétrica proveniente de cabos de alimentação, de telefone e de comunicação é perigosa. Para evitar choques elétricos, conecte e desconecte os cabos conforme descrito a seguir, ao instalar, movimentar ou abrir tampas deste produto ou de dispositivos conectados.

Para Conectar	Para Desconectar
<ol style="list-style-type: none">1. DESLIGUE tudo.2. Conecte primeiro todos os cabos nos dispositivos.3. Conecte os cabos de sinal nos receptáculos.4. Conecte o(s) cabo(s) de alimentação nas tomadas.5. LIGUE o dispositivo.	<ol style="list-style-type: none">1. DESLIGUE tudo.2. Remova primeiro o(s) cabo(s) de alimentação das tomadas.3. Remova os cabos de sinal dos receptáculos.4. Remova todos os cabos dos dispositivos.



Cuidado:

Ao substituir a bateria, utilize apenas o Número de Peça IBM 33F8354 ou um tipo de bateria equivalente recomendado pelo fabricante. Se seu sistema possuir um módulo com uma bateria de lítio, substitua-o apenas pelo mesmo tipo de módulo, produzido pelo mesmo fabricante. A bateria contém lítio e pode explodir se não for utilizada, manuseada e descartada de forma adequada.

Não:

- Jogue ou coloque na água
- Aqueça a mais de 100°C (212°F)
- Conserte nem desmonte.

Descarte a bateria conforme requerido pelas disposições e regulamentações locais.



Cuidado:

Quando uma unidade de CD-ROM estiver instalada, observe o seguinte.

A utilização de controles ou ajustes ou a execução de procedimentos diferentes daqueles especificados nesta publicação pode resultar em exposição perigosa à radiação.

A remoção das tampas da unidade de CD-ROM pode resultar em exposição a radiação perigosa de laser. Não existem peças que possam ser consertadas no interior da unidade de CD-ROM. Não remova as tampas da unidade de CD-ROM.

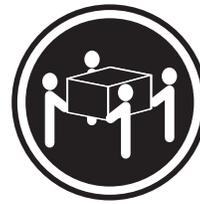
PERIGO

Algumas unidades de CD-ROM contém um diodo de laser da Classe 3A ou da Classe 3B. Observe o seguinte.

Radiação de laser quando aberto. Não olhe diretamente para o feixe de laser, não olhe diretamente com instrumentos óticos, e evite exposição direta ao raio.



≥ 32 kg (70.5 lbs)



≥ 55 kg (121.2 lbs)

Cuidado:

Utilize práticas seguras para levantamento de peso ao levantar sua máquina.



Cuidado:

A corrente elétrica proveniente de cabos de alimentação, de telefone e de comunicação é perigosa. Para evitar ferimentos pessoais ou danos aos equipamentos, desconecte os cabos de alimentação, sistemas de telecomunicação, redes e modems antes de abrir as tampas do servidor, a menos que receba outras instruções nos procedimentos de instalação e configuração.

声明 1



危险！

为避免电击危险，请不要在暴风雨期间连接或断开任何电缆，或是进行此产品的安装、维护或重新配置操作。

为避免电击危险：

- 电源线必须连接到适当的电线及接地插座。
- 此产品将要连接的所有设备也必须连接到正确接线的插座上。

如果可能，请使用一只手连接或断开连接信号电缆，以避免在接触两个具有不同电势的表面时遭到电击。

电源线、电话线以及通信电缆中的电流非常危险。为避免电击，请在安装、移动或打开本产品或连接设备的外盖时，按照下述步骤连接或断开电缆。

要连接电缆

1. 关闭所有设备。
2. 首先将所有电缆与设备连接。
3. 将信号线连接到插座。
4. 将电源线连接到电源插座。
5. 打开设备。

要断开电缆

1. 关闭所有设备。
2. 首先从电源插座拔下电源线。
3. 从插座拔下信号电缆。
4. 从设备上拔下所有电缆。

声明 2



注意！

当更换电池时，仅可使用 IBM 部件号为 33F8354 的产品或由制造商推荐的同等电池。如果系统中有包含锂电池的模块，则只能使用由相同制造商制造的相同类型模块更换。该电池含有锂，如果使用、操作或处理不当会发生爆炸。

不要：

- 将其投入或浸于水中
- 加热超过100°C (212°F)
- 修理或拆卸

应按照当地法规和条例对此电池进行处理。

声明 3



注意！

在已安装 CD-ROM 驱动器的情况下，请注意下面的内容。

不遵循此处指定的控制、调整、或操作过程的操作将可能导致危险的辐射泄漏。

取下 CD-ROM 驱动器的外盖会导致危险的激光辐射泄漏。CD-ROM 驱动器内没有可以使用的部件。请不要取下 CD-ROM 驱动器的外盖。

声明 4

危险！

一些 CD-ROM 驱动器中包含内置的 3A 类或 3B 类激光二极管。
请注意下述内容。

打开驱动器会产生激光辐射。请不要凝视激光束，请不要使用光学仪器直接观看激光束，同时也要避免人体直接暴露在激光束下。

声明 5



32 kg (70.5 磅)

55 kg (121.2 磅)

注意!

搬运机器时，请进行安全搬运操作。

声明 10



注意!

电源线、电话线以及通信电缆中的电流非常危险。为避免人身伤害或设备损坏，除非在安装和配置过程中特别指明，请在打开服务器外盖前断开已连接的全部电源线、电信系统、网络及调制解调器。

· 声明 1



危险

為了避免雷擊，在閃電期間，請勿連接或拔掉本裝置上的任何電纜線，或請勿安裝、維修或重新架構本產品。

為了避免雷擊：

- 電源線必須連接到接線及接地正確的插座。
- 本產品所連接的設備也必須連接到接線正確的插座。

儘可能使用單手來連接或拔掉信號電纜，以避免因接觸兩不同電位的平面，而受到電擊。

電源、電話及通信電纜上均有電流通過。為了避免電擊，在安裝、移動本產品，或開啓本產品的蓋子或與本產品連接之裝置的蓋子時，請依照下列「連接」及「拔掉」電纜線的步驟操作。

連接

1. 關掉所有開關。
2. 首先，將所有電纜線連接到裝置。
3. 將信號電纜連接到信號插座。
4. 將電源線連接到電源插座。
5. 開啓裝置電源。

拔掉

1. 關掉所有開關。
2. 首先，自電源插座拔掉電源線。
3. 拔掉信號插座上的所有信號電纜。
4. 拔掉裝置上的所有電纜線。

• 聲明 2



注意：

更換電池時，只可使用 IBM 零件編號 33F8354 的電池，或廠商建議的相當類型的電池。如您系統中的模組含有鋰電池，更換時，請使用相同廠商製造的相同模組類型。如未正常使用、處理或捨棄含有鋰的電池時，可能會造成爆炸。

嚴禁：

- 丟入或浸入水中
- 加熱超過攝氏100度（華氏 212 度）
- 修補或拆解

處理廢棄電池時，請遵照當地法令規章處理。

• 聲明 3



注意：

安裝光碟機時，請注意下列事項：

不依此處所指示的控制、調整或處理步驟，恐有遭致輻射之虞。

移開光碟機蓋子，恐有遭致雷射輻射之虞。光碟機中沒有需要維修的部分。請勿移開光碟機的蓋子。

• 聲明 4



危險

光碟機含有內嵌式 Class 3A 或 Class 3B 雷射二極體時，請注意下列事項：

開啓時會產生雷射輻射。請勿凝視光束，不要使用光學儀器直接觀察，且應避免直接暴露在光束下。

• 聲明 5



≥ 32 公斤 (70.5 磅)



≥ 55 公斤 (121.2 磅)

注意：

提昇機器時，請使用安全提昇措施。

• 聲明 10



注意：
電源、電話及通信電纜上均有電流通過。在安裝及架構之時，若非專家指導，為了避免人員受傷、設備受損，在開啓伺服器蓋子之前，請切斷電源線、電信系統、網路及數據機。

**DANGER**

Pour éviter tout risque de choc électrique, ne manipulez aucun câble et n'effectuez aucune opération d'installation, d'entretien ou de reconfiguration de ce produit au cours d'un orage.

Pour éviter tout risque de choc électrique:

- Les cordons d'alimentation du présent produit et de tous les appareils qui lui sont connectés doivent être branchés sur des socles de prise de courant correctement câblés et mis à la terre.

Afin d'éviter tout risque de choc électrique provenant d'une différence de potentiel de terre, n'utilisez qu'une main, lorsque cela est possible, pour connecter ou déconnecter les cordons d'interface.

Le courant électrique passant dans les câbles de communication, ou les cordons téléphoniques et d'alimentation peut être dangereux. Pour éviter tout risque de choc électrique, lorsque vous installez ou que vous déplacez le présent produit ou des périphériques qui lui sont raccordés, reportez-vous aux instructions ci-dessous pour connecter et déconnecter les différents cordons.

Connexion	Déconnexion
<ol style="list-style-type: none">1. Mettez les unités hors tension.2. Commencez par brancher tous les cordons sur les unités.3. Branchez les câbles d'interface sur les prises.4. Branchez les cordons d'alimentation sur un socle de prise de courant.5. Mettez les unités sous tension.	<ol style="list-style-type: none">1. Mettez les unités hors tension2. Commencez pas débrancher les cordons alimentation des socles de prise de courant.3. Débranchez les câbles d'interface des prises.4. Débranchez tous les câbles des unités.



Attention:

Remplacez la pile usagée par une pile de référence identique exclusivement - voir la référence IBM - ou par une pile équivalente recommandée par le fabricant. Si votre système est doté d'un module contenant une pile au lithium, vous devez le remplacer uniquement par un module identique, produit par le même fabricant. La pile contient du lithium et présente donc un risque d'explosion en cas de mauvaise manipulation ou utilisation.

- Ne la jetez pas à l'eau.
- Ne l'exposez pas à une température supérieure à 100°C.
- Ne cherchez pas à la réparer ou à la démonter.

Pour la mise au rebut, reportez-vous à la réglementation en vigueur.



Attention:

Si une unité de CD-ROM est installée, prenez connaissance des informations suivantes:

Pour éviter tout risque d'exposition au rayon laser, respectez les consignes de réglage et d'utilisation des commandes, ainsi que les procédures décrites dans le présent document.

Pour éviter une exposition directe au rayon laser, n'ouvrez pas l'unité de CD-ROM. Vous ne pouvez effectuer aucune opération de maintenance à l'intérieur.

DANGER

Certaines unités de CD-ROM contiennent une diode laser de classe 3A ou 3B. Prenez connaissance des informations suivantes:

Rayonnement laser lorsque le carter est ouvert. évitez de regarder fixement le faisceau ou de l'observer à l'aide d'instruments optiques. évitez une exposition directe au rayon.



≥ 32 kg (70.5 lbs)



≥ 55 kg (121.2 lbs)

Attention:

Ce produit pèse un poids considérable. Faites-vous aider pour le soulever.



Attention:

Le courant électrique circulant dans les câbles de communication et les cordons téléphoniques et d'alimentation peut être dangereux. Pour votre sécurité et celle de l'équipement, avant de retirer les carters du serveur, mettez celui-ci hors tension et déconnectez ses cordons d'alimentation, ainsi que les câbles qui le relient aux réseaux, aux systèmes de télécommunication et aux modems (sauf instruction contraire mentionnée dans les procédures d'installation et de configuration).

**VORSICHT**

Aus Sicherheitsgründen bei Gewitter an diesem Gerät keine Kabel anschließen oder l÷sen. Ferner keine Installations-, Wartungs- oder Rekonfigurationsarbeiten durchführen.

Aus Sicherheitsgründen:

- Gerät nur an eine Schutzkontaktsteckdose mit ordnungsgemäß geerdetem Schutzkontakt anschließen.
- Alle angeschlossenen Geräte ebenfalls an Schutzkontaktsteckdosen mit ordnungsgemäß geerdetem Schutzkontakt anschließen.

Signalkabel möglichst einhändig anschließen oder l÷sen, um einen Stromschlag durch Berühren von Oberflächen mit unterschiedlichem elektrischem Potential zu vermeiden.

Elektrische Spannungen von Netz-, Telefon- und Datenübertragungsleitungen sind gefährlich. Um einen Stromschlag zu vermeiden, nur nach den Anweisungen arbeiten, die für Installation, Transport oder Öffnen von Gehäusen dieses Produkts oder angeschlossenen Einheiten gelten.

Kabel anschließen	Kabel l÷sen
<ol style="list-style-type: none">1. Alle Geräte ausschalten und Netzstecker ziehen.2. Zuerst alle Kabel an Einheiten anschließen.3. Signalkabel an Anschlußbuchsen anschließen.4. Netzstecker an Steckdose anschließen.5. Gerät einschalten.	<ol style="list-style-type: none">1. Alle Geräte ausschalten.2. Zuerst Netzstecker von Steckdose l÷sen.3. Signalkabel von Anschlußbuchsen l÷sen.4. Alle Kabel von Einheiten l÷sen.



Achtung:

Eine verbrauchte Batterie nur durch eine Batterie mit der IBM Teilenummer 33F8354 oder durch eine vom Hersteller empfohlene Batterie ersetzen. Wenn Ihr System ein Modul mit einer Lithium-Batterie enthält, ersetzen Sie es immer mit dem selben Modultyp vom selben Hersteller. Die Batterie enthält Lithium und kann bei unsachgemäßer Verwendung, Handhabung oder Entsorgung explodieren.

Die Batterie nicht

- mit Wasser in Berührung bringen.
- über 100 C erhitzen.
- reparieren oder zerlegen.

Die örtlichen Bestimmungen für die Entsorgung von Sondermüll beachten.



Achtung:

Wenn ein CD-ROM-Laufwerk installiert ist, beachten Sie folgendes. Steuer- und Einstellelemente sowie Verfahren nur entsprechend den Anweisungen im vorliegenden Handbuch einsetzen. Andernfalls kann gefährliche Laserstrahlung auftreten.

Das Entfernen der Abdeckungen des CD-ROM-Laufwerks kann zu gefährlicher Laserstrahlung führen. Es befinden sich keine Teile innerhalb des CD-ROM-Laufwerks, die vom Benutzer gewartet werden müssen. Die Verkleidung des CD-ROM-Laufwerks nicht öffnen.

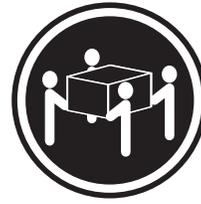
VORSICHT

Manche CD-ROM-Laufwerke enthalten eine eingebaute Laserdiode der Klasse 3A oder 3B. Die nachfolgend aufgeführten Punkte beachten.

Laserstrahlung bei geöffneter Tür. Niemals direkt in den Laserstrahl sehen, nicht direkt mit optischen Instrumenten betrachten und den Strahlungsbereich meiden.



≥ 32 kg (70.5 lbs)



≥ 55 kg (121.2 lbs)

Achtung:

Beim Anheben der Maschine die vorgeschriebenen Sicherheitsbestimmungen beachten.



Achtung:

An Netz-, Telefon- und Datenleitungen können gefährliche elektrische Spannungen anliegen. Um eine Gefährdung des Benutzers oder Beschädigung des Geräts zu vermeiden, ist der Server auszuschalten. Die Verbindung zu den angeschlossenen Netzkabeln, Telekommunikationssystemen, Netzwerken und Modems ist vor dem Öffnen des Servergehäuses zu unterbrechen (sofern in Installations- und Konfigurationsanweisungen nicht anders angegeben).

**PERICOLO**

Per evitare il pericolo di scosse elettriche durante i temporali, non collegare o scollegare cavi, non effettuare l'installazione, la manutenzione o la riconfigurazione di questo prodotto.

Per evitare il pericolo di scosse elettriche:

- collegare il cavo di alimentazione ad una presa elettrica correttamente cablata e munita di terra di sicurezza;
- collegare qualsiasi apparecchiatura collegata a questo prodotto ad una presa elettrica correttamente cablata e munita di terra di sicurezza.

Quando possibile, collegare o scollegare i cavi di segnale con una sola mano per evitare il rischio di scosse derivanti dal contatto con due superfici a diverso potenziale elettrico.

La corrente elettrica circolante nei cavi di alimentazione, del telefono e di segnale è pericolosa. Per evitare scosse elettriche, collegare e scollegare i cavi come descritto quando si effettuano l'installazione, la rimozione o l'apertura dei coperchi di questo prodotto o durante il collegamento delle unità.

Per collegare	Per scollegare
<ol style="list-style-type: none">1. SPEGNERE tutti i dispositivi.2. Collegare prima tutti i cavi alle unità.3. Collegare i cavi di segnale alle prese.4. Collegare il(i) cavo(i) di alimentazione alla presa elettrica.5. ACCENDERE le unità.	<ol style="list-style-type: none">1. SPEGNERE tutti i dispositivi.2. Rimuovere prima il(i) cavo(i) di alimentazione dalla presa elettrica.3. Rimuovere i cavi di segnale dalle prese.4. Rimuovere tutti i cavi dalle unità.



Attenzione:

Quando si sostituisce la batteria, utilizzare solo una batteria IBM o batterie dello stesso tipo o di tipo equivalente consigliate dal produttore. Se il sistema di cui si dispone è provvisto di un modulo contenente una batteria al litio, sostituire tale batteria solo con un tipo di modulo uguale a quello fornito dal produttore. La batteria contiene litio e può esplodere se utilizzata, maneggiata o smaltita impropriamente.

Evitare di:

- Gettarla o immergerla in acqua
- Riscaldarla ad una temperatura superiore ai 100°C
- Cercare di ripararla o smaltirla

Smaltire secondo la normativa in vigore (D.Lgs 22 del 5/2/97) e successive disposizioni nazionali e locali.



Attenzione:

Quando è installata un'unità CD-ROM, notare quanto segue:

L'utilizzo di controlli, regolazioni o l'esecuzione di procedure non descritti nel presente manuale possono provocare l'esposizione a radiazioni pericolose.

L'apertura di un'unità CD-ROM può determinare l'esposizione a radiazioni laser pericolose. All'interno dell'unità CD-ROM non vi sono parti su cui effettuare l'assistenza tecnica. Non rimuovere i coperchi dell'unità CD-ROM.

PERICOLO

Alcune unità CD-ROM contengono all'interno un diodo laser di Classe 3A o Classe 3B. Prestare attenzione a quanto segue:

Aperto l'unità vengono emesse radiazioni laser. Non fissare il fascio, non guardarlo direttamente con strumenti ottici ed evitare l'esposizione diretta al fascio.



≥ 32 kg (70.5 lbs)



≥ 55 kg (121.2 lbs)

Attenzione:

Durante il sollevamento della macchina seguire delle norme di sicurezza.



Attenzione:

La corrente circolante nei cavi di alimentazione, del telefono e di segnale è pericolosa. Per evitare situazioni pericolose per le persone o danneggiamenti all'apparecchiatura, scollegare i cavi di alimentazione, i sistemi di telecomunicazioni, le reti e ed i modem prima di aprire i coperchi del server se non diversamente indicato nelle procedure di installazione e configurazione.

경고문 1



위험

전기 충격을 피하려면 날씨가 나쁠 때(예: 눈 또는 비가 오거나 천둥 번개가 칠 때)는 케이블을 연결하거나 끊지 않도록 하고 이 제품의 설치, 유지보수 또는 재구성 등의 작업을 수행하지 않도록 하십시오.

전기 충격을 피하려면 다음과 같아야 합니다.

- 고압선은 적절한 배선 및 접지 상태의 콘센트로 연결되어야 합니다.
- 이 제품이 접속될 모든 장비도 적절한 배서 상태의 콘센트로 연결되어야 합니다.

다른 전위를 가진 두 표면을 만졌을 때 발생할 수 있는 전기 충격을 피하려면 한 손으로 신호선을 연결하거나 끊으십시오.

전원, 전화 및 통신 케이블로부터 흘러 나오는 전류는 위험합니다. 전기 충격을 피하려면 이 제품이나 접속 장치를 설치, 이동 및 덮개를 열 때 다음 설명에 따라 케이블을 연결하고 끊도록 하십시오.

연결하려면	연결해제하려면
1. 모든 스위치를 켜다.	1. 모든 스위치를 끈다.
2. 먼저 모든 케이블을 장치에 연결한다.	2. 먼저 모든 케이블을 장치에 제거한다.
3. 신호선을 콘센트에 연결한다.	3. 신호선을 콘센트에서 제거한다.
4. 전원을 콘센트에 연결한다.	4. 장치에서 모든 케이블을 제거한다.
5. 장치 스위치를 켜다.	

경고문 2



주의:

배터리를 교체할 때는 IBM 부품 번호 &PN. 또는 제조업체에서 추천하는 동등한 유형의 배터리를 사용하십시오. 시스템에 리튬 배터리를 포함하는 모듈이 있으면 이것은 동일한 제조업체에서 생산된 동일한 모듈 유형으로만 교체하십시오. 배터리에는 리튬이 포함되어 있으므로 제대로 사용, 처리 또는 처분하지 않으면 폭발할 수 있습니다.

다음은 주의하십시오.

- 던지거나 물에 담그지 않도록 하십시오.
- 100°C(212°F) 이상으로 가열하지 않도록 하십시오.
- 수리하거나 분해하지 않도록 하십시오.

지역 법령이나 규정의 요구에 따라 배터리를 처분하십시오.

경고문 3



주의:

CD-ROM 드라이브가 설치되어 있으면 다음 사항을 명심하십시오.

여기에서 지정하지 않은 방식으로 CD-ROM 드라이브를 제어 또는 조절하거나 다른 절차로 사용하면 위험한 방사능 노출이 발생할 수 있습니다.

CD-ROM 드라이브의 덮개를 제거하면 위험한 레이저 방사능이 노출될 수 있습니다. CD-ROM 드라이브 내에는 정비할 수 있는 부품이 없습니다. CD-ROM 드라이브 덮개를 제거하지 않도록 하십시오.

경고문 4

위험

일부 CD-ROM 드라이브에는 클래스 3A 또는 3B 레이저 2급 진공관(다이오드)이 들어 있습니다. 다음 사항을 명심하십시오.

열면 레이저 방사능이 노출됩니다. 광선을 주시하거나 광학 기계를 직접 쳐다보지 않도록 하고 광선에 노출되지 않도록 하십시오.

경고문 5



32kg(70.5 파운드)



55kg(121.2 파운드)

주의:

기계를 들 때는 안전하게 들어 올리십시오.

경고문 10



주의:

전원, 전화 및 통신 케이블로부터 흘러 나오는 전류는 위험합니다. 설치 및 구성 절차에 다른 지시가 없으면, 다치거나 장비 손상이 생기지 않게 하기 위해 서버 덮개를 열기 전에 접속된 전선, 원격 통신 시스템, 네트워크 및 모뎀의 연결을 끊으십시오.

**PELIGRO**

Para evitar una posible descarga eléctrica, no conecte ni desconecte los cables ni lleve a cabo ninguna operación de instalación, de mantenimiento o de reconfiguración de este producto durante una tormenta eléctrica.

Para evitar una posible descarga:

- El cable de alimentación debe conectarse a un receptáculo con una instalación eléctrica correcta y con toma de tierra.
- Los aparatos a los que se conecte este producto también deben estar conectados a receptáculos con la debida instalación eléctrica.

Cuando sea posible, utilice una sola mano para conectar o desconectar los cables de señal a fin de evitar una posible descarga al tocar dos superficies con distinto potencial eléctrico.

La corriente eléctrica de los cables de comunicaciones, teléfono y alimentación puede resultar peligrosa. Para evitar una posible descarga, siga las indicaciones de conexión y desconexión de los cables siempre que tenga que instalar, mover o abrir las cubiertas de este producto o de los dispositivos acoplados.

Instrucciones de conexión	Instrucciones de desconexión
<ol style="list-style-type: none">1. Apague todos los componentes (OFF).2. En primer lugar, conecte todos los cables a los dispositivos.3. Conecte los cables de señal a los receptáculos.4. Conecte los cables de alimentación a las tomas.5. Encienda el dispositivo (ON).	<ol style="list-style-type: none">1. Encienda todos los componentes (ON).2. En primer lugar, retire los cables de alimentación de las tomas.3. Retire los cables de señal de los receptáculos.4. Retire todos los cables de los dispositivos.



Precaución:

Al cambiar la batería, utilice únicamente la batería IBM Número de pieza 33F8354 o un tipo de batería equivalente recomendado por el fabricante. Si el sistema tiene un módulo que contiene una batería de litio, sustitúyalo únicamente por el mismo tipo de módulo del mismo fabricante. La batería contiene litio y puede explotar si no se utiliza, manipula o desecha correctamente.

Lo que no debe hacer

- Tirar o sumergir el producto en agua.
- Exponer el producto a una temperatura superior a 100°C.
- Reparar o desmontar el producto.

Cuando quiera desechar la batería, siga las disposiciones y reglamentaciones locales.



Precaución:

Cuando instale una unidad de CD-ROM, tenga en cuenta la siguiente información.

Si se llevan a cabo controles o ajustes o se utilizan métodos que no se atengan a lo aquí especificado, se puede producir una exposición peligrosa a las radiaciones.

Si se retiran las cubiertas de la unidad de CD-ROM, se puede producir una peligrosa exposición a radiaciones de láser. Dentro de la unidad de CD-ROM no existen piezas reparables. No retire las cubiertas de la unidad de CD-ROM.

PELIGRO

Algunas unidades de CD-ROM tienen incorporado un diodo de láser de Clase 3A o de Clase 3B. Tenga en cuenta la siguiente información.

Cuando la unidad está abierta se generan emisiones de rayos láser. No dirija la mirada al haz, no lo observe directamente con instrumentos ópticos y evite la exposición directa.



≥ 32 kg (70.5 lbs)



≥ 55 kg (121.2 lbs)

Percaución::

Alce la máquina con cuidado; el sobrepeso podría causar alguna lesión.



Percaución:

La corriente eléctrica de los cables de comunicaciones, de teléfono y de alimentación puede resultar peligrosa. Para evitar posibles lesiones o daños del aparato, desconecte los cables de alimentación, los sistemas de telecomunicaciones, las redes y los módems antes de abrir las cubiertas del servidor, salvo que se indique lo contrario en las instrucciones de las operaciones de instalación y configuración.

Safety information

This section contains the safety information with which you need to be familiar, before you service an IBM mobile computer.

General safety

Follow these rules to ensure general safety:

- Observe good housekeeping in the area of the machines during and after maintenance.
- When lifting any heavy object:
 1. Ensure you can stand safely without slipping.
 2. Distribute the weight of the object equally between your feet.
 3. Use a slow lifting force. Never move suddenly or twist when you attempt to lift.
 4. Lift by standing or by pushing up with your leg muscles; this action removes the strain from the muscles in your back. *Do not attempt to lift any objects that weigh more than 16 kg (35 lb) or objects that you think are too heavy for you.*
- Do not perform any action that causes hazards to the customer, or that makes the equipment unsafe.
- Before you start the machine, ensure that other service representatives and the customer's personnel are not in a hazardous position.
- Place removed covers and other parts in a safe place, away from all personnel, while you are servicing the machine.
- Keep your tool case away from walk areas so that other people will not trip over it.
- Do not wear loose clothing that can be trapped in the moving parts of a machine. Ensure that your sleeves are fastened or rolled up above your elbows. If your hair is long, fasten it.
- Insert the ends of your necktie or scarf inside clothing or fasten it with a nonconductive clip, approximately 8 centimeters (3 inches) from the end.
- Do not wear jewelry, chains, metal-frame eyeglasses, or metal fasteners for your clothing. **Remember:** Metal objects are good electrical conductors.
- Wear safety glasses when you are doing any of the following: hammering, drilling soldering, cutting wire, attaching springs, using solvents, or working in any other conditions that might be hazardous to your eyes.
- After service, reinstall all safety shields, guards, labels, and ground wires. Replace any safety device that is worn or defective.
- Reinstall all covers correctly before returning the machine to the customer.

Grounding requirements

Electrical grounding of the computer is required for operator safety and correct system function. Proper grounding of the electrical outlet can be verified by a certified electrician.

Electrical safety

Important

Use only approved tools and test equipment. Some hand tools have handles covered with a soft material that does not insulate you when working with live electrical currents.

Many customers have, near their equipment, rubber floor mats that contain small conductive fibers to decrease electrostatic discharges. Do not use this type of mat to protect yourself from electrical shock.

Observe the following rules when working on electrical equipment.

- Find the room emergency power-off (EPO) switch, disconnecting switch, or electrical outlet. If an electrical accident occurs, you can then operate the switch or unplug the power cord quickly.
- Do not work alone under hazardous conditions or near equipment that has hazardous voltages.
- Disconnect all power before:
 - Performing a mechanical inspection
 - Working near power supplies
 - Removing or installing main units
- Before you start to work on the machine, unplug the power cord. If you cannot unplug it, ask the customer to power-off the wall box that supplies power to the machine and to lock the wall box in the off position.
- If you need to work on a machine that has *exposed* electrical circuits, observe the following precautions:
 - Ensure that another person, familiar with the power-off controls, is near you.

Remember: Another person must be there to switch off the power, if necessary.
 - Use only one hand when working with powered-on electrical equipment; keep the other hand in your pocket or behind your back.

Remember: There must be a complete circuit to cause electrical shock. By observing the above rule, you may prevent a current from passing through your body.
 - When using testers, set the controls correctly and use the approved probe leads and accessories for that tester.
 - Stand on suitable rubber mats (obtained locally, if necessary) to insulate you from grounds such as metal floor strips and machine frames.

Observe the special safety precautions when you work with very high voltages; these instructions are in the safety sections of maintenance information. Use extreme care when measuring high voltages.

- Regularly inspect and maintain your electrical hand tools for safe operational condition.
- Do not use worn or broken tools and testers.
- *Never assume* that power has been disconnected from a circuit. First, *check* that it has been powered-off.
- Always look carefully for possible hazards in your work area. Examples of these hazards are moist floors, nongrounded power extension cables, power surges, and missing safety grounds.
- Do not touch live electrical circuits with the reflective surface of a plastic dental mirror. The surface is conductive; such touching can cause personal injury and machine damage.
- Do not service the following parts (or similar units) *with the power on* when they are removed from their normal operating places in a machine. This practice ensures correct grounding of the units.)
 - Power supply units
 - Pumps
 - Blowers and fans
 - Motor generators
- If an electrical accident occurs:
 - **Use caution; do not become a victim yourself.**
 - **Switch off power.**
 - **Send another person to get medical aid.**

Handling electrostatic discharge-sensitive devices

Any computer part containing transistors or integrated circuits (ICs) should be considered sensitive to electrostatic discharge (ESD). ESD damage can occur when there is a difference in charge between objects. Protect against ESD damage by equalizing the charge so that the machine, the part, the work mat, and the person handling the part are all at the same charge.

Notes:

1. Use product-specific ESD procedures when they exceed the requirements noted here.
2. Make sure that the ESD protective devices you use have been certified (ISO 9000) as fully effective.

Use the following precautions when handling ESD-sensitive parts.

- Keep the parts in protective packages until they are inserted into the product.
- Avoid contact with other people.
- Wear a grounded wrist strap against your skin to eliminate static on your body.
- Prevent the part from touching your clothing. Most clothing is insulative and retains a charge even when you are wearing a wrist strap.
- Select a grounding system, such as those listed below, to provide protection that meets the specific service requirement.

Note: The use of a grounding system is desirable but not required to protect against ESD damage.

- Attach the ESD ground clip to any frame ground, ground braid, or green-wire ground.
- Use an ESD common ground or reference point when working on a double-insulated or battery-operated system. You can use coax or connector-outside shells on these systems.
- Use the round ground-prong of the ac plug on ac-operated computers.
- Use the black side of a grounded work mat to provide a static-free work surface. The mat is especially useful when handling ESD-sensitive devices.

Safety inspection guide

The intent of this inspection guide is to assist you in identifying potentially unsafe conditions on these products. Each machine, as it was designed and built, had required safety items installed to protect users and service personnel from injury. This guide addresses only those items. However, good judgment should be used to identify potential safety hazards due to attachment of non-IBM features or options not covered by this inspection guide.

If any unsafe conditions are present, you must determine how serious the apparent hazard could be and whether you can continue without first correcting the problem.

Consider these conditions and the safety hazards they present:

- Electrical hazards, especially primary power (primary voltage on the frame can cause serious or fatal electrical shock).
- Explosive hazards, such as a damaged CRT face or bulging capacitor
- Mechanical hazards, such as loose or missing hardware

The guide consists of a series of steps presented in a checklist. Begin the following checks with the power off, and the power cord disconnected.

1. Check exterior covers for damage (loose, broken, or sharp edges).
2. Power-off the computer. Disconnect the power cord.

3. Check the power cord for the following:
 - a. A third-wire ground connector in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and frame ground.
 - b. The power cord should be the appropriate type as specified in the parts listings.
 - c. Insulation must not be frayed or worn.
4. Remove the cover.
5. Check for any obvious non-IBM alterations. Use good judgment as to the safety of any non-IBM alterations.
6. Check inside the unit for any obvious unsafe conditions, such as metal filings, contamination, water or other liquids, or signs of fire or smoke damage.
7. Check for worn, frayed, or pinched cables.
8. Check that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

Problem determination tips

Because there is a large variety of hardware and software combinations that can be encountered, use the following information to assist you in problem determination.

- Verify any recent hardware changes. See “Hardware considerations” on page 117.
- Verify any recent software changes. See “Software considerations” on page 116.
- Verify that the BIOS is at the latest level. See “BIOS” on page 116.
- Verify that the drivers are at the latest levels. See “Drivers” on page 116.
- Verify that the Configuration matches the hardware. See “System resource conflicts” on page 117.
- Verify that the Diagnostics diskette is at the latest level. See “File updates”.

As you go through problem determination, consider these questions.

- Do diagnostics fail?
- What, when, where, single, or multiple systems?
- Is the failure repeatable?
- Has this configuration ever worked?
- If it has been working, what changes were made prior to it failing?
- Is this the original reported failure?

Important

To eliminate confusion, systems are considered identical only if the following are *exactly* identical for *each* system:

1. Machine type and model
2. BIOS level
3. Adapters/attachments (in same locations)
4. Address jumpers/terminators/cabling
5. Software versions and levels
6. Reference/Diagnostics Diskette
7. Configuration options set in the system
8. Setup for operation system control files

Comparing the configuration and software setup between “working” and “non-working” systems will often resolve problems.

File updates

Use the IBM support area on the World Wide Web (WWW) to download Diagnostic, BIOS Flash, and Device Driver files.

<http://www.ibm.com/support>

Adding adapters to the system

When adapters are added to the system, an area in memory has to be allocated to run its programs. This can be done with either **hardware switches** or **software mapping**.

If there is a conflict in software mapping, then the following may be true.

- The first device to attach to an IRQ, DMA, I/O Address, or RAM location will probably function. The second device will not be found.
- Standalone diagnostics might function properly because the device that was found is the only device running.

Software configuration conflicts occur when the following are true.

- Hardware has a different configuration than the software that is using it expects.
- Hardware memory address space is in conflict with memory used by the application software.

Software considerations

Suspect a software failure if one of the following is true.

- Hardware diagnostics run error-free.
- Swapping hardware components fails to isolate the problem.

A software problem might be the result of a mismatch between the hardware and the operating system device drivers or direct drivers.

BIOS

The BIOS acts as an interface between the system hardware, application software, and the operating system.

The BIOS contains the instructions to operate the basic system components:

- Keyboard
- Serial and parallel ports
- Diskette drive
- Hard disk drive
- VGA display
- Clock
- Memory controller.

The BIOS then starts the IPL or Boot functions.

Drivers

Device drivers are the BIOS for additional hardware. They are the communicators of the hardware assignments to the operating system, including the following:

- IRQ level
- DMA channel
- I/O address
- ROM or RAM.

Some device drivers like HIMEM.SYS are position sensitive and must be placed before other device drivers in the CONFIG.SYS file.

Not all device drivers are found in the CONFIG.SYS file. Advanced operating systems use .INI files to set up and start devices.

Device drivers can access the hardware in five ways.

- **Operating system direct to hardware using a direct driver**

Direct drivers, which bypass BIOS, have the advantage of faster throughput, but the disadvantage of limited error-handling capability and reduced software and hardware compatibility and flexibility. This method is not used in the IBM PC Series systems.

- **Operating system to BIOS to hardware**

This is the recommended way. It's the most flexible because it is independent of the hardware.

- **Applications to operating system to BIOS to hardware**

This method is inflexible and is dependent on the operating system.

- **Applications to BIOS to hardware**

This method has some flexibility but it is dependent on the BIOS.

- **Applications to hardware**

This method is dependent on the hardware and is very inflexible. However, it is very fast, very efficient, and it has no overhead.

Hardware considerations

Use the following tools to help identify and resolve hardware-related problems.

- Power-on self-test (POST)
- POST Beep codes
- Test programs
- Error messages

POST does the following operations.

- Checks some basic system board operations
- Checks the memory operation
- Starts the video operation
- Verifies that the diskette drive is working
- Verifies that the hard disk drive is working

Use the test programs that come with this HMM or with the system you are servicing to test the IBM components of the system and some external devices. Also, from the DOS prompt or from OS/2 Utilities, use the **CHKDSK** command to check and repair hard disk data allocation errors.

Error messages generated by the software (the operating system or application programs), generally are text messages. However, error messages can be text, numeric, or both text and numeric.

Any time there is an error message indicating a problem with the system, follow the General Checkout procedures in this HMM to resolve the problem.

Basically, there are five types of error messages.

- **POST error messages** are displayed when the POST finds problems with the hardware or detects a change in the hardware configuration.
- **POST Beep codes** are sounds emitted from the speaker if the POST finds a problem. One beep indicates that the POST completed successfully. Multiple beeps indicate a problem was found.
- **Diagnostic error messages** are displayed when a test program finds a problem with a hardware component.
- **Software-generated error messages** are displayed if a problem or conflict is found by an application program, the operating system, or both. For an explanation of these messages, refer to the information supplied with the installed software package. Also, refer to "Software considerations" on page 116.
- **Multiple messages** occur when the first error causes additional errors. Follow the suggested action of the first error displayed.

System resource conflicts

System failures occur when there are system resource conflicts with the following:

- Interrupt Request Queue (IRQ)
- Direct Memory Access (DMA)

- I/O Address
- ROM and RAM Addresses.

IRQ

- Assigns a unique interrupt request line to every I/O device (line numbers range from 0 to 15).
- Interrupts the processor to force it to service the request.
- Handles interrupts on a priority basis (low numbers have the highest priority).
- Queues interrupt request.

IRQ conflicts occur when there are multiple assignments to the same interrupt level. If there is an IRQ conflict, the system will hang. Use the systems diagnostics to check for multiple assignments to the same interrupt level before replacing any hardware component.

DMA

- **Accesses the memory by bypassing the processor.** This allows the processor more time for applications and programs.
- Accesses memory directly from the serial and parallel ports on some systems.
- **Accesses memory directly from some adapters using a DMA channel.** This allows the adapter to operate faster.
- **Provides from 4 to 15 DMA channels.**The number varies depending on the system.

If multiple assignments of the same DMA channel occur, the system will hang. Use the system diagnostics to check for multiple assignments to the same DMA channel before replacing any hardware components.

I/O address

A unique I/O address is assigned to each system component.

If multiple assignments of the same I/O address occur, the system will hang. Use the **DOS MEM** command to check for multiple assignments to the same I/O address before replacing any hardware component.

ROM and RAM Addresses

Adapter cards with processors can contain RAM and ROM. If the adapter cards have onboard memory, then the following are true.

- ROM contains operating instructions for the adapter I/O.
- RAM is used for buffering.

Two adapters using the same memory area will cause a failure. This failure might appear as a hardware failure.

The IRQ levels, DMA channels, I/O address, and ROM and RAM addresses all become potential conflicts and system problems. When conflicts arise, they might show up as system hangs, lost or missing devices, incorrect or bad data, or failing diagnostics. **Always eliminate conflicts in these areas before replacing any hardware components.**

Miscellaneous information

Acronyms, Abbreviations, and Terms

Term	Information
ACPA/A	Audio Capture and Playback Adapter
ADP	Automatic Data Processing
AGP	Advanced Graphics Port
Alt	Alternate
ANSI	American National Standards Institute
ARTIC	A Real Time Interface Coprocessor
ASCII	American National Standard Code for Interface Interchange
AT	Advanced Technology (refer to AT Bus)
AVC	Audio Video Connection
BIOS	Basic Input/Output System
bps	Bits Per Second
BPS	Bytes Per Second
CCITT	The International Telephone and Telegraph Consultative Committee
CCS	Common Command Set
CCSB	Common Complete Status Block
CCSB	Configuration Control Sub Board
CD	Compact Disc
CDPD	Cellular Digital Packet Data
CD-ROM	CD Read-Only Memory
CGA	Color Graphics Adapter (See EGA)
CRC	Cyclic Redundancy Check
CRT	Cathode Ray Tube
CRU	Customer Replaceable Unit
CSA	Canadian Standards Association
CSD	Corrective Service Diskette
DASD	Direct Access Storage Device (hard disk)
DMA	Direct Memory Access
DRAM	Dynamic Random Access Memory
ECA	Engineering Change Announcement
ECC	Error Correction Code
EGA	Enhanced Graphics Adapter
ESD	Electrostatic Discharge
ESDI	Enhanced Small Device Interface
EEPROM	Electrically Erasable Programmable Read-Only Memory
EWS	Energy Work Station
FC	Fibre Channel
FRU	Field Replaceable Unit (replaceable part)
GBIC	Gigabit Interface Converter
GPIB	General Purpose Interface Bus (IEEE 348)
GSA	General Services Administration
Ht	Height
IDE	Integrated Drive Electronics
I/O	Input/Output
IC	Integrated Circuit
IEEE	Institute of Electrical and Electronics Engineers
IEC	International Electrotechnical Commission
IML	Initial Machine Load
IPL	Initial Program Load
IRQ	Interrupt Request
ISA	Industry Standard Architecture

Term	Information
ISO	International Organization for Standardization
ISDN	Integrated-Services Digital Network
LAN	Local Area Network
LBA	Local Block Address
LED	Light Emitting Diode
LTB	Local Transfer Bus
LUN	Logical Unit Number (refer to SCSI)
MAP	Maintenance Analysis Procedure
MCGA	Modified Color Graphics Adapter
MCA	Micro Channel Architecture (bus structure)
MHz	Mega Hertz (million cycles per second)
MIDI	Musical Instrument Digital Interface
MM	Multimedia
N/A	Not Available or Not Applicable
NDD	National Distribution Division
NDIS	Network Driver Interface Specification
NMI	Non-Maskable Interrupt
NSC	National Support Center
NVSRAM	Non-Volatile Static Random Access Memory
OEM	Original Equipment Manufacturer
PCI	Peripheral Component Interconnect
PCMCIA	Personal Computer Memory Card International Association
POS	Programmable Option Select
PUN	Physical Unit Number (refer to SCSI)
RAID	Redundant Array of Inexpensive Disks
RAM	Random Access Memory (read/write)
RGB	Red Green Blue (refer to monitors)
RIPL	Remote Initial Program Load
ROM	Read-Only Memory
SASD	Sequential Access Storage Device (Tape)
SCB	Subsystem Control Block
SCSI	Small Computer Systems Interface
SCSI ID	SCSI Identification Number
SPD	Software Product Description
SR	Service Representative
SRAM	Static Random Access Memory
SSA	Serial Storage Architecture
SVGA	Super Video Graphics Array (800x600x16)
STN	Super Twisted Nematic
T/A	NDD Technical Advisor (see your Marketing Representative)
TDD	Telecommunications Device for the Deaf
TFT	Thin-Film Transistor
TPF	ThinkPad File
TSR	Terminate and Stay Resident
UL	Underwriters Laboratory
VCA	Video Capture Adapter
VESA	Video Electronics Standards Association
VGA	Video Graphics Array (640x480x16)
VPD	Vital Product Data
VRAM	Video Random Access Memory
WORM	Write Once Read Many (storage medium)
XGA	Extended Graphics Array
Y/C	Luminance/Chrominance Signal (Video)

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