

IBM Fibre Channel



Hardware Maintenance Manual

Fibre Channel Hardware Maintenance Manual

Note: Before using this information and the product it supports, be sure to read the general information under "Notices" on page 400.

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Fibre Channel Hardware Maintenance Manual

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Chapter 1. IBM Fibre Channel

Note: If you are using a PDF version of this book, please be patient in allowing the software to take you from a link to its destination.

Fibre Channel technology is outlined in the *Information Systems - Fibre Channel Protocol for SCSI (small computer system interface -FCP)* standard, revision 12, 30 May 1995. Fibre Channel is a high-speed data transport technology used for mass storage and networking.

The IBM® Host Bus Adapter connects:

- Mainframe computers
- Super computers
- Workstations
- Storage devices
- Servers

Using a Fibre Channel Arbitrated Loop (FC-AL), 126 devices can be supported, compared to 15 devices with Ultra SCSI.

Fibre Channel supports data transfer rates of 100 MB per second. A multimode optical interface is used for distances up to 500 meters. With increased connectivity and performance, Fibre Channel is the technology preferred and used by system designers.

About this book

This hardware maintenance manual is designed to accompany the *Fibre Channel Problem Determination Guide*. This manual contains basic information, such as specifications, replacement and installation procedures, and symptom lists, about many of the components of a Fibre Channel configuration. This information will be useful in completing the tasks given in the problem determination procedures outlined in the *Fibre Channel Problem Determination Guide*.

This manual's companion guide, the *Fibre Channel Problem Determination Guide*, should always be your starting point when attempting to isolate and solve problems that may occur in your Fibre Channel configurations.

Note: The component information provided in this manual has been extracted from the individual hardware maintenance manuals for each component. Therefore, you may find it helpful to refer to the individual hardware maintenance manuals for specific components.

Diagnostics and test information

Start with the "General checkout" sections in each chapter of this Fibre Channel hardware maintenance manual to assist you in diagnosing the IBM Fibre Channel products described within this manual.

For Error Codes and Error Messages, refer to the "Symptom-to-FRU index" of the server that the Fibre Channel Hub, Adapter, or RAID Controller is connected to.

Note: For information about managed hubs and switches that may be in your installation, refer to the individual publications for those devices:

- *IBM 3534 SAN Fibre Channel Managed Hub Installation and Service Guide SY27-7616*
- *IBM SAN Fibre Channel Switch 2109 Model S8 Installation and Service Guide*
- *IBM SAN Fibre Channel Switch 2109 Model S16 Installation and Service Guide SG26-7352*

This installation and service information can be accessed on the World Wide Web:

<http://www.storage.ibm.com/ibmsan/products.htm>

Chapter 2. Type 3523 Fibre Channel Hub and GBIC

Note: The problem determination (PD) maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

The type 3523 Fibre Channel Hub and GBIC are compatible with the following IBM products:

- Fibre Channel Adapter (FRU 01K7354)
- IBM FAS/T Host Adapter (FRU 09N7292)
- Type 3526 Fibre Channel RAID controller

The IBM Fibre Channel Hub is a 7-port central interconnection for Fibre Channel Arbitrated Loops that follow the ANSI FC-AL standard. Each Fibre Channel Hub port receives serial data from an attached node and retransmits the data out of the next hub port to the next node attached in the loop. Each reception includes data regeneration (both signal timing and amplitude) supporting full-distance optical links.

The Fibre Channel Hub detects any loop node that is missing or is inoperative and automatically routes the data to the next operational port and attached node in the loop. LED indicators provide status information to indicate whether the port is active or bypassed.

Each port requires a Gigabit Interface Converter (GBIC) to connect it to each attached node. The Fibre Channel Hub supports any combination of short-wave or long-wave optical GBICs. The GBICs are *hot-pluggable* into the Fibre Channel Hub, which means you can add host computers, servers, and storage modules to the arbitrated loop dynamically without powering off the Fibre Channel Hub or any connected devices. If you remove a GBIC from a Fibre Channel Hub port, that port is automatically bypassed. The remaining hub ports continue to operate normally with no degradation of system performance. Conversely, if you plug a GBIC into the Fibre Channel Hub, it is automatically inserted and becomes a node on the loop if valid Fibre Channel data is received from the device.

Data transfer within the Fibre Channel Hub is implemented in serial differential Positive Emitter Coupled Logic (PECL) AC coupled logic. Each Fibre Channel Hub port monitors the serial data input stream as well as the GBIC connected to it.

The following conditions cause the Fibre Channel Hub to bypass a port:

- TX_FAULT: Detects a GBIC transmitter fault.
- RX_LOS: Detects a loss of received signal amplitude from the device.
- MOD_DEF: Detects the absence of a GBIC.

The Fibre Channel Hub circuitry detects off-frequency data, excessive jitter, or inadequate edge transition density on a per-port basis. The Fibre Channel Hub uses the standardized AMP SCA2 20-pin connector to implement hot plugging. Surge currents, caused by hot plugging, are minimized by slow-start circuitry and a pin-sequencing procedure on the GBIC. Electrostatic discharge (ESD) transients are minimized by means of sequenced connector contacts.

The Fibre Channel Hub includes a universal power supply that can operate from 95 to 250 V ac and from 50 to 60 Hz.

General checkout

Installation and operational problems in an arbitrated loop environment are typically caused by one of the following:

- Faulty cabling or cable connector
- Incorrect cable plugging
- Faulty GBIC
- Faulty hubs
- Invalid Fibre Channel signaling from the host bus adapter (HBA) or disk array
- Device driver or microcode conflicts between the HBAs and other devices.

The following information will help you to isolate and correct the physical layer problems. For protocol-related problems, such as inoperability between devices, see the documentation that came with the individual devices.

Port Status LEDs

The hub provides two status LEDs for each port. Use these LEDs to help you quickly diagnose and recover from problems.

The upper, green LED is lit when an operational GBIC is installed. The lower, amber LED is lit when the port is in the bypass mode. In the bypass mode, a port is disabled, which prevents erratic signals or data from disrupting loop activity. The bypass mode could be triggered by the loss of valid signal or by a GBIC fault. The combination of green and amber LEDs indicates one of the four following states.

Table 1. Port Status LEDs.

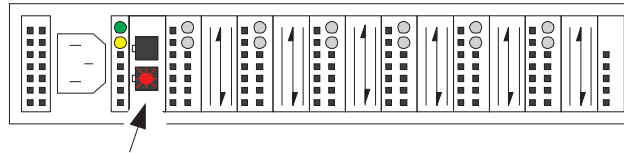
Green LED	Amber LED	Port State
Off	Off	No GBIC Installed
On	Off	Operational GBIC; Valid Signal
Off	On	Faulty GBIC; Port Bypassed
On	On	Operational GBIC; No Valid Signal; Port Bypassed

Verifying GBIC and cable signal presence

Note: Do *not* look directly into any fiber cable or GBIC optical output. Read Appendix B, "Related service information," on page 369. To view an optical signal, use a mirror to view the reflected light.

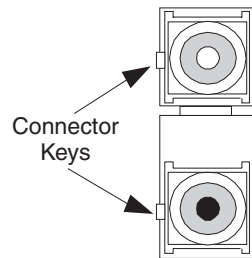
Verifying signal presence

In addition to verifying port LED status, you can verify signal presence by using a mirror to look for a reflected light at the fiber-optic cable ends and the GBIC transmitter. To verify signal presence at the hub end of a link, insert a GBIC into the hub and place a mirror at the bottom of the SC connector. If a signal is present, you will see a low intensity red light in the mirror reflecting from the GBIC transmitter.



Verifying node end

To verify the integrity of the fiber-optic cable at the node end of a link, make sure the cable is attached to the GBIC at the hub and the hub is turned on. Dual SC fiber-optic cable connectors are keyed and will insert into a GBIC in one direction only. Place a mirror at the node end of the link. A low intensity red light is visible in the mirror reflection of one of the SC leads, as shown in the following figure.



If a fiber-optic cable has good transmitter output but a broken or degraded receiver lead, the end node might sense a *loop down* state. Because the transmitter is good, the hub responds to the end node valid Fibre Channel signal and adds the device to the loop. But, because the end node is not receiving Fibre Channel signals, it will stream loop-down sequences onto the loop. This prevents all data communications among the devices on the loop and will continue to do so until the condition is corrected.

Verifying hub end

To verify the integrity of the fiber-optic cable at the hub end, make sure the fiber-optic cable is plugged into the host bus adapter at the host or into a disk-array controller and that the device is enabled on the loop. Using a mirror, examine the cable SC leads to verify that a low-intensity red light is visible on the receiver lead.

Note: Some fiber-optic cables are marked with an A on the receiver lead and a B on the transmitter lead and are keyed. Some multimode cables plugged into a GBIC, HBA, or disk array controller are key-oriented with the B lead inserted into the device transmitter. Place a mirror on the opposite end of the cable to see the low-intensity red light on the A receiver lead.

Features

The Fibre Channel Hub is designed with seven modular user-configurable interface ports. These seven ports comply with the GigaBit Interface Converter (GBIC) specification. GBICs are available in two media types:

- Long-wave optical
- Short-wave optical

This section covers both the Fibre Channel Hub and the GBICs.

The following list summarizes the features of the Fibre Channel Hub:

- Seven configurable media-interface optical ports provide high performance.
- Plug and Play provides fault tolerance for online system configuration changes.

- Modular Gigabit Interface Converter (GBIC) transceiver design allows you to use ports when needed.
- Cascadable ports allow up to 127 connections (where one port is reserved for connection to fabric or switch-active ports) or support of multiple loop implementations.
- Simplified cable management can be used for centralized storage management applications.
- Hot-pluggable GBIC provides an optimal solution for entry storage interconnect needs.
- Half-rack width (1U = 1.75 in.) low profile hub packaging offers highest port density in single 1 unit height rack mount.
- Auto-sensing power supply supports 95 to 250 V ac and 50 to 60 Hz.

Fibre Channel long-wave GBIC

Features of the long-wave optical GBIC include:

- Full-speed: 1.0625 Gbps
- Uses single-mode 9 micron fiber
- Wavelength: 1310 nm
- Non-OFC laser
- Uses dual SC fiber-optic connectors
- Fiber lengths: 1 meter minimum, 10 kilometers maximum

Fibre Channel short-wave GBIC

Features of the short-wave optical GBIC include:

- Compliant with Fibre Channel FC-PH-2 physical layer option 100-M5-SN-I
- Full-speed: 1.0625 Gbps
- Wavelength: 780 nm
- Non-OFC laser
- Supports multimode 50 micron fiber (1 meter/minimum, 500 meters/maximum)
- Uses dual SC fiber-optic connectors

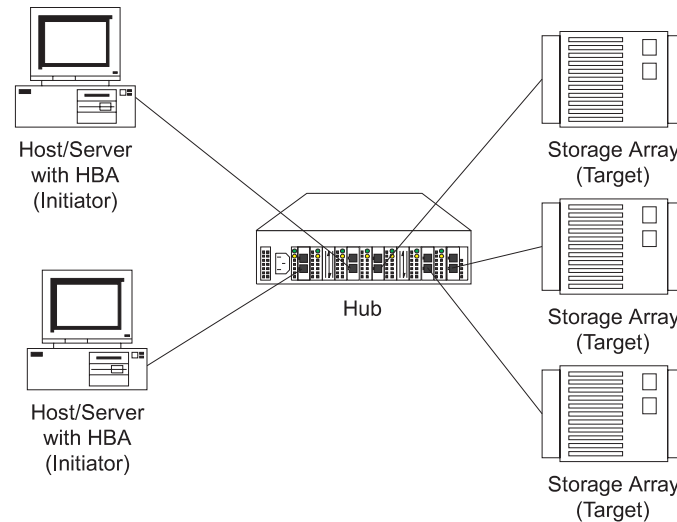
Fibre Channel-Arbitrated Loop

The Fibre Channel-Arbitrated Loop (FC-AL) is an ANSI standard (X3T11) product designed to provide shared bandwidth over low-cost media. Early adapters primarily use the SCSI protocol transported over Fibre Channel for distributed server and storage-cluster applications. The Fibre Channel Hub is a central point of interconnection designed to maintain a fault-tolerant physical loop topology. The Fibre Channel Hub can also be used to implement configurations that extend the size of the FC-AL loop to its maximum size of 127 active loop ports (includes one optional Fabric-Loop port).

Additional service information

Applications and configurations

The Fibre Channel Hub modular interface provides flexibility and is upgradable to available short-wave and long-wave optical Fibre Channel product port interfaces. Fibre Channel products that are commonly interconnected to the Fibre Channel Hub are Fibre Channel host bus adapters, FC-AL storage devices, and FC-AL storage arrays. SCSI initiators (workstations and servers) set up and initiate the transfer of data to or from the storage devices. The storage devices that receive the requests made by the SCSI initiators are the SCSI targets. Initiators and targets represent individual nodes that are linked by the shared FC-AL.



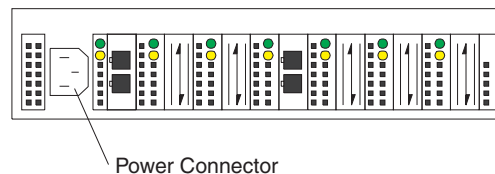
Power on systems check — Fibre Channel Hub

Power on the storage modules first, then the controller and the Fibre Channel Hub, then everything else.

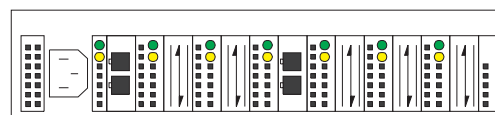
Note: Make sure the Fibre Channel Hub is powered on before the host adapter to insure proper loop initialization.

To insure proper operation:

1. Connect the power cord to the Fibre Channel Hub, then to the electrical outlet.



2. Power on the attached FC-AL compatible nodes.
3. Check the Device Active (green) LEDs on the Fibre Channel Hub ports.



Active On
Green LEDs on Top Row

LED On

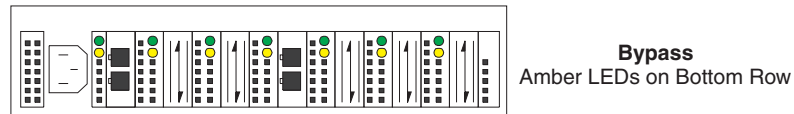
This indicates that a GBIC is present and functioning properly.

LED Off

This indicates a fault condition. Examples of a fault condition include: a GBIC transmitter fault, an improperly seated GBIC, an absent GBIC, or another failed device. The port will be in the bypass state, which precludes the port from participating in the FC-AL. This is the normal status of operation for Fibre Channel Hub ports in which GBICs are not installed.

Note: FC-AL compatible nodes must perform loop initialization procedures at power on to function properly on the loop. FC-AL nodes also perform loop initialization or reinitialization depending on their prior state of operation.

4. Check the Port Bypass (amber) LEDs.



LED On If the Active (green) LED of the port is off, the port is nonoperational and the Bypass (amber) LED for the port is on. If a properly functioning port (the Active green LED is on) with a GBIC present also has the Bypass LED on, either the loss of signal or poor signal integrity has caused the port to go into the bypass state. When the port is in this state, it cannot participate in the FC-AL.

The bypass state is also the normal status condition when no GBIC is present in the port, a GBIC is present but not attached to a FC-AL node, or a GBIC is attached to a cable assembly with nothing attached at the opposite end. Replacing such a port (or removing and reinserting the GBIC into the same port twice) is considered to be a loop configuration change which invokes the Loop Initialization Procedure.

LED Off

This indicates that the Fibre Channel Hub port and device are fully operational and actively participating in the FC-AL.

5. The FC-AL should be fully operational. Check that proper loop discovery has taken place and all required devices are participating in the loop. Some host bus adapters might provide this level of functionality or it might be resident in the application software on the host operating system.

Installation procedures

This section contains the following installation information:

- “Installing the Fibre Channel Hub rack”
- “Installing the GBIC” on page 11
- “Removing the GBIC” on page 12

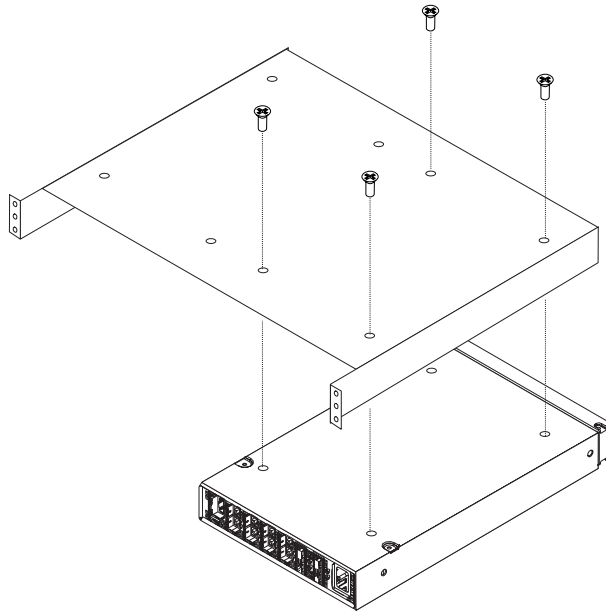
Installing the Fibre Channel Hub rack

The Fibre Channel Hub comes with a tray and bezel for installation in a rack.

Note: Also use this procedure to assist in removing the Fibre Channel Hub from a rack shelf.

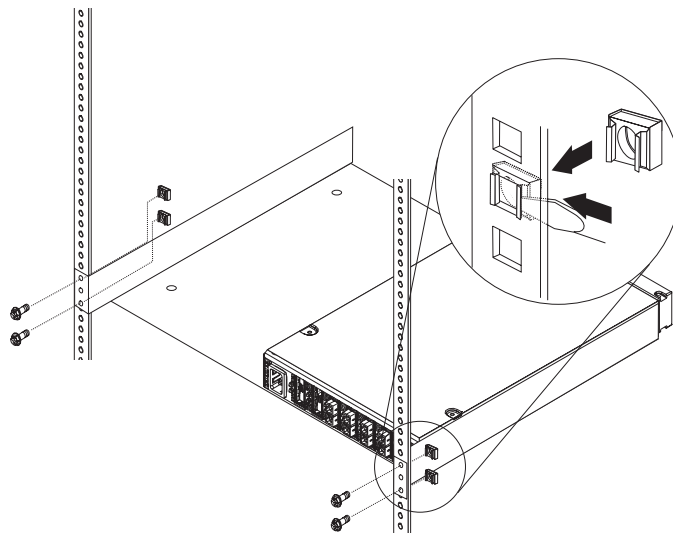
To install the Fibre Channel Hub in the rack:

1. Turn the hub upside down and place it on a flat surface.
2. Turn the tray upside down and place it on the hub.
3. Align the four holes in the tray with the holes in the hub. Line up the back lip of the tray with the back side of the hub.
4. Using a Phillips head screw driver, install the four smaller screws in the aligned holes.

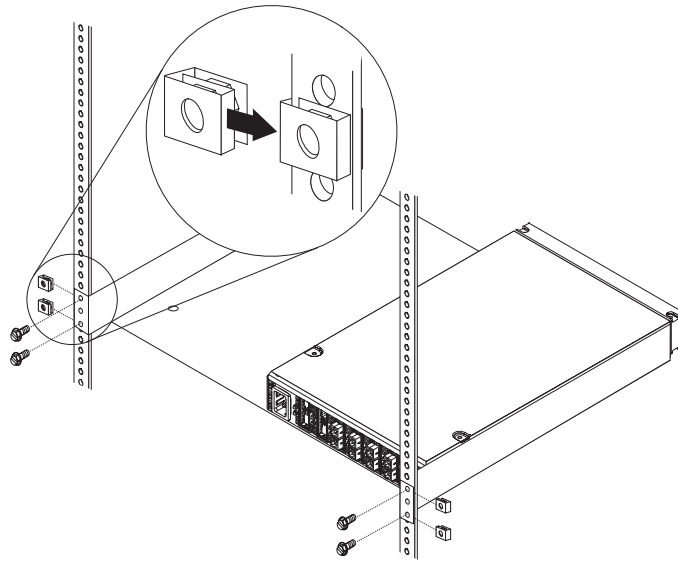


5. Turn the tray over so that the hub is on top of the tray.
6. Find the rack position into which you are installing the Fibre Channel Hub; then, take four clip nuts and install them in the rear of the rack. Make sure you have installed one in each screw hole you will be using for the tray installation.

If the rack has square holes, snap the M6 clip nuts into place on the rear of the rack.



If the rack has round holes, slide the 10-32 clip nuts into place on the rear of the rack.

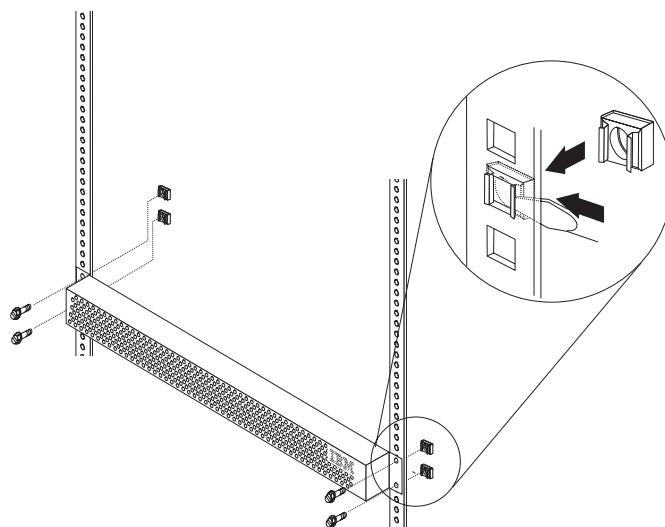


7. Pick up the tray and line up the top and bottom screw holes with the clip nuts on the rack. While holding the tray in place, install four of the larger screws.

If the rack has square holes and you used the M6 clip nuts, use the M6 hex washer headed screws.

If the rack has round holes and you used the 10-32 clip nuts, use the 10-32 hex washer headed screws.

8. Install the remaining four clip nuts in the front of the rack. Be sure to line them up opposite the hub and tray.
9. Line up the top and bottom bezel screw holes with the clip nuts on the rack. While holding the bezel in place, install four of the larger screws.



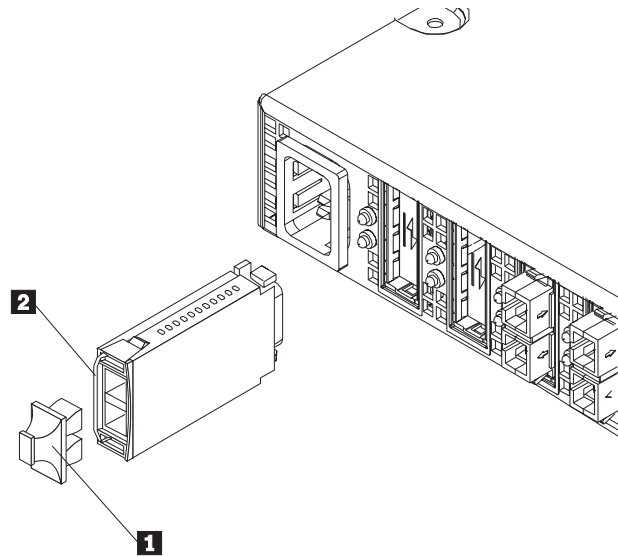
If the rack has square holes, use the M6 clip nuts and hex washer headed screws.

If the rack has round holes, use the 10-32 clip nuts and hex washer headed screws.

Installing the GBIC

There are several different types of GBICs available. You can insert any type of GBIC into any available hub port.

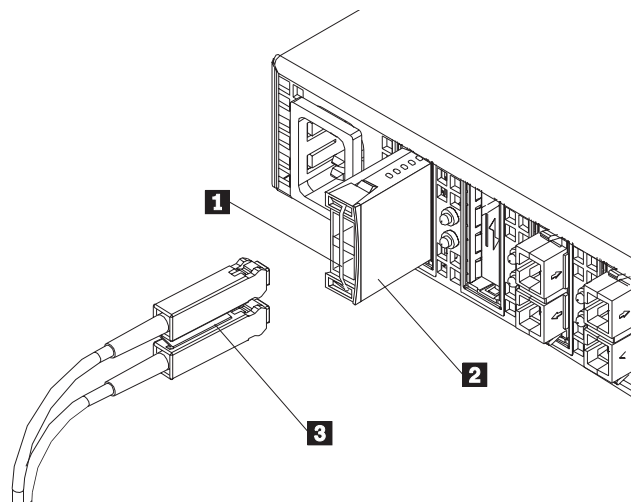
1. Remove the plastic cover (1) from the GBIC (2).



2. Insert the cables into the GBIC.

If the GBIC you are installing has a metal latch, move the latch to the unlocked (center) position (1). Slide the GBIC (2) into the port, then move the GBIC latch back to the locked position (flush with the rear of the GBIC). Connect the fiber-optic cable (3) to the installed GBIC.

If the GBIC you are installing does not have a metal latch, slide the GBIC (2) into the port. Connect the fiber-optic cable (3) to the installed GBIC.



For cable management information, go to <http://www.pc.ibm.com/support/> on the World Wide Web.

Removing the GBIC

To remove a GBIC that does not have a metal latch from the hub port:

1. Press the opposing tabs on the GBIC toward each other while slowly removing the module from the hub (with the fiber-optic cables still installed).
2. Remove the cable assembly from the GBIC.

To remove a GBIC that has a metal latch from the hub port: (Refer to the figures in “Installing the GBIC” on page 11.)

1. Remove the fiber-optic cable assembly from the GBIC.
2. Move the latch to the unlocked (center) position.
3. Press the opposing tabs on the GBIC toward each other while slowly removing it from the port.

Symptom-to-FRU index

The Symptom-to-FRU lists symptoms, errors, and the possible causes. The most likely cause is listed first.

The PD maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

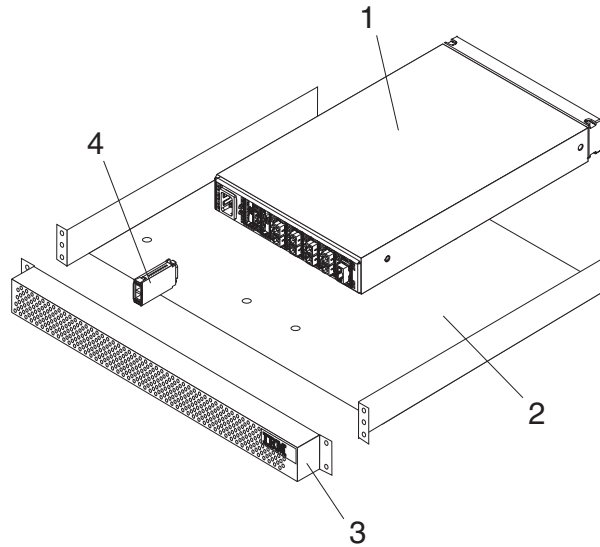
Note:

1. Always start with the “General checkout” on page 4. For IBM devices not supported by this index, refer to the manual for that device.
2. Do *not* look directly into any fiber cable or GBIC optical output. Read Appendix B, “Related service information,” on page 369. To view an optical signal, use a mirror to view the reflected light.

Table 2. Symptom-to-FRU index for Type 3523 Fibre Channel Hub and GBIC.

Problem	FRU/Action
GBIC installed in one or more ports but no LED is lit.	<ol style="list-style-type: none"> 1. Power cord 2. Power source
GBIC installed but only the amber LED is lit.	<ol style="list-style-type: none"> 1. Reseat GBIC 2. GBIC
GBIC installed and both green and amber LEDs are lit.	<p>The hub is not receiving a valid Fibre Channel signal from the end node. Do the following:</p> <ol style="list-style-type: none"> 1. Unplug the fiber cable from the node and, using a mirror, verify that an optical signal is present on the cable. If no red light is visible, replace the cable. 2. Using a mirror, examine the SC connectors on the HBA or disk controller. If no red light is visible, check the HBA or disk controller. 3. If a light is present on both the cable lead and the end node, check the HBA or the disk controller.
GBIC is installed, only the green LED is lit, but no communication occurs between the devices.	<p>The hub is receiving a valid Fibre Channel signal from the end device, but no upper-level protocols are active.</p> <ol style="list-style-type: none"> 1. Verify that the proper HBA device drivers are loaded for the appropriate operating system and that the host has been configured to recognize the attached disk devices. 2. Unplug the fiber cable from the end node and verify that an optical signal is present on the cable lead. If no signal is present, the lead of the cable might be defective. Replace the cable.

Parts listing (Type 3523 Fibre Channel Hub & GBIC)



Index	Fibre Channel Hub (Type 3523)	FRU
1	Port Fiber Hub Assembly	01K6738
2	HUB Tray Assembly	10L7042
3	HUB Tray Bezel	10L7041
4	Short-Wave GBIC	03K9206
	Long-Wave GBIC (option)	03K9208
	Misc. Hardware Kit	01K6739

Chapter 3. Fibre Channel Adapter (FRU 01K7354)

Note: The problem determination (PD) maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

The Fibre Channel Adapter (FRU 01K7354) is compatible with the following IBM products:

- Type 3523 Fibre Channel Hub and GBIC
- Type 3526 Fibre Channel RAID controller
- Type 2109 Fibre Channel Switch
- Type 3534 Managed Hub

Appendix A, "Using IBM Fast!UTIL," on page 361 provides detailed configuration information for advanced users who want to customize the configuration of the Fibre Channel Adapter (FRU 01K7354).

General checkout

There are three basic types of problems that can cause the adapter to function incorrectly:

- Hardware problems
- System configuration problems
- Fibre Channel problems

Hardware problems

The following list will help you determine whether a problem was caused by the hardware:

- Verify that all of the adapters are installed securely.
- Verify that all of the cables are connected securely to the correct connectors. Be sure that the SC connectors that attach from the J1 connector on the adapter to the device are connected correctly.
- Verify that the adapter is installed correctly and seated firmly in the expansion slot.
- Verify that all peripheral devices are properly powered on. See "Scan Fibre Channel devices" on page 368 for information about displaying attached devices.

System configuration problems

To determine whether a problem was caused by the system configuration, check the system board to make sure it is configured properly (see "Installation procedures" on page 17).

Fibre Channel problems

To determine whether a problem was caused by the Fibre Channel, verify that all of the FC devices were powered on before you powered on the server.

Features

Fibre Channel adapter features include:

- Compliance with Fibre Channel Physical and Signaling Interface - 3 (PC-PH-3), revision 9.2
- Compliance with Fibre Channel Arbitrated Loop (FC-AL), revision 4.5
- Compliance with Intel® PCI version 2.1 specification
- Compliance with U.S. and international safety and emissions standards
- Support for bus master DMA
- Use of Fast!UTIL basic input/output system (BIOS) utility program for customizing the configuration parameters on the IBM Fibre Channel PCI Adapter and attached drives

Mixed peripheral support includes:

- Simultaneous mixed-peripheral configurations and startable device support for FC devices that meet the following standards:
- Compliance with FC-PLDA, revision 1.10, 17 February 1997
- Compliance with FC-FLA, revision 2.1, 12 July 1997

Additional service information

The following information supports the IBM Fibre Channel PCI Adapter.

Specifications

The IBM Fibre Channel PCI Adapter operating environment and specification information is as follows:

Table 3. IBM Fibre Channel PCI Adapter operating environment.

Environment	Minimum	Maximum
Operating temperature	0° C (32° F)	55° C (131° F)
Storage temperature	-20° C (-4° F)	70° C (158° F)
Relative humidity (noncondensing)	10%	90%
Storage humidity (noncondensing)	5%	95%

Table 4. IBM Fibre Channel PCI Adapter specifications.

Type	Specification
Host bus	Conforms to PCI Local Bus Specification, revision 2.1
PCI signaling environment	3.3 V and 5.0 V buses supported
PCI transfer rate	264 MB per second maximum burst rate for 33 MHz operation (ISP2100 chip)

Table 4. IBM Fibre Channel PCI Adapter specifications.

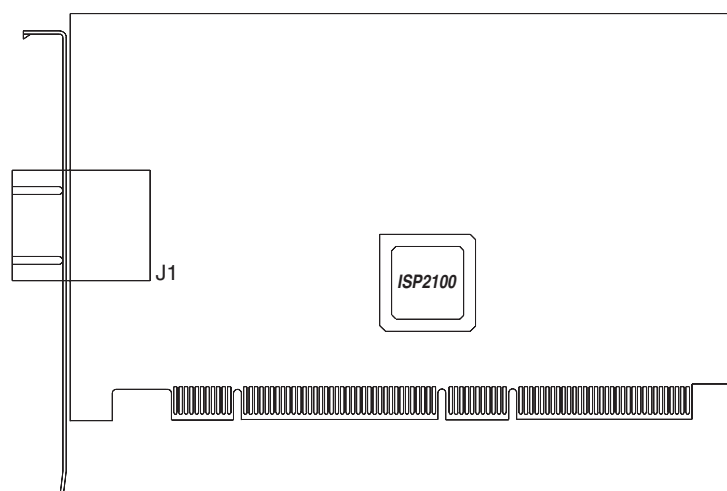
Type	Specification
Fibre Channel specifications	Bus type: fiber-optic media (QLA2100F) Bus transfer rate: 100 MB per second maximum
Central processing unit (CPU)	Single chip design that includes a RISC processor, Fibre Channel protocol manager, PCI DMA controller, and 1-gigabit transceivers
Host data transfer	64-bit, bus master DMA data transfers to 264 MB per second
RAM	128KB of SRAM
BIOS ROM	128KB of flash ROM in two 64KB, software selectable banks. The flash is field-programmable.
NVRAM	256 bytes, field-programmable
Onboard DMA	Three independent DMA channels: two data and one command. Integrated 4KB frame buffer FIFO for each data channel
Connectors (external)	SC-style connector that supports non-OFC, multimode fiber-optic cabling using 1x9 fiber-optic transceiver module. Total cable length cannot exceed 500 meters.
Form factor	17.78 cm x 10.67 cm (7.0 in. x 4.2 in.)
Operating power	Less than 15 watts

Installation procedures

This section contains information about installing adapter layouts.

Adapter layouts

The following figure identifies the adapter components referenced throughout this section.



Installing the adapter

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

- Do not route the cable along a folding cable management arm.
- When attaching to a device on slides, leave enough slack in the cable so that it does not bend to a radius smaller than 3 inches when extended or become pinched when retracted.
- Route the cable away from places where it can be snagged by other devices in the rack.
- Do not over tighten the cable ties or bend the cables to a radius smaller than 3 inches.
- Do not put excess weight on the cable at the connection point and be sure it is well supported.

Follow these steps to install the IBM Fibre Channel PCI Adapter. Also refer to these steps for removal and replacement.

Note: The adapter can be installed in any PCI bus slot that supports 32 or 64-bit adapters.

1. Check the system board and make any configuration changes necessary to accommodate the IBM Fibre Channel PCI Adapter if the system requires it.
2. Power off the peripheral devices. Then, power off the computer.
3. Disconnect the power cords.
4. Remove the computer cover, saving the screws.
5. Line up the adapter with the expansion slot. Carefully press the adapter into the slot until it seats firmly.
6. Secure the adapter in place.
7. Connect one end of the fiber cable from the devices to the J1 connector on the adapter.
8. Carefully reinstall the computer cover and secure it.
9. Connect the power cables.
10. Power on all external FC devices; then, power-on the PC and observe the monitor. The BIOS lists all FC devices attached to the PCI adapter.

```
QLogic Corporation
QLA2000, QLA 2100 PCI Fibre Channel ROM BIOS Version X.XX
Copyright (C) QLogic Corporation 1998 All rights
reserved.
```

```
Press <Alt-Q> for Fast!UTIL
```

```
BIOS for Adapter X is disabled
```

```
ROM BIOS not installed
```

Refer to *IBM Fibre Channel PCI Adapter Software Installation Guide* for detailed instructions on how to install the device drivers.

If the information displayed is not correct and you have checked the adapter configuration, go to “General checkout” on page 15.

Chapter 4. IBM FAStT Host Adapter (FRU 09N7292)

Note: The problem determination (PD) maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

The IBM FAStT Host Adapter (FRU 09N7292) is compatible with the following IBM products:

- Type 3526 Fibre Channel RAID controller
- Type 3552 FAStT500 RAID controller
- FAStT200 type 3542 and FAStT200 HA type 3542
- Type 2109 Fibre Channel Switch
- Type 3534 Managed Hub

The IBM FAStT Host Adapter is a high-performance, direct memory access (DMA), bus-master host adapter designed for high-end systems. The function and performance are derived from the ISP2200A chip, making this FAStT Host Adapter a leading-edge host adapter.

The ISP2200A chip combines a powerful RISC processor, a fibre protocol module (FPM) with gigabit transceivers, and a 64-bit peripheral component interconnect (PCI) local bus interface in a single-chip solution. The FAStT Host Adapter supports all Fibre Channel (FC) peripheral devices that support private-loop direct attach (PLDA) and fabric-loop attach (FLA).

Appendix A, "Using IBM Fast!UTIL," on page 361 provides detailed configuration information for advanced users who want to customize the configuration of the Fibre Channel Adapter (FRU 09N7292).

General checkout

There are two basic types of problems that can cause the adapter to malfunction:

- Hardware problems
- System configuration problems
- Fibre Channel problems

Hardware problems

The following list will help you determine whether your installation problem is caused by the hardware:

- Verify that all adapters are installed securely.
- Verify that all cables are attached securely to the correct connectors. Be sure that the FC connectors that attach from the J1 connector on the adapter to the device are connected securely.
- Verify that the adapter is installed correctly and fully seated in the expansion slot. Check for interference due to nonstandard PCI connectors.
- Verify that all peripheral devices are turned on. See "Scan Fibre Channel devices" on page 368" for information about displaying attached devices.

System configuration problems

To determine whether a problem was caused by the system configuration, check the system board to make sure that it was configured properly (see "Installation procedures" on page 22).

Fibre Channel problems

To determine whether your installation problem is caused by the FC, verify that all of the FC devices were turned on before you turned on the server. Also, ensure that all cables are connected properly.

The problem determination (PD) maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

Features

FAST Host Adapter features include:

- Compliance with Third Generation Fibre Channel Physical and Signaling Interface - 3 (PC-PH-3), revision 9.2
- Compliance with Fibre Channel Arbitrated Loop (FC-AL-2) standard
- Compliance with Intel® PCI version 2.2 specification
- Compliance with U.S. and international safety and emissions standards
- Support for bus-master DMA
- Fast!UTIL basic input/output system (BIOS) utility program to customize the configuration parameters on the FAST Host Adapter and attached drives
- Support for Fibre Channel SCSI (FCP-SCSI) and internet protocol (IP) protocols
- Support for point-to-point fabric connection (F-PORT FABRIC LOGIN)
- Support for Fibre Channel service (Classes 2 and 3)
- 32 bit or 64 bit, 66 or 33 MHz operation
- Simultaneous mixed-peripheral configurations and startable device support for Fibre Channel devices that meet the following standards:
 - Fibre Channel -- Private Loop Direct Attach Technical Report (FC-PLDA) revision 1.10, 17 February 1997
 - Fibre Channel -- Fabric Loop Attachment Technical Report (FC-FLA) revision 2.1, 12 July 1997

Additional service information

The following information supports the IBM FAStT Host Adapter.

Specifications

This section contains the FAStT Host Adapter operating environment and specification information.

Table 5. FAStT Host Adapter operating environment.

Environment	Minimum	Maximum
Operating temperature	0° C (32° F)	55° C (131° F)
Storage temperature	-20° C (-4° F)	70° C (158° F)
Relative humidity (noncondensing)	10%	90%
Storage humidity (noncondensing)	5%	95%

Table 6. FAStT Host Adapter Specifications.

Type	Specification
Host bus	Conforms to PCI Local Bus Specification, revision 2.2
PCI signaling environment	3.3 V and 5.0 V buses supported
PCI transfer rate	<ul style="list-style-type: none">• 264 MB per second maximum burst rate for 33 MHz operation (ISP2200A chip)• Supports dual address bus cycles
Fibre Channel specifications	<ul style="list-style-type: none">• Bus type: fiber-optic media (shortwave 50 micron)• Bus transfer rate: 100 MB per second maximum (200 full-duplex)• Supports both FCP-SCSI and IP protocols• Supports point-to-point fabric connection: F-Port Fabric Login• Supports FC-AL public loop profile: FL-Port Login• Supports Fibre Channel services class 2 and 3• FCP SCSI initiator and target operation• Full-duplex operation
Processor	Single chip design that includes a RISC processor, Fibre Channel protocol manager, PCI DMA controller, and 1-gigabit transceivers
Host data transfer	64-bit, bus master DMA data transfers to 528 MB per second
RAM	128 KB of SRAM
BIOS ROM	128 KB of flash ROM in two 64 KB, software selectable banks. The flash is field-programmable.
NVRAM	256 bytes, field-programmable
Onboard DMA	Three independent DMA channels: two data and one command. Integrated 4 KB frame buffer FIFO for each data channel

Table 6. FAStT Host Adapter Specifications.

Type	Specification
Connectors (external)	<ul style="list-style-type: none"> • SC-style connector that supports non-OFC, multimode fiber-optic cabling using 1x9 fiber-optic transceiver module • Total cable length cannot exceed 500 meters • Two three-position, point-to-point cable (internal)
Form factor	17.8 cm x 10.7 cm (7.0 in. x 4.2 in.)
Operating power	Less than 15 watts
Other compliance	<ul style="list-style-type: none"> • PCI 98, including ACPI • Less than 28% processor utilization as measured in a TPCC benchmark • Operation system support for Microsoft® Windows NT® version 4, Windows® 2000 version 1, NetWare version 4.x and 5.x, SCO UnixWare version 7.x • Worldwide agency compliance as defined for IBM products • 100% Plug and Play compatibility with our existing Fibre Channel RAID Controller

Installation procedures

This section contains the following installation information:

- “Adapter preinstallation procedures”
- “Adapter layouts” on page 23
- “Installing the adapter” on page 23
- “Installing the software” on page 25
- “Installing the Windows NT and Windows 2000 device drivers” on page 25
- “Installing the NetWare device driver” on page 28

Adapter preinstallation procedures

Use the following instructions for preparing to install the FAStT Host Adapter.

Handling static-sensitive devices

Static electricity, though harmless to you, can seriously damage adapter components or options.

Note: When you are adding an internal option, do not open the static-protective package containing the option until you are instructed to do so.

When you handle options and other adapter components, take these precautions to avoid damage from static electricity:

- Limit your movement. Movement can cause static electricity to build up around you.
- Always handle components carefully. Never touch any exposed circuitry.
- Prevent others from touching components.

- When you are installing a new option, touch the static-protective package containing the option to a metal expansion-slot screw or other unpainted metal surface on the adapter for at least two seconds. (This reduces static electricity from the package and from your body.)
- When possible, remove the option and install it directly into the adapter without setting the option down. When this is not possible, place the static-protective package that the option comes in on a smooth, level surface and place the option on it.
- Do not place the option on the adapter's covers or any metal surface.

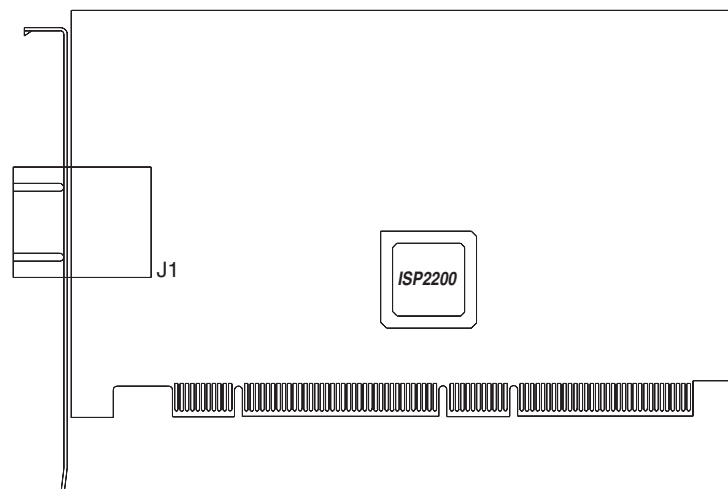
What you need for the installation

To install the FAStT Host Adapter in your server, you need:

- An optical, multimode cable with an SC-style duplex connector
- A screwdriver (usually a Phillips #1)
- Two three-position, point-to-point, internal FC cables for the FAStT Host Adapter, if you are using an internal connector

Adapter layouts

The following figure identifies the adapter components referred to in this chapter.



Installing the adapter

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 cables to a device on slides, leave enough slack in the cables so that they do not bend to a radius smaller than 76mm (3 in.) when extended or become pinched when retracted.
- Route the cable away from places where it can be snagged by other devices in the rack.
- Do not over tighten the cable straps or bend the cables to a radius smaller than 76mm (3 in.).
- Do not put excess weight on the cable at the connection point and be sure it is well supported.

Follow these steps to install the FAStT Host Adapter in your server:

1. Turn off the peripheral devices. Then turn off the server.
2. Disconnect the power cords.
3. Remove the server cover.
4. Remove the slot cover.
5. Choose any PCI bus slot that supports 32 or 64-bit adapters. You can install the adapter in a 64-bit PCI slot if one is available. If a 64-bit slot is not available, then you can use a 32-bit PCI slot.
6. Align the adapter with the expansion slot. Carefully press the adapter into the slot until it is fully seated.
7. Connect one end of the fiber cable from the devices to the J1 connector on the adapter.
8. Carefully replace and secure the server cover.
9. Reconnect the power cords.
10. Turn on all external FC devices; then, turn on the server and observe the monitor. You will not see the devices because the adapter BIOS is set to Disabled by default. Instead, you will see the information below. To see the devices, press Alt+Q; then, use the utility program. See Appendix A, "Using IBM Fast!UTIL," on page 361 for details about the utilities.

The BIOS lists all FC devices attached to the FAStT Host Adapter.

Note: You will see this information only if you have the BIOS set to Enabled. Otherwise, you will see a portion of this information on your monitor because BIOS is set to Disabled by default.

```
QLogic Corporation
QLA2200 PCI Fibre Channel ROM BIOS Version X.XX
Copyright (C) QLogic Corporation 1998 All rights reserved.
www.qlogic.com
```

```
Press <Alt-Q> for Fast!UTIL
```

```
BIOS for Adapter X is disabled.
```

```
ROM BIOS not installed.
```

If the information displayed is correct, you have successfully installed the FAStT Host Adapter in your computer.

See "Installing the software" on page 25 for detailed instructions on how to install the device drivers.

If the information displayed is not correct and you have checked the adapter configuration, see "General checkout" on page 19 for troubleshooting information.

Installing the software

After installing your IBM FAS*t*T Host Adapter, you are ready to install the device drivers that you need.

The device drivers for the following supported operating systems are provided with your IBM FAS*t*T Host Adapter:

- Windows 2000
- Windows NT Version 4.0
- Novell NetWare Version 5.1

Note: The latest versions of the device drivers, utilities, and documentation are available on the following IBM Web site:

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

Before you begin

Create driver diskettes by copying the image you need from the IBM FAS*t*T Host Adapter Support CD for the following:

- *FAS*t*T Host Adapter for Windows 2000*
- *FAS*t*T Host Adapter for Windows NT 4.0*
- *FAS*t*T Host Adapter for NetWare 5.1*

You will be prompted for the driver diskettes during the operating system installation process. Read through the software installation chapters to determine which device driver you want to install.

Use the following steps if you need to create driver diskettes to support the installation of Novell NetWare version 5.1, Microsoft Windows NT 4.0, or Windows 2000:

1. Insert the *IBM FAS*t*T Host Adapter Support CD* into the CD-ROM drive.
2. To create the IBM FAS*t*T Host Adapter device driver diskette for Windows NT 4, at the command prompt, type:

```
d:\tools\dsk4w32 d:\images\nt4\nt4_7040404.img a:
```

Where *d* is the CD-ROM drive and *a* is the diskette drive.
3. To create the IBM FAS*t*T Host Adapter device driver diskette for Windows 2000, at the command prompt, type:

```
d:\tools\dsk4w32 d:\images\w2k\w2k_7040302.img a:
```

Where *d* is the CD-ROM drive and *a* is the diskette drive.
4. To create the IBM FAS*t*T Host Adapter device driver diskette for NetWare 5.1, at the command prompt, type:

```
d:\tools\dsk4w32 d:\images\nw51\nw51_550v.img a:
```

Where *d* is the CD-ROM drive and *a* is the diskette drive.
5. Press Enter.
6. Remove the diskette from the diskette drive and label the diskette appropriately.
7. Remove the *IBM FAS*t*T Host Adapter Support CD* from the CD-ROM drive.

Installing the Windows NT and Windows 2000 device drivers

This section provides instructions for installing the Windows NT and Windows 2000 device drivers under the following operating system conditions:

- Initial installation of the operating system and the device driver
- Installation of the device driver in a previously installed operating system
- Installing an updated device driver in a previously installed operating system that has an older version of the device driver

The following files are provided on the IBM FAStT Host Adapter driver diskette that you created for the Windows NT device driver installation:

- TXTSETUP.OEM: Driver installation script for initial Windows NT text setup
- QLOGIC: Identification file for Windows NT setup program
- \NT\OEMSETUP.INF: Driver installation script for the Windows NT setup program
- \NT\QL2200.SYS: Windows NT 4.0 device driver
- \NT\README.TXT: Helpful hints about the Windows NT device driver
- \NT\RELEASE.TXT: History of release fixes

The following files are provided on the IBM FAStT Host Adapter driver diskette that you created for the Windows 2000 device driver installation:

- TXTSETUP.OEM: Driver installation script for initial Windows 2000 text setup
- QLOGIC: Identification file for Windows 2000 setup program
- \WK2\OEMSETUP.INF: Driver installation script for the Windows 2000 setup program
- \WK2\QL2200.SYS: Windows 2000 device driver
- \WK2\README.TXT: Helpful hints about the Windows 2000 device driver
- \WK2\RELEASE.TXT: History of release fixes

The following files are provided on the IBM FAStT Host Adapter driver diskette that you created for the NetWare Version 5.1 device driver installation.

- README.TXT
- RELEASE.TXT
- \Netware\QL2200.DDI
- \Netware\QL2200.HAM

Installing Windows NT and Windows 2000

Perform the following steps to install Windows NT 4.0 or Windows 2000 on the drive that is attached to the IBM FAStT Host Adapter.

1. Insert the Windows NT or Windows 2000 setup diskette or insert the Windows NT or Windows 2000 installation CD into the CD-ROM drive.
2. After the standard devices have been detected and configured, use the **S** option to **Specify Additional Device**.
3. Select Other; then, press Enter.
4. Insert the FAStT Host Adapter device driver diskette you made in "Installing the Windows NT and Windows 2000 device drivers" on page 25; then, press Enter.
5. Select **QLogic QLA2200**; then, press Enter.
6. Select the standard installation procedure.

Adding the Windows NT driver

Perform the following steps to add the Windows NT device driver to a previously installed Windows NT 4.0 system.

1. On your desktop, click **My Computer** → **Control Panel** → **SCSI Adapters**.
2. Click the **Drivers** tab and click **Add**.
3. Select **QLogic** from the list of manufacturers and click **Have Disk**.
4. Insert the IBM FAStT Host Adapter driver diskette you created for Windows NT. At the prompt type:

```
a:\nt
```

where *a* is the diskette drive letter. Click **OK**.

5. If you are installing the drivers from a CD-ROM, at the prompt type:

```
z:\NT4\2200\NT
```

where *z* is the CD-ROM drive letter.

6. Select **IBM Netfinity QLA2200 PCI Fibre Channel Adapter** and click **OK**.
7. Click **Yes** to restart your server so the driver settings can take effect now or click **No** to restart your system at a later time.

Adding the Windows 2000 driver

Perform the following steps to add the Windows 2000 device driver to a previously installed Windows 2000 system.

1. After you install the IBM FAStT Host Adapter, restart the system. The system searches for the newly installed device. If the system finds the new device, it indicates that the device has been detected.
2. If prompted to insert the device driver diskette, insert the IBM FAStT Host Adapter device driver for Windows 2000 diskette that you created. When prompted, follow the instructions. If you want to update a previously installed version of the device driver, follow the procedures in “Updating the Windows 2000 device driver” on page 28.

Updating the Windows NT device driver

Perform the following steps if you want to replace an existing Windows NT device driver with an updated version.

1. Open a DOS command prompt.
2. Change the current directory to the Windows NT device driver directory. For example, type:

```
CD \WINNT\SYSTEM32\DRIVERS
```

3. Make a backup copy of the old device driver. You can copy the file into the same directory with a .SAV extension, indicating that it is the saved file. For example, type:

```
COPY QL2200.SYS QL2200.SAV
```

4. Insert the IBM FAStT Host Adapter device driver for Windows NT diskette into your diskette drive.
5. Copy the new device driver over the old device driver. For example, type:

```
COPY A:\NT\QL2200.SYS
```

Where *a* is the diskette drive letter.

6. If you are installing drivers from the CD-ROM, type:

```
copy z:\NT4\2200\NT\QL2200.sys
```

Where *z* is the CD-ROM drive letter.

7. Remove the IBM FAStT Device Drivers for Windows NT diskette.
8. Restart your system to install the device driver.

Updating the Windows 2000 device driver

Perform the following steps if you want to replace the existing Windows 2000 device driver with an updated version.

1. Click **Start → Settings → System → Hardware → Device Manager → SCSI and RAID Controllers**
2. Select the QLogic adapter you want to update.
3. Click on the adapter and select **Properties**.
4. Select the **Driver** tab.
5. Click the **Update driver** button and follow the instructions that display in the window.

Installing the NetWare device driver

This section provides instructions for installing the NetWare device driver in an installed Novell NetWare system.

NetWare device driver files and parameters: The following files are provided on the IBM FAStT Host Adapter device drivers for NetWare diskette for the NetWare 5.1 device driver installation:

- NETWARE\QL2200.HAM: Driver for NetWare 5.1
- NETWARE\QL2200.DDI: Installation information file for QL2200.HAM driver
- README.TXT: Helpful hints about the device driver and setting options for NetWare 5.1
- RELEASE.TXT: History of release fixes

Be sure to review the README.TXT file for both new and changed information.

To customize the interface between the device driver and Novell NetWare, load the QL2200.HAM device driver with the following parameters.

Table 7. NetWare device driver parameters.

Parameter	Description
SLOT	Provides support for multiple IBM FASTT Host Adapters and installs the device driver for each adapter individually. This parameter is mandatory if you have more than one adapter.
/LUN	Enables support for multiple LUN (logical unit number) devices. This parameter is optional.

Installing the NetWare 5.1 device driver: The QL2200.HAM device driver might not be compatible with NetWare versions earlier than 5.1.

Note: You can enter the LOAD command lines in your NetWare STARTUP.NCF file to install the driver automatically when your system starts.

Perform the following steps to install the NetWare 5.1 device driver in a previously installed NetWare system.

1. Insert the IBM FASTT Host Adapter device drivers for NetWare diskette in the diskette drive.
2. Copy the QL2200.HAM device driver file from the diskette to the server root directory. For example, type:

```
COPY A:\NETWARE\QL2200.HAM C:\NWSERVER\
```

3. If you are installing the driver from a CD-ROM, type:
COPY z:\NW51\2200\NETWARE\QL2200.HAM C:\NWSERVER\
Where *a* is the diskette drive letter and *z* is the CD-ROM drive letter.
4. Install the device driver at the NetWare server prompt (:) by typing the LOAD command with the SLOT parameter.

The following LOAD example works for a default (factory setting) QL2200/2200F adapter.

```
LOAD QL2200.HAM SLOT=X
```

Replace the *X* in the load line example with the slot identification number of the slot in which the adapter is installed.

5. If you are attaching multiple LUN devices, such as tape changers, add the /LUN switch to the LOAD line. For example, type:

```
LOAD QL2200.HAM SLOT=X /LUN
```

Chapter 5. IBM FAStT FC-2 Host Bus Adapter (19K1246)

Note: The problem determination (PD) maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

The IBM FAStT FC-2 Host Bus Adapter is a 2 Gb high-performance, direct memory access (DMA), bus master, Fibre Channel host adapter designed for high-end systems. The function and performance are derived from the ISP2310 chip, making this IBM FAStT FC-2 Host Bus Adapter a leading-edge host adapter.

The ISP2310 chip combines a powerful, reduced instruction set computer (RISC) processor, a Fibre Channel protocol manager (FPM) with one 2 Gb Fibre Channel transceiver, and a peripheral component interconnect (PCI) or peripheral component interconnect-extended (PCI-X) local bus interface in a single-chip solution. The IBM FAStT FC-2 Host Bus Adapter supports all Fibre Channel (FC) peripheral devices that support private-loop direct attach (PLDA) and fabric-loop attach (FLA).

Appendix A, "Using IBM Fast!UTIL," on page 361 provides detailed configuration information for advanced users who want to customize the configuration of the FAStT FC-2 Host Bus Adapter.

General checkout

There are three types of installation problems that might cause your FAStT FC-2 Adapter to function incorrectly:

- Hardware problems
- System configuration problems
- Fibre Channel problems

If you are having problems, use the following information to help you determine the cause of the problem and the action to take.

Hardware problems

Take the following actions to determine if your installation problem is caused by the hardware:

- Verify that all adapters are installed securely.
- Verify that all cables are attached securely to the correct connectors. Be sure that one end of the LC-LC Fibre Channel cable is attached to the optical interface connector (located at J1 on the adapter) and that the other end is connected to the Fibre Channel device.
- Verify that the FAStT FC-2 Adapter is installed correctly and is fully seated in the expansion slot. Check for interference due to nonstandard PCI connectors.
- Verify that the Fast!UTIL data-rate setting is correct. Refer to "Extended Firmware settings" on page 366. The Fast!UTIL data-rate setting must match the speed of the device to which you are connected.
- Verify that all peripheral devices are turned on. See "Scan Fibre Channel devices" on page 368 for information about displaying attached Fibre Channel devices.

System configuration problems

To verify that your installation problem is caused by the system configuration, check your server to ensure that it is configured properly (see “Installing the FAStT FC-2 Adapter” on page 36).

Note: All PCI-compliant and PCI-X-compliant systems automatically detect 32-bit or 64-bit adapters and set the appropriate bus speed (for example, 33 MHz or 66 MHz).

Fibre Channel problems

To determine if your installation problem is caused by an attached Fibre Channel device, do the following:

- Verify that all of the Fibre Channel devices were turned on before you turned on the server.
- Ensure that all cables are connected properly.
- Verify that you configured your RAID storage subsystems using the utilities provided by the manufacturer.
- If your Fibre Channel switch supports zoning, make sure that your peripheral device is configured to the same switch zone as the FAStT FC-2 Adapter. For more information, refer to your Fibre Channel switch documentation.

FastT FC-2 Adapter components

The following figure identifies the FAStT FC-2 Adapter components that are referred to in this section.

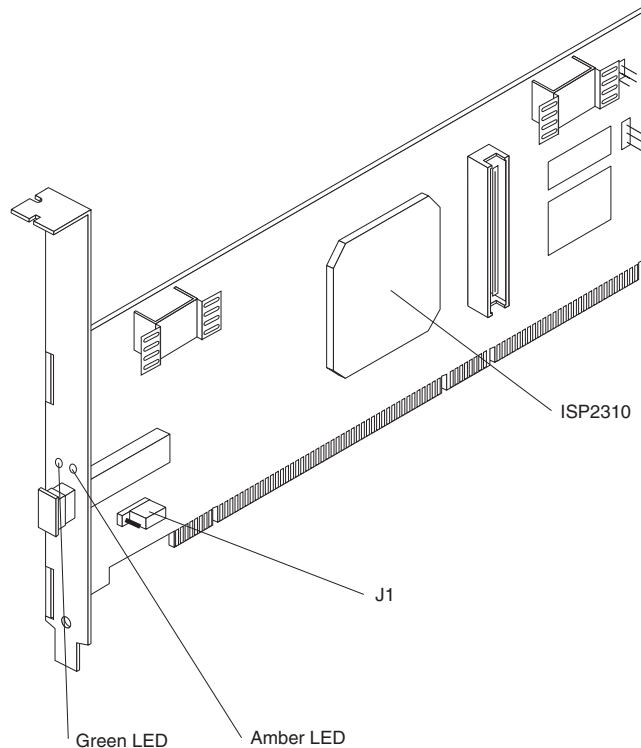


Table 8 on page 33 describes the green and amber light emitting diodes (LEDs) and the activity of the FAStT FC-2 Adapter.

Table 8. IBM FAStT FC-2 Adapter activity.

Green LED	Amber LED	Activity
On	On	Power
On	Off	Online
Off	On	Signal required
Off	Flashing	Loss of synchronization
Flashing	Flashing	Firmware error

Features

The FAStT FC-2 Adapter has the following features:

- Compliance with Intel® PCI Local Bus version 2.2 specification
- Compliance with peripheral component interconnect-extended (PCI-X) addendum, revision 1.0 to the Intel PCI Local Bus version 2.2 specification
- Compliance with Third Generation Fibre Channel Physical and Signaling Interface (PC-PH-3), revision 9.2
- Compliance with Fibre Channel Arbitrated Loop (FC-AL-2) standard
- Compliance with U.S. and international safety and emissions standards
- Support for direct memory access (DMA)
- Support for bus master
- Fast!UTIL basic input/output system (BIOS) utility program to customize the configuration parameters on the FAStT FC-2 Adapter and attached drives
- Support for Fibre Channel protocol SCSI (FCP-SCSI) and Fibre Channel Internet protocol (FCP-IP)
- Support for point-to-point fabric connection (F-PORT FABRIC LOGIN)
- Support for Fibre Channel service (Classes 2 and 3)

Additional service information

The following information supports the FAStT FC-2 Adapter.

Specifications

This section contains the FAStT FC-2 Adapter operating environment and specification information.

Table 9. Adapter operating environment.

Environment	Minimum	Maximum
Operating temperature	0°C (32°F)	55°C (131°F)
Storage temperature	-20°C (-4°F)	70°C (158°F)
Relative humidity (noncondensing)	10%	90%
Storage humidity (noncondensing)	5%	95%

Table 10. Adapter specifications.

Type	Specification
Host bus	Conforms to Intel PCI Local Bus Specification, revision 2.2 and the PCI-X Addendum, revision 1.0.
PCI/PCI-X signaling environment	3.3 V and 5.0 V buses supported
PCI/PCI-X transfer rate	<ul style="list-style-type: none"> • Support for 32 bit and 64 bit PCI bus at 33 MHz and 64 MHz • Support for 64 bit PCI-X bus at 50 MHz and 100 MHz • PCI transfer rate 264 MB per second maximum burst rate for 33 MHz operation (ISP2310 chip) • Support for dual address bus cycles
Fibre Channel specifications	<ul style="list-style-type: none"> • Bus type: fiber-optic media (shortwave 50 micron) • Bus transfer rate: 200 MB per second maximum at half-duplex and at 400 MB per second maximum full-duplex. • Interface chip: ISP2310 (PCI-X QLA23xx boards) • Support for both FCP-SCSI and IP protocols • Support for point-to-point fabric connection: F-Port Fabric Login • Support for FCAL public loop profile: FL-Port Login • Support for Fibre Channel services class 2 and 3 • Support for FCP SCSI initiator and target operation • Support for full-duplex operation
Processor	Single-chip design that includes a RISC processor, Fibre Channel protocol manager, PCI/PCI-X DMA controller, and integrated serializer/deserializer (SERDES) and electrical transceivers that can auto-negotiate a data rate of 2 Gb per second.
Host data transfer	64-bit, bus-master DMA data transfers to 528 MB per second
RAM	RAM 256 KB of SRAM supporting parity protection
BIOS ROM	BIOS ROM 128 KB of flash ROM in two 64 KB, software selectable banks. The flash is field programmable.
NVRAM	NVRAM 256 bytes, field programmable
Onboard DMA	Five-channel DMA controller: two data, one command, one auto-DMA request, and one auto-DMA response.
Frame buffer FIFO	Integrated 4 KB transmit and 6 KB receive frame buffer FIFO for each data channel
Connectors (external)	<ul style="list-style-type: none"> • LC-style connector that supports non-OFC, multimode fiber-optic cabling using a small form factor (SFF) fiber-optic transceiver module. • Total cable length cannot exceed 500 meters.
Form factor	6.47 cm x 16.75 cm (2.54 in. x 6.6 in.)
Operating power	Less than 15 watts

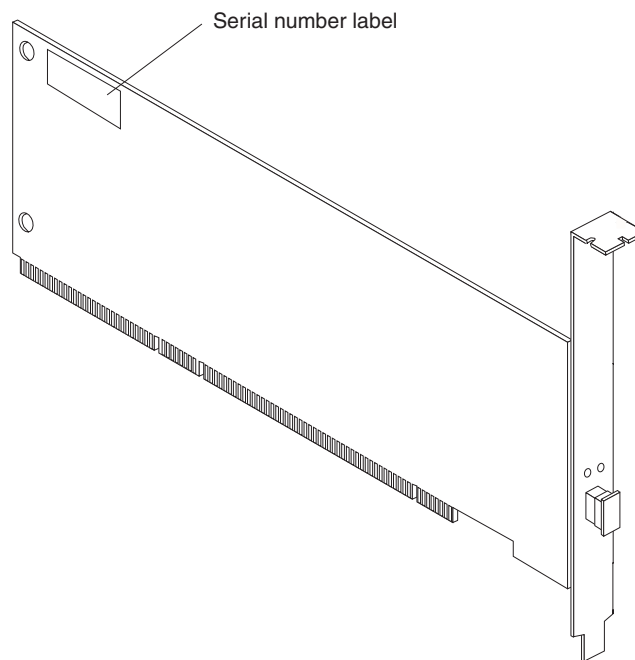
Installation procedures

This section contains information on installing the FAStT FC-2 Host Bus Adapter.

Preinstallation procedures

Before you begin the FAStT FC-2 Adapter installation, do the following:

- Read “Handling static-sensitive devices”.
- Read “What you need for the installation” on page 36.
- Write down the serial number of the FAStT FC-2 Adapter. Each adapter has a unique serial number. If the nonvolatile random access memory (NVRAM) is damaged, the system will prompt you for the FAStT FC-2 Adapter serial number. The following figure shows the serial number label location.



Handling static-sensitive devices

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

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

- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed printed circuitry.
- Do not leave the device where others can handle and possibly damage the device.
- While the device is still in its static-protective package, touch it to an unpainted metal part of the system unit for at least 2 seconds. (This drains static electricity from the package and from your body.)
- Remove the device from its package and install it directly into your system unit without setting it down. If it is necessary to set the device down, place it in its

static-protective package. Do not place the device on your system unit cover or on a metal table.

- Take additional care when handling devices during cold weather because heating reduces indoor humidity and increases static electricity.

What you need for the installation

To install the FAStT FC-2 Adapter in your server, you need the following two items:

- A small Phillips screwdriver
- An LC-LC Fibre Channel Cable¹

Installing the FAStT FC-2 Adapter

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 Fibre Channel device on slide rails, leave enough slack in the cables so that they do not bend to a radius smaller than 38 mm (1.5 in.) when extended or become pinched when retracted.
- Route the cable away from places where it can snag on other Fibre Channel devices in the rack.
- Do not overtighten the cable straps or bend the cables to a radius smaller than 38 mm (1.5 in.).
- Do not put excess weight on the cable at the connection point and be sure that the cable is well supported.

The FAStT FC-2 Adapter comes with an attached standard 3U adapter bracket. An additional Low Profile 2U bracket also comes with the adapter. Before you install the FAStT FC-2 Adapter, verify whether you need the Fibre Channel Low Profile 2U adapter bracket. If you need to install the Low Profile 2U bracket, go to step 1. Otherwise go to step 2.

1. To install the Fibre Channel Low Profile 2U adapter bracket, do the following:
 - a. Remove your FAStT FC-2 Adapter from the static-protective package. Set the adapter down on a nonconductive, static-protected surface (place it component side up). Do not place the adapter on your system unit cover or on a metal table.
 - b. Use your small Phillips screwdriver to carefully remove the two bracket screws from your 3U adapter (you will reuse the two adapter screws). Take off the 3U bracket and set it aside.
 - c. Align the two screw holes in the 2U adapter bracket with the two screws holes on the adapter. Using the two screws you removed in step 1a, secure the bracket to the adapter.
 - d. Return the adapter to the static-protective package until you are ready for installation.
2. Check the system board and make any configuration changes needed to accommodate the FAStT FC-2 Adapter.

Note: The FAStT FC-2 Adapter is self-configuring; however, some system boards require manual configuration. For example, some systems have a PCI Device Configuration menu in the system board setup BIOS code where you must enable host adapters, bus-master slots, and interrupt request (IRQ) levels. If the system board supports triggering, use level triggering

1. This option does not come with the IBM FAStT FC-2 Host Bus Adapter and must be ordered separately.

for the FAStT FC-2 Adapter. For system specific configuration, refer to the documentation that comes with your server, or contact your IBM technical support representative to determine if your system board requires configuration.

3. Turn off the peripheral devices, then the server.
4. Disconnect the power cords.
5. Remove the server cover.
6. Remove the expansion slot cover. Refer to the documentation that comes with the server to determine the expansion slot cover type and detailed instructions. Choose any PCI bus-master slot that supports bus mastering. Most system boards automatically assign an IRQ level and interrupt line. If your system board does not automatically assign an IRQ level and interrupt line, you must assign an IRQ level and use interrupt line A for this PCI bus-master slot.
 - Some system boards have two kinds of PCI bus slots: master and subordinate. The FAStT FC-2 Adapter must be in a PCI bus-master slot. (Some system boards have PCI bus-master slots that are shared with on-board devices. The FAStT FC-2 Adapter does not work in shared PCI bus-master slots.)
 - PCI connectors vary among system board manufacturers. The FAStT FC-2 Adapter is a 64-bit PCI device that can function in a 32-bit PCI bus-master slot.

Attention: If you try to install the FAStT FC-2 Adapter into a PCI bus-master slot that does not conform to the PCI specification, you might damage the FAStT FC-2 Adapter.
 - The FAStT FC-2 Adapter is designed and tested to operate at PCI bus speeds of up to 66 MHz.
 - The FAStT FC-2 Adapter is designed and tested to operate at PCI-X bus speeds up to 100 MHz.
 - PCI and PCI-X slots look the same. If the server contains both PCI and PCI-X bus-master slots, refer to the documentation that comes with the server to determine the slot type.
7. Align the adapter with the expansion slot. Carefully press the adapter into the PCI bus-master slot until it is fully seated and secure.
8. Connect one end of an LC-LC Fibre Channel cable to the optical interface connector (located at J1) on the FAStT FC-2 Adapter. Connect the other end to a Fibre Channel device. (See “FastT FC-2 Adapter components” on page 32 for the location of the J1 connector.)
9. Carefully install and secure the server cover.
10. Connect the power cables.
11. Turn on all external Fibre Channel devices; then, turn on the server. The following information is displayed:

```
QLogic Corporation
QLA2300 PCI Fibre Channel ROM BIOS Version X.XX
Copyright (C) QLogic Corporation 1993-2001 All Rights Reserved.
www.qlogic.com

Press <Ctrl+Q> for Fast!UTIL

BIOS for Adapter 0 is disabled
ROM BIOS not installed
```

To display the Fibre Channel devices, press Ctrl+Q, and then use the Fast!UTIL program. See Appendix A, “Using IBM Fast!UTIL,” on page 361 for detailed utility information.

If the information displayed is not correct and you have checked the adapter configuration, refer to the FASTT FC-2 Adapter documentation for problem solving information.

If the information displayed is correct, go to “Updating the FASTT FC-2 Adapter BIOS code and device drivers” for detailed instructions on how to update the FASTT FC-2 Adapter BIOS code.

Updating the FASTT FC-2 Adapter BIOS code and device drivers

After installing your FASTT FC-2 Adapter, you are ready to install the device drivers for the adapter and update the adapter BIOS code.

The FASTT FC-2 Adapter device drivers are provided on the *IBM FASTT FC-2 Host Bus Adapter Support CD* that comes with the adapter. For device driver installation documentation, go to the <http://www.ibm.com/pc/support> IBM Web site.

The device drivers for the following supported operating systems are provided with your FASTT FC-2 Adapter:

- Microsoft Windows 2000
- Windows NT Version 4.0
- Novell NetWare Version 5.1
- Linux

Note: Always check for the latest versions of the device drivers, utilities, and documentation on the <http://www.ibm.com/pc/support/> IBM Web site.

After installing the adapter device drivers, you must update the FASTT FC-2 Adapter BIOS code using the BIOS Update Utility that is provided on the Support CD. To update the adapter BIOS code, you can use the BIOS Update Utility from the bootable Support CD or you can create and use a BIOS Update Utility diskette.

The BIOS code update procedures are described in the following sections.

Updating the FASTT FC-2 Adapter BIOS code from the Support CD

To update the FASTT FC-2 Adapter BIOS code and non-volatile random access memory (NOVRAM) using the BIOS Update Utility on the Support CD, use one of following two methods:

- The flasutil command prompt
- The flasutil BIOS Update Utility menu

Using the flasutil command prompt (from the Support CD)

To update your FASTT FC-2 Adapter BIOS code and NOVRAM, do the following:

1. Insert the *IBM FASTT FC-2 Host Bus Adapter Support CD* into the CD-ROM drive. Restart the server. Your server will start to a DOS prompt.

From the DOS prompt, type:

```
flasutil /f /1
```

2. Press Enter. Then type:

```
flasutil /u
```


3. Press Enter. Then type:

```
flasutil /?
```

The following command-line options display:

```
/L xxxx = Write NOVRAM, adapter address = xxxx  
    If no address specified then write NOVRAM to all adapters  
/F xxxx = Write Flash, adapter address = xxxx  
    If no address specified then write Flash to all adapters  
/D xxxx = Copy NOVRAM to file: QL1xNVRM.SAV, adapter address = xxxx  
/U xxxx = Update BIOS NOVRAM defaults, adapter address = xxxx  
    If no address specified then write then update all adapters  
/W xxxx = Copy Flash to file: QL1xROM.SAV, adapter address = xxxx  
/N <filename.ext> = Use <filename.ext> instead of NVRMxx0.DAT  
/O <filename.ext> = Use <filename.ext> instead of QLxxROM.BIN  
/I = Ignore Subsystem ID  
/P = Program all adapters  
/M = Don't prompt for I/O address  
/Q = Quiet Mode, no messages will be displayed  
/S xxxx = Display serial number of adapter at address xxxx  
    If no address specified then display the serial number of all adapters  
/V xxxx = Display current version number of BIOS on adapters at address xxxx  
    If no address specified then display the BIOS version of all adapters  
/C xxxx = Verify Flash of adapter at address xxxx  
    If no address specified verify the Flash of all adapters  
/T = Multiport Fibre Channel adapter  
/X xxxx = Verify NOVRAM of adapter at address xxxx
```

Command-line option examples: The following are additional command-line options that you can use.

To write NOVRAM on all FAS[™]T Host Adapters in a system without being prompted for I/O address, type:

```
flasutil /L
```

To write NOVRAM and flash to all adapters, type:

```
flasutil /L /F
```

To make the new settings the defaults, type:

```
flasutil /U
```

To write NOVRAM to the adapter at I/O address f400, type:

```
flasutil /L f400
```

To write NOVRAM and flash an adapter at I/O address f800, type:

```
flasutil /L f800 /F f800
```

Using the flasutil BIOS Update Utility menu (from the Support CD)

To update the FAS[™]T FC-2 Adapter BIOS code using the flasutil BIOS Update Utility menu, do the following:

1. Insert the *IBM FAS[™]T FC-2 Host Bus Adapter Support* CD into the CD-ROM drive. Restart the server. Your server will start to a DOS prompt.
2. From the DOS prompt, type:

flasutil

3. Press Enter.

If you have more than one adapter, a list of adapters and their I/O addresses displays. If you have only one adapter, the following list of options displays.

L = Write NOVRAM
F = Write Flash
A = Write NOVRAM and defaults
D = Copy NOVRAM to file:QLxxNVRM.SAV
W = Copy Flash to file: QLxxROM.SAV
U = Update BIOS NOVRAM defaults
S = Display serial number
V = Display current BIOS version
C = Verify Flash
X = Verify NOVRAM

4. At the command prompt, type the appropriate I/O address and press Enter.

Note: You can run the utility from the command line with the options as */y*, where *y* is the option required.

Updating the FASTT FC-2 Adapter BIOS code from the BIOS Update Utility diskette

If you can not use the bootable Support CD to update the adapter BIOS code, you can create a diskette using the Support CD. Instructions for creating and using the diskette are described in the following sections.

Creating the BIOS Update Utility diskette

Create the BIOS Update Utility diskette by copying the image you need from the *IBM FASTT FC-2 Host Bus Adapter Support CD* or from the <http://www.ibm.com/pc/support/> IBM Web site.

For Microsoft Windows 95, Windows 98, Windows NT 4.0, or Windows 2000: To create a BIOS Update Utility diskette for Microsoft Windows 95, Windows 98, Windows NT 4.0, or Windows 2000 from the *IBM FASTT FC-2 Host Bus Adapter Support CD*, do the following:

1. Insert the *IBM FASTT FC-2 Host Bus Adapter Support CD* into the CD-ROM drive.
2. At the command prompt, type:

```
d:\tools\dsk4w32 d:\images\biosnvr\23x0\2300_xxx.img a:
```

Where *d* is the CD-ROM drive and *a* is the diskette drive.
3. Press Enter.
4. Remove the *IBM FASTT FC-2 Host Bus Adapter Support CD* from the CD-ROM drive.
5. Remove the diskette from the diskette drive and label the diskette appropriately.

For Linux: To create a BIOS Update Utility diskette for Linux from the *IBM FASTT FC-2 Host Bus Adapter Support CD*, do the following:

1. Insert the *IBM FASTT FC-2 Host Bus Adapter Support CD* into the CD-ROM drive and restart the server.

2. At the command prompt, type:

```
mount -t iso9660/dev/cdromdevicefile /mnt
```

 Where *cdromdevicefile* is the specific device file for the CD-ROM block device.
3. Press Enter.
4. Type:

```
dd if=/mnt/images/biosnvr/23x0/2300_xxx.img of=/dev/diskettefile  
bs=32
```
5. Press Enter.
6. Unmount the CD-ROM by typing:

```
umount /mnt
```
7. Remove the *IBM FAStT FC-2 Host Bus Adapter Support* CD from the CD-ROM drive.
8. Remove the diskette from the diskette drive and label the diskette appropriately.
9. To update your adapter BIOS code, go to “Using the flasutil command prompt (from the diskette)” or “Using the flasutil BIOS Update Utility menu (from the diskette)” on page 42.

Using the flasutil command prompt (from the diskette)

To update your FAStT FC-2 Adapter BIOS code and NOVRAM using the flasutil command prompt, do the following:

1. Insert the BIOS Update Utility diskette that you created into drive A and restart the server. Your server will start to a DOS prompt.
2. From the DOS prompt, type:

```
flasutil /f /1
```
3. Press Enter.
4. Type:

```
flasutil /u
```
5. Press Enter.
6. Type:

```
flasutil /?
```

The following command-line options display:

```
/L xxxx = Write NOVRAM, adapter address = xxxx
          If no address specified then write NOVRAM to all adapters
/F xxxx = Write Flash, adapter address = xxxx
          If no address specified then write Flash to all adapters
/D xxxx = Copy NOVRAM to file: QL1xNVRM.SAV, adapter address = xxxx
/U xxxx = Update BIOS NOVRAM defaults, adapter address = xxxx
          If no address specified then write then update all adapters
/W xxxx = Copy Flash to file: QL1xROM.SAV, adapter address = xxxx
/N <filename.ext> = Use <filename.ext> instead of NVRMxx0.DAT
/O <filename.ext> = Use <filename.ext> instead of QLxxROM.BIN
/I = Ignore Subsystem ID
/P = Program all adapters
/M = Don't prompt for I/O address
/Q = Quiet Mode, no messages will be displayed
/S xxxx = Display serial number of adapter at address xxxx
```

If no address specified then display the serial number of all adapters
/V xxxx = Display current version number of BIOS on adapters at address xxxx
If no address specified then display the BIOS version of all adapters
/C xxxx = Verify Flash of adapter at address xxxx
If no address specified verify the Flash of all adapters
/T = Multiport Fibre Channel adapter
/X xxxx = Verify NOVRAM of adapter at address xxxx

/L xxxx = Write NOVRAM, adapter address = xxxx

Command-line options : The following are additional command-line options that you can use.

To write NOVRAM on all FAStT Host Adapters in a system without being prompted for the I/O address, type:

```
flasutil /L
```

To write NOVRAM and flash to all adapters, type:

```
flasutil /L /F
```

To make the new settings the defaults, type:

```
flasutil /U
```

To write NOVRAM to the adapter at I/O address f400, type:

```
flasutil /L f400
```

To write NOVRAM and flash an adapter at I/O address f800, type:

```
flasutil /L f800 /F f800
```

Using the flasutil BIOS Update Utility menu (from the diskette)

To update your FAStT FC-2 Adapter BIOS code and NOVRAM using the flasutil BIOS Update Utility, do the following:

1. Insert the BIOS Update Utility diskette into drive A and restart the server. Your server will start to a DOS prompt:
2. From the DOS prompt, type:

```
flasutil
```

If you have more than one adapter, a list of adapters and their I/O addresses displays. If you have only one adapter, the following list of options displays.

```
L = Write NOVRAM  
F = Write Flash  
A = Write NOVRAM and defaults  
D = Copy NOVRAM to file:QLxxNVRM.SAV  
W = Copy Flash to file:QLxxROM.SAV  
U = Update BIOS VNOVRAM defaults  
S = Display serial number  
V = Display current BIOS version  
C = Verify Flash  
X = Verify NOVRAM
```

3. At the command prompt, type the appropriate I/O address and press Enter.

Note: You can run the utility from the command line with the options as /y, where y is the option required.

Chapter 6. Type 3526 Fibre Channel RAID controller

Note: The problem determination (PD) maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

The Type 3526 Fibre Channel RAID controller is compatible with the following IBM products:

- Type 3523 Fibre Channel Hub and GBIC
- Fibre Channel Adapter (FRU 01K7354)
- IBM FAStT Host Adapter (FRU 09N7292)
- Type 2109 Fibre Channel Switch
- Type 3534 Managed Hub

General checkout

Use the status LEDs, the “Symptom-to-FRU index” on page 61, and the connected server HMM to diagnose problems.

Using the Status LEDs

The LEDs of the control unit indicate the hardware status:

- Green LED indicates normal operation
- Amber LED indicates a hardware problem

The LEDs on the controller unit indicate the status of the controller unit and its individual components. The green LEDs indicate a normal operating status; amber LEDs indicate a hardware fault. Check all of the LEDs on the front and back of the controller unit when it is powered on.

Note:

1. 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.
2. To view the controller Customer Replaceable Unit (CRU) LEDs, the front cover must be removed from the controller unit. See “Removing the front cover” on page 55.

Also use LEDs on the front cover, controller CRUs, and drive units (if applicable) to determine whether the controllers and drives are responding to I/O transmissions from the host.

The following list describes LED activities:

- If a Fast Write Cache operation to the controller unit (or attached drive units), or if other I/O activity is in progress, then you might see several green LEDs blinking, including: the Fast Write Cache LED (on the front cover), controller CRU status LEDs, or applicable drive activity LEDs.
- The green Heartbeat LEDs on the controller CRUs blink continuously. The number and pattern of green status LEDs lit on the controllers depend on how the system is configured. An active controller will not have the same status LEDs lit as a passive controller. See “Controller CRU and battery LEDs” on page 57.

Features

The following list summarizes the features of the Type 3526 Fibre Channel RAID controller:

- Redundant fail-over
- Hot-swap components
- 128 MB cache per controller CRU as shipped
- Supports up to six IBM EXP 15 Expansion Units
- Supports Ethernet, Fiber, and Serial communications to each controller CRU
- Supports EXP200 expansion units

Additional service information

Powering on the controller

Note: All drive modules must be powered on before you power on the controller.

The controller might take from three to 10 seconds to power on. During this time, the amber and green LEDs on the controller unit flash.

After power on, check all fault LEDs to make sure they are off. If a fault LED is on, refer to the "Symptom-to-FRU index" on page 61.

Recovering from a power supply shutdown

Both power supplies have a built-in temperature sensor designed to prevent the power supplies from overheating. If a temperature sensor detects an over-temperature condition (ambient air temperature of 70° C (158° F) or above), the "overheated" power supply automatically shuts down. The other power supply remains on as long as its temperature remains below 70° C (158° F). If not, the second power supply shuts down, which turns off all power to the controller unit.

After the air temperature cools to below 70° C (158° F), the power supplies automatically restart. An automatic restart resets the controllers, attempts to spin up the drives (which has no effect on the drives if they are already running), and returns the controller unit to a normal operating state. Typically, you will not need to perform recovery procedures after an automatic power supply shutdown and restart.

After a power supply shutdown, check all controller LEDs.

If the power supply power LED is off, or the amber power supply LED on the front cover is on, go to the "Symptom-to-FRU index" on page 61.

Connectors and Host IDs

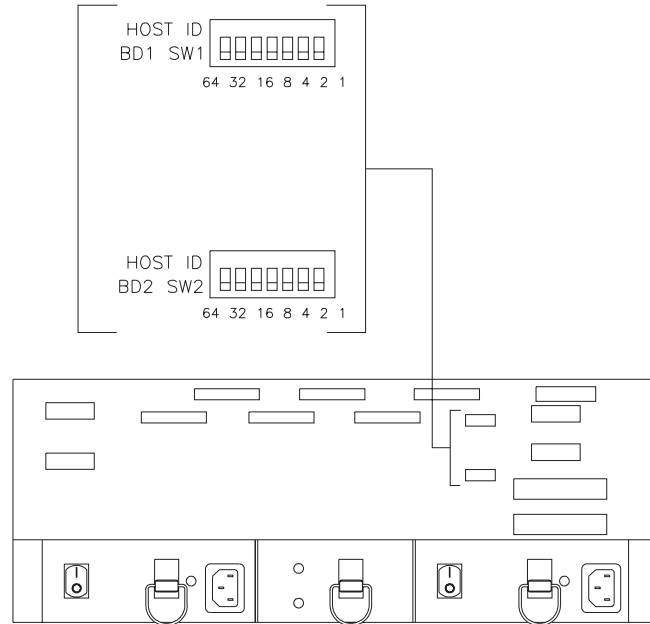
The Host ID switches and connectors for interface cables are on the connector plate located on the back of the controller unit.

Host and drive ID numbers

Each controller must have a unique Fibre Host ID number. The Host ID numbers assigned to each controller are based on two elements:

- Host ID numbers set through hardware switches on the controller unit. There are five Host ID switches that allow you to set ID numbers 0 through 127 for each controller. The factory default settings are ID #5 for Controller A and ID #4 for controller B.
- Software algorithms that calculate the actual Fibre Channel address, based on the controller unit's hardware settings and position on the loop or hub.

Note: The preferred ID is assigned on the Fibre Channel loop unless it is already being used. If the ID is already in use, a soft ID is assigned.



Fibre Channel host cable requirements

For the Type 3526 Fibre Channel RAID Controller, you must use multi-mode, 50 micrometer fiber-optic cable and a Media Interface Adapter (MIA), shown in the following figure.

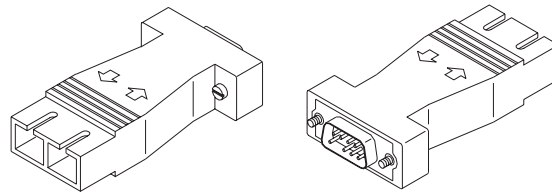


Table 11. Media Interface Adapter (MIA) specifications.

Cable	Media type	Data size	Transfer speed	Range
Fiber-optic (multi-mode, 50 micrometer)	Short-wave laser	100 MB/sec	1062.5 Mbaud	up to 500 m

LVD-SCSI drive cable requirements

To connect the controller unit to a drive module, you must use 68-pin, VHDCI (very high density cable interface) LVD, Ultra 2 SCSI cables. The controller unit has six drive connectors that support 16-bit interface protocols. Each connector represents a single drive channel that supports up to 10 drives per channel for a total of 60 drives.

Specifications

Size

- With front panel:
 - Depth: 610mm (24in.)
 - Height: 174mm (6.8in.)
 - Width: 482mm (19in.)

Weight

- Controller unit maximum weight: 34.5 kg (76 lb)
- Controller unit empty: 14.3 kg (31.6 lb)
- Battery: 9.7 kg (21.4 lb)

Electrical Input

- Sign-wave input (50 to 60 Hz)
 - Low range: Minimum: 90 V ac Maximum: 127 V ac
 - High range: Minimum: 198 V ac Maximum: 257 V ac
- Input Kilovolt-amperes (kVA) approximately:
 - Minimum configuration: 0.06 kVA
 - Maximum configuration: 0.39 kVA

Environment

- Air temperature:
 - hub on: 10° to 35° C (50° to 95° F) Altitude: 0 to 914 m (3000 ft.)
 - hub on: 10° to 32° C (50° to 90° F) Altitude: 914 m (3000 ft.) to 2133 m (7000 ft.)
- Humidity:
 - 8% to 80%

Heat Output

- Approximate heat output in British Thermal Units (BTU) per hour:
 - Maximum configuration: 731.8 BTU (214 watts)

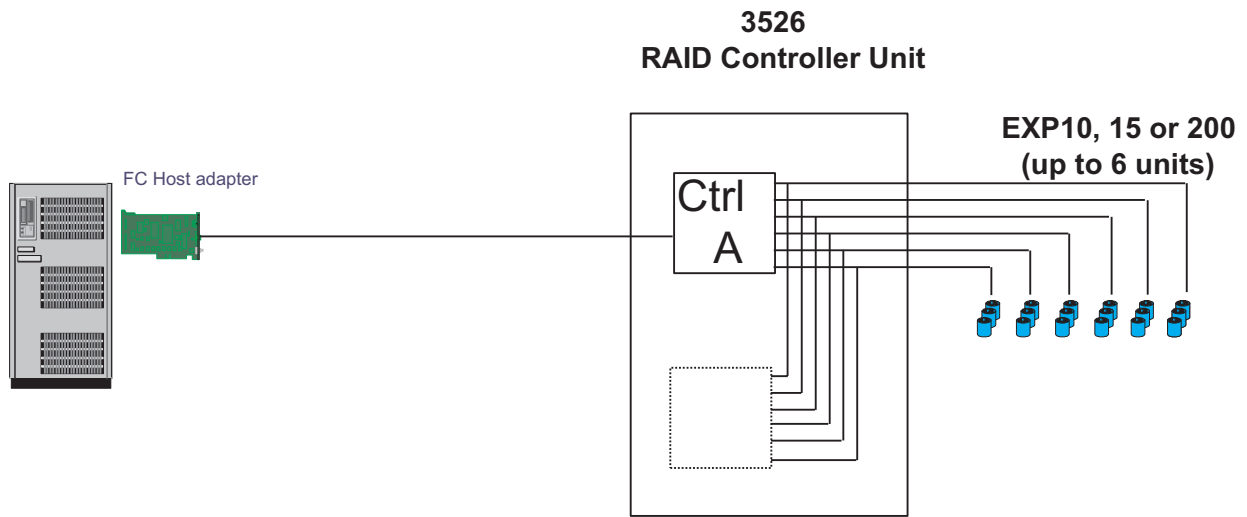
Acoustical Noise Emissions Values

- Sound Power (idling and operating):
 - 6.4 bels
- Sound Pressure (idling and operating):
 - 50 dBA

Tested configurations

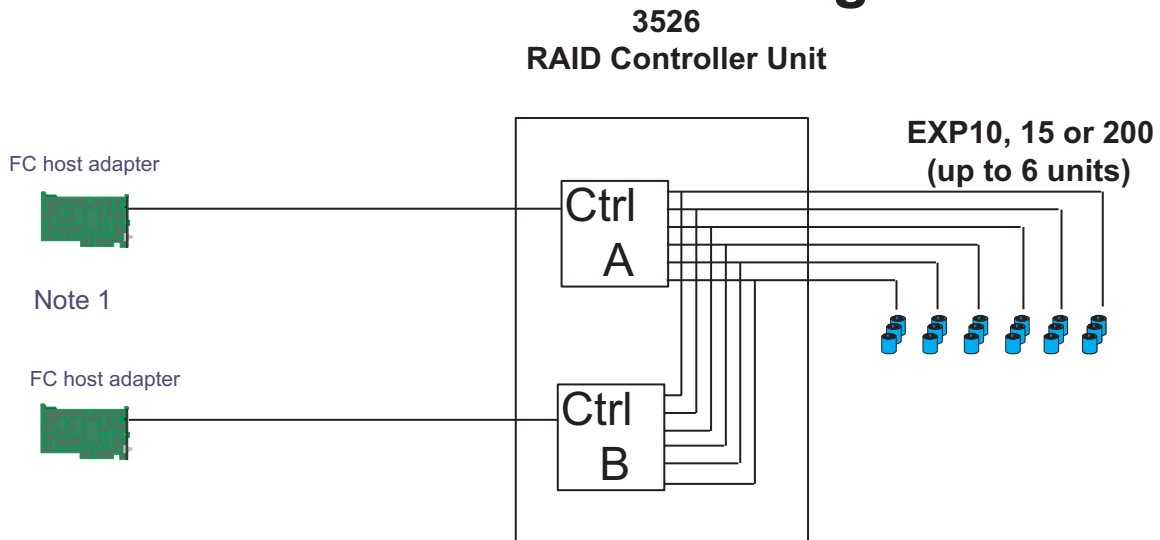
The following configurations are for the Type 3526 Fibre Channel RAID Controller.

Basic Configuration



Note: Basic as shipped, single controller, no hubs or switches

Basic Dual Controller Configuration



Note 1: Adapters can be in the same or different systems; choice affects total redundancy

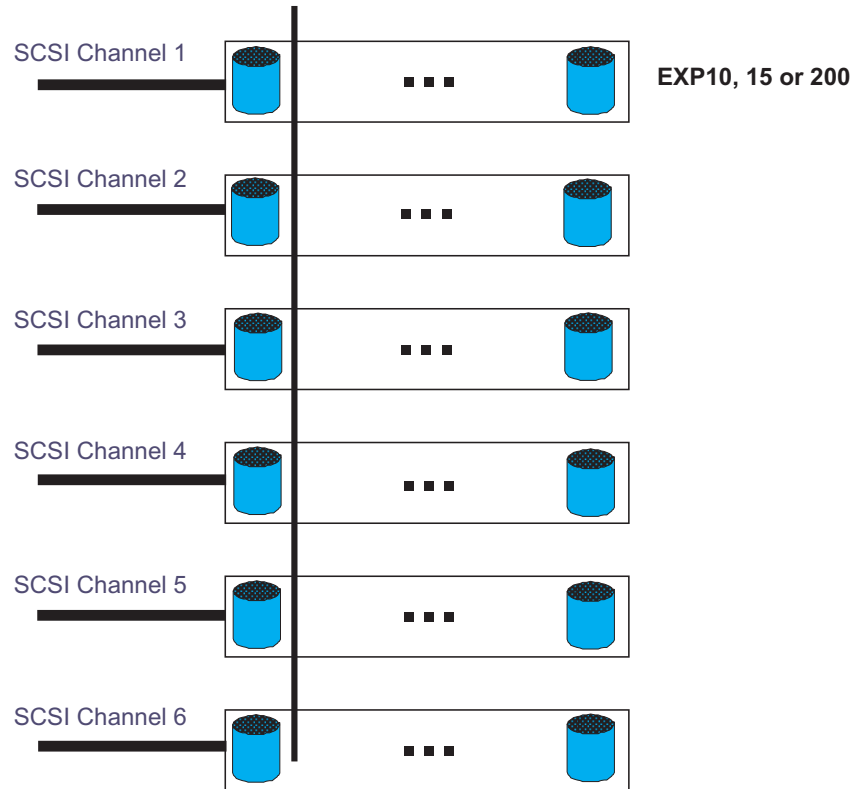
Note 2: No hubs or switches

Note 3: For max redundancy on the drive side use orthogonal striping (see orthogonal striping chart)

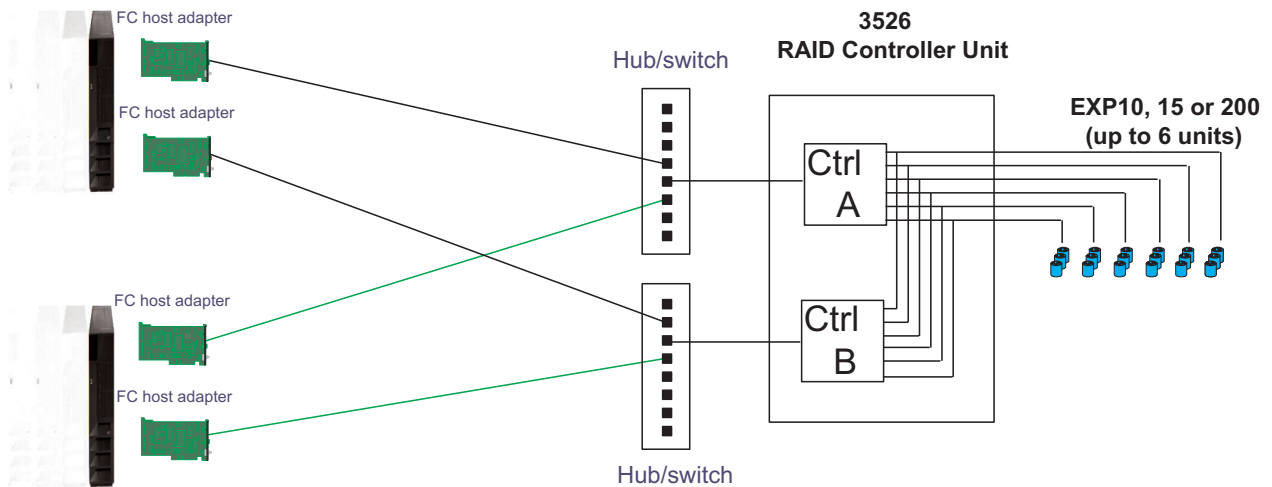
Note 4: This config does not provide for "NO single point of failure"

Orthogonal Data Striping

Data striped across channels



Simple Fully Redundant



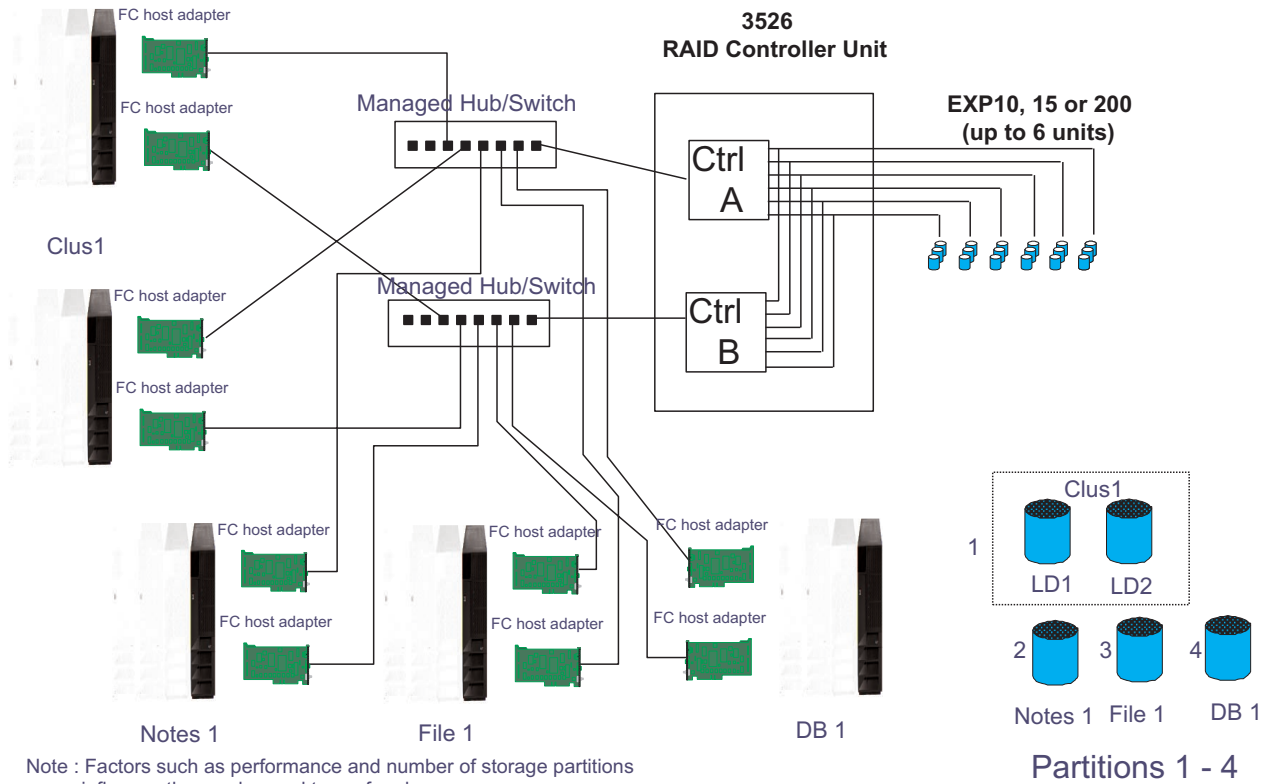
Redundant Servers

Note 1: Since disks are seen from multiple places some form of protection such as MSCS, storage partitioning, Sanergy, Oracle etc **must** be used.

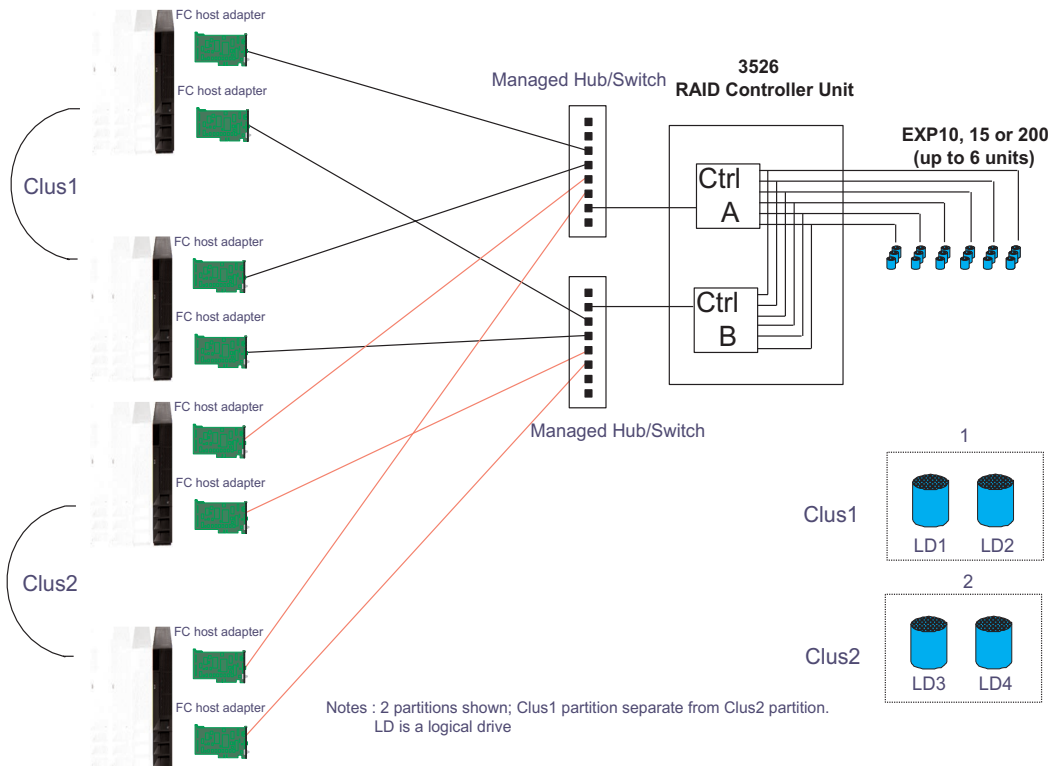
Note 2: For best performance and managability a managed hub or switch is preferred

Note 3: Always try to keep connections to hub on adjacent ports and unplug all unused GBICs

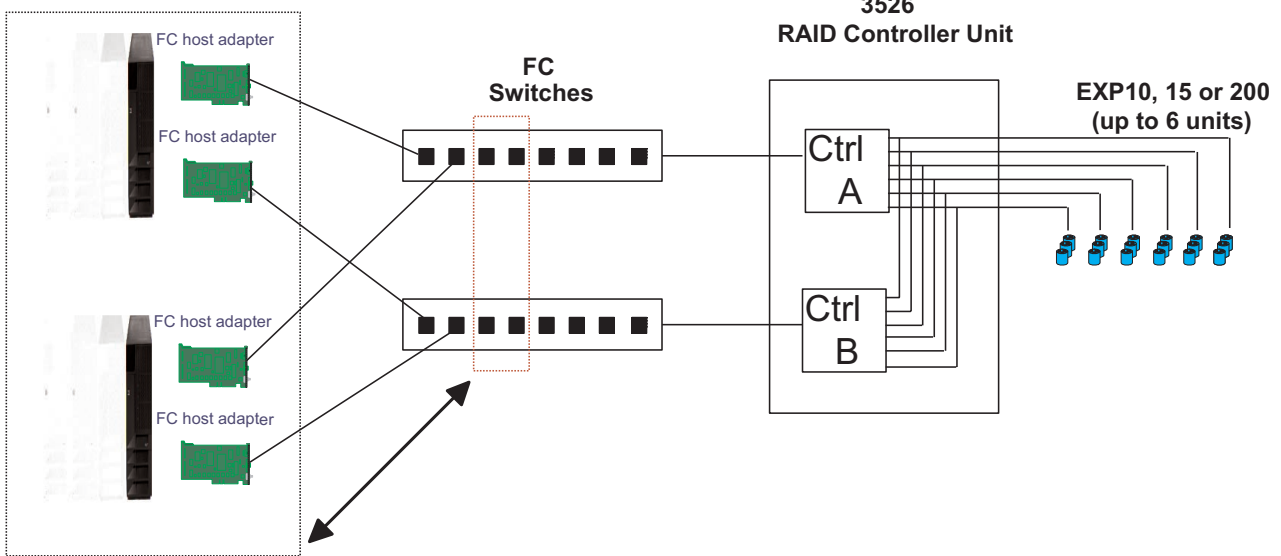
Cluster/Non-Cluster Share



Multi-MSCS No External Hubs



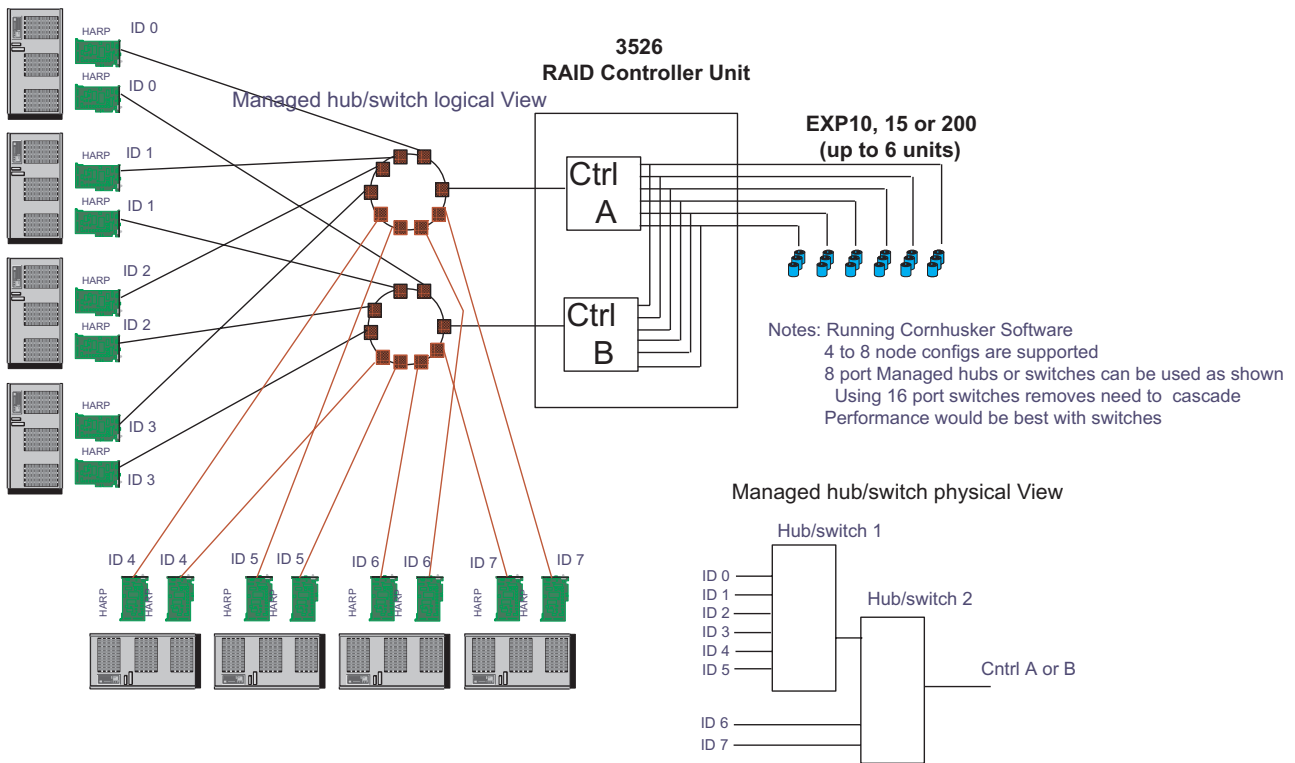
Multi-MSCS extended



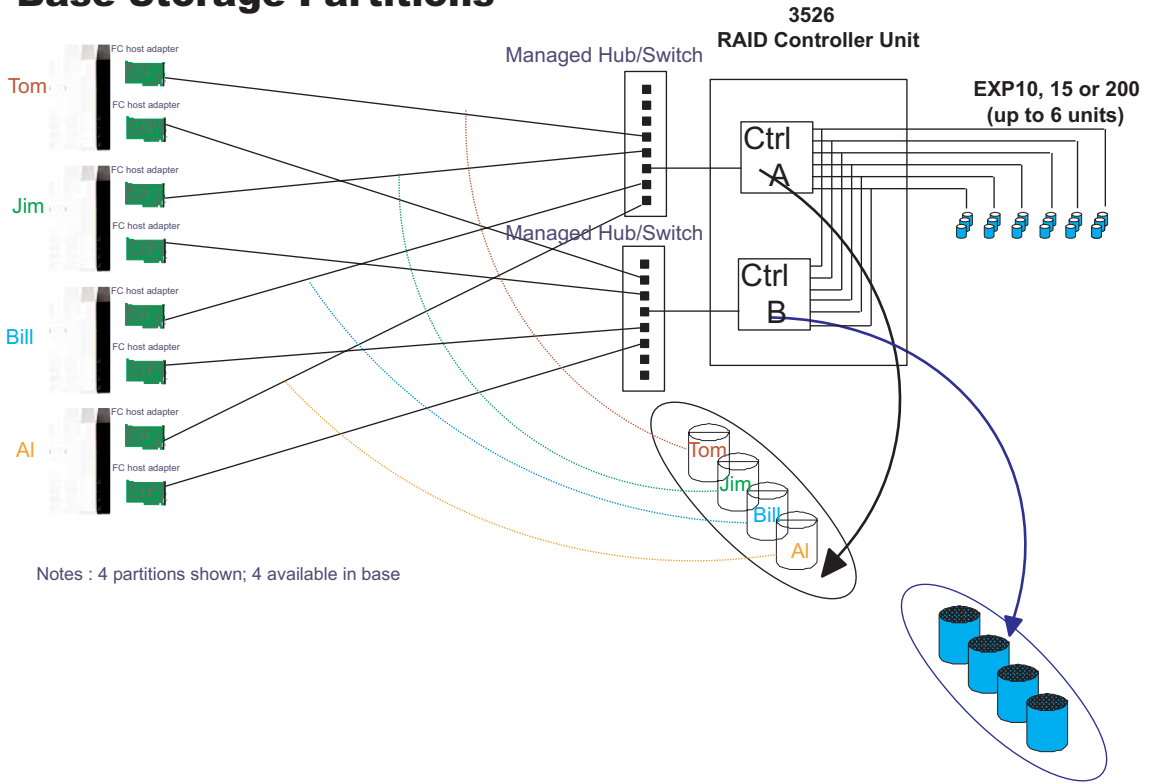
Notes :

- Each group of 4 ports on the switches (red dash box) can support one cluster element (black dash box)
- Storage partitioning is used to separate clusters
- Match performance needs of servers to max I/O available from 60 drives
- You may use some the switch ports to add 3526 units rather than hosts. Extending this to 16 port switches allows more of both

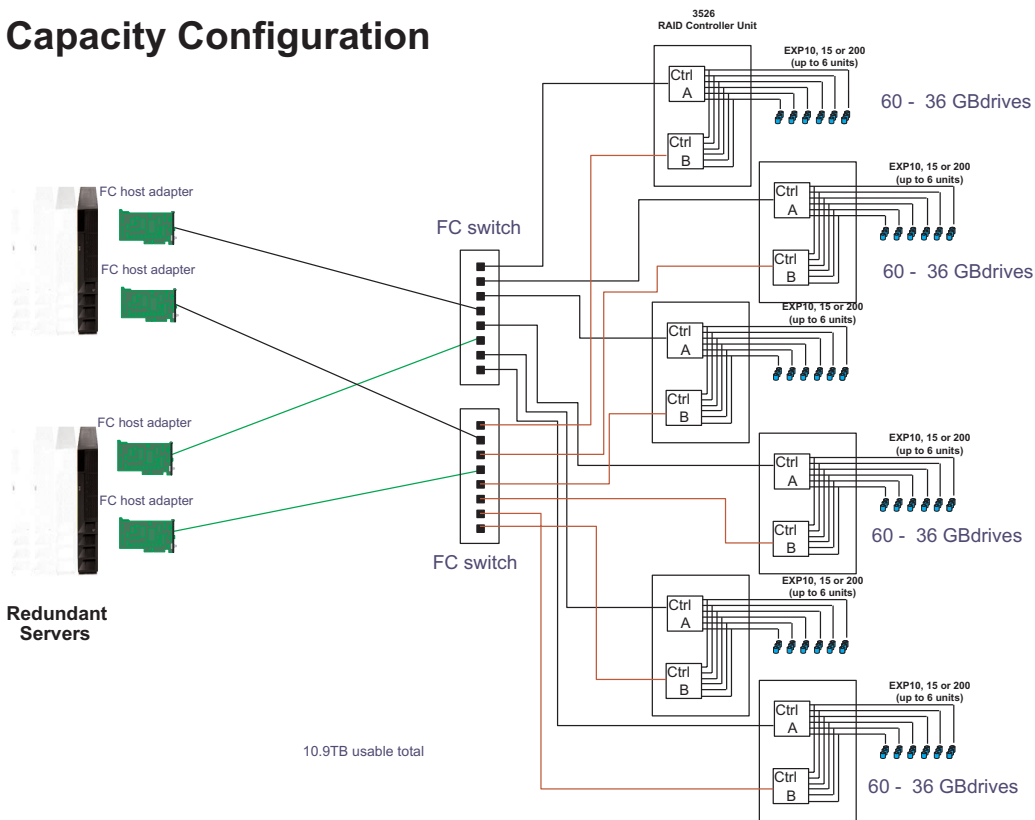
Cornhusker configuration



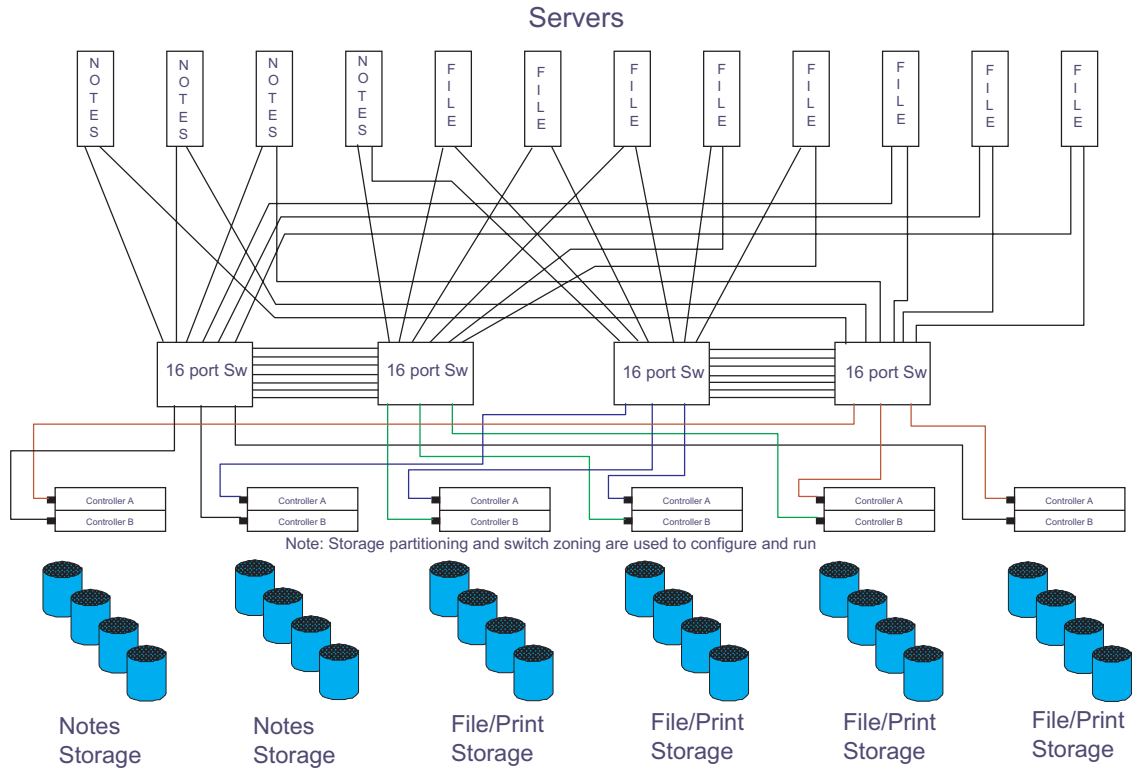
Base Storage Partitions



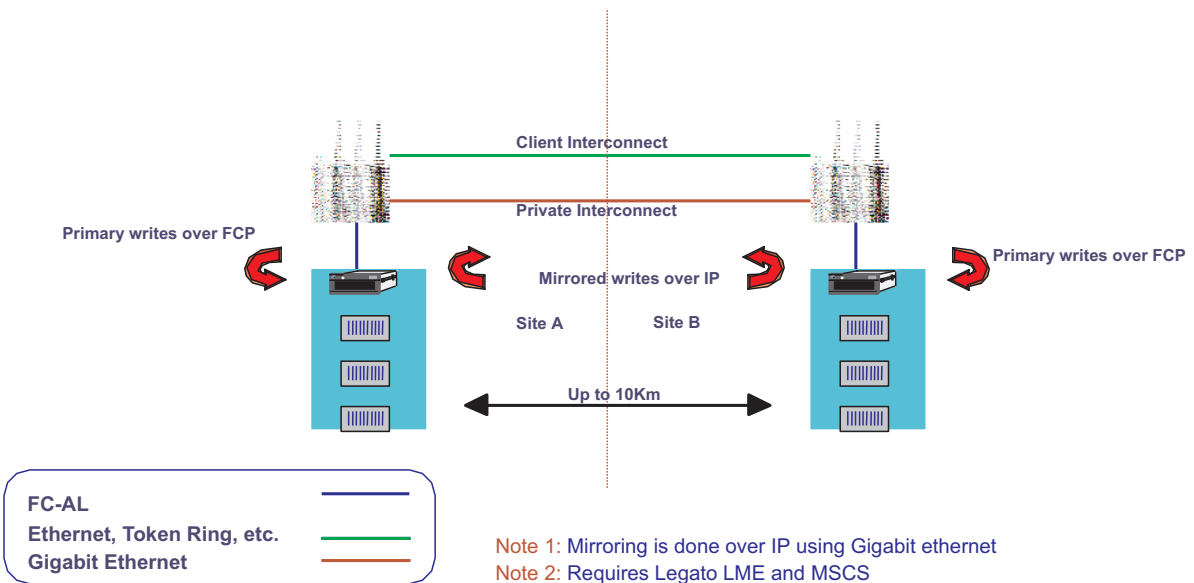
Capacity Configuration



SAN - Using Partitions of Clusters



Legato HA/Replication for MSCS

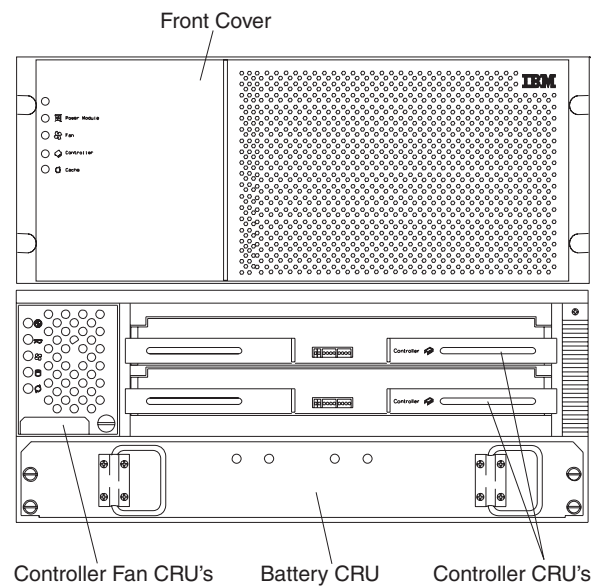


Locations and installation procedures

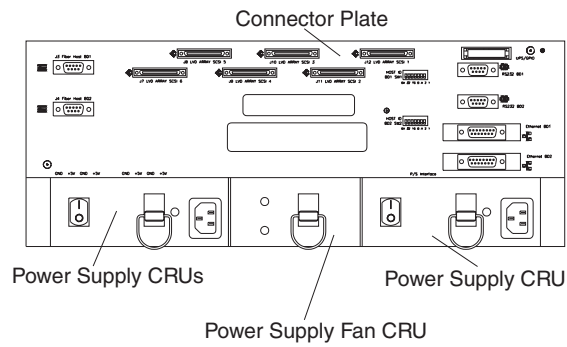
This section contains the following:

- “Controller unit front view”
- “Controller unit back view” on page 54
- “Air flow” on page 54
- “Removing the front cover” on page 55
- “Front LEDs” on page 55
- “Rear LEDs” on page 56
- “Removing and installing the controller CRU” on page 56
- “Controller CRU and battery LEDs” on page 57
- “Removing and installing the controller CRU fan” on page 58
- “Interface connections” on page 58
- “Removing and installing the power supply” on page 59
- “Removing and installing the power supply fan” on page 59
- “Replacing the battery” on page 60
- “Installing the rack” on page 61

Controller unit front view

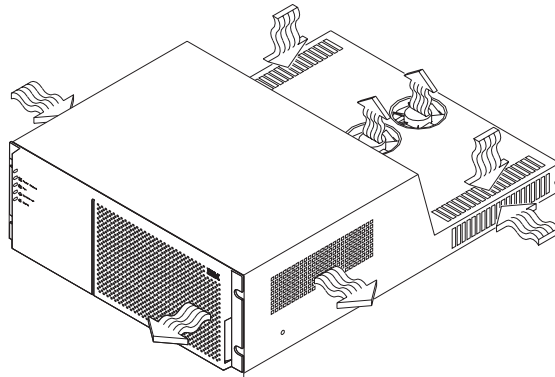


Controller unit back view

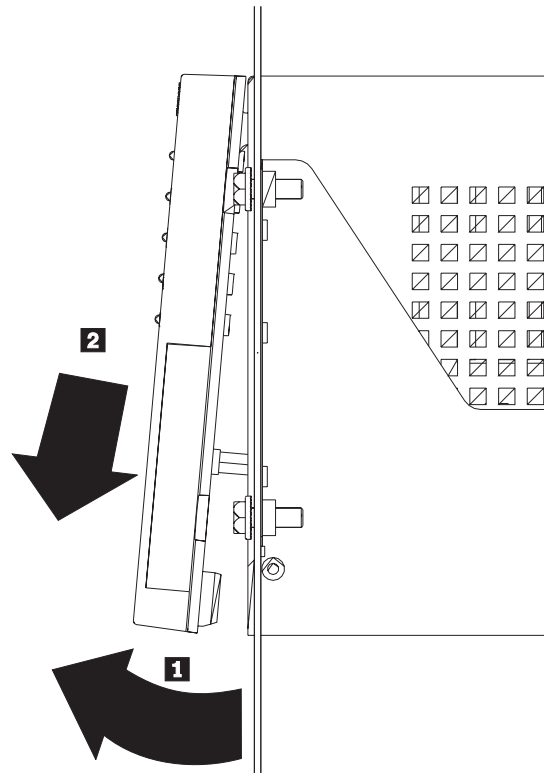


Air flow

The controller unit must have proper air circulation throughout the chassis. To boost air circulation, the chassis has air vents along its top and sides. These vents serve as air intake and exhaust passages. Assure that vents are clean and free of obstruction.



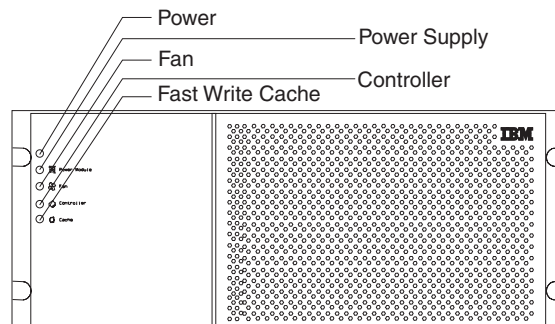
Removing the front cover



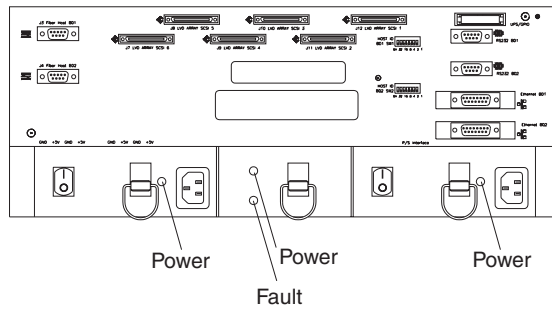
Removing the front cover:

1. Pull out on the bottom to release pins, then slide cover down.
2. To replace front cover, slide top edge of cover under lip of chassis, then push bottom of cover until pins snap into mounting holes.

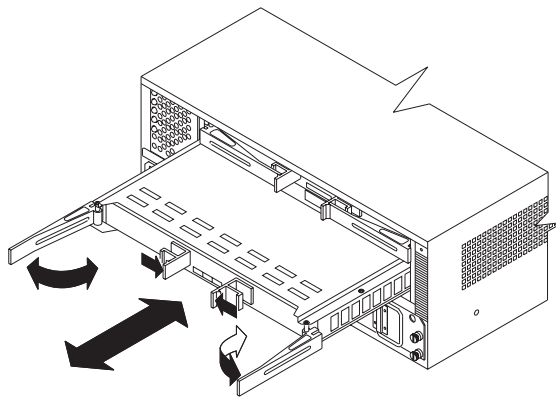
Front LEDs



Rear LEDs



Removing and installing the controller CRU



Note: Keep track of which controller CRU belongs in each slot. To prevent data loss, you must replace each controller (A or B) in its original slot.

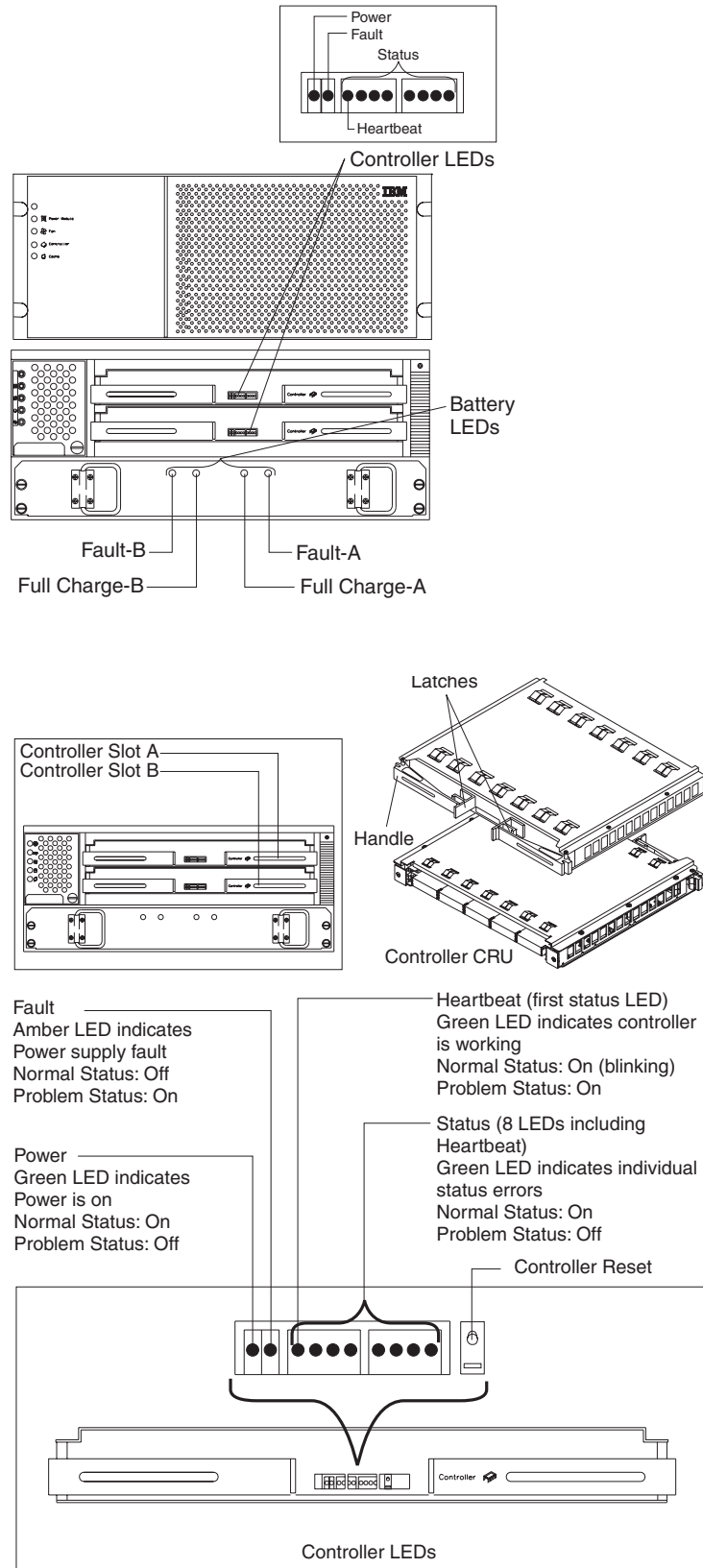
Removing a Controller CRU:

1. Unlock the levers of the controller you want to remove.
2. Open both levers *at the same time*.
3. Pull out the controller.

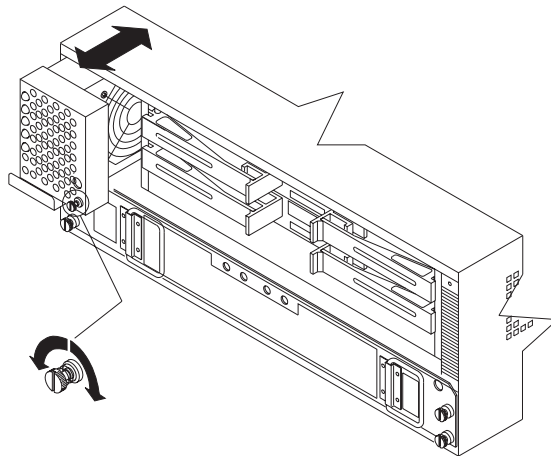
Installing a Controller CRU:

1. Make sure both levers are straight out as shown in the figure above.
2. Carefully push the Controller CRU into the slot making sure both levers swing inward *at the same time*.
3. Close and lock both levers at the same time.

Controller CRU and battery LEDs



Removing and installing the controller CRU fan



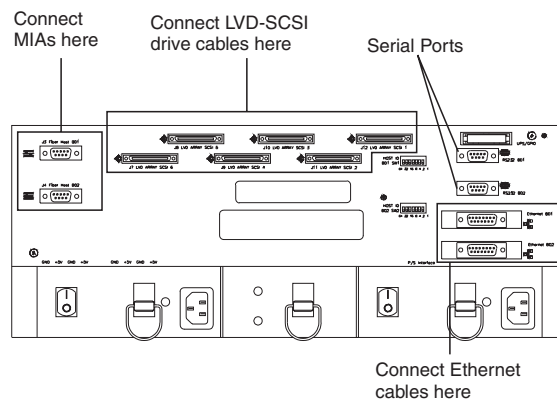
Removing the Controller CRU fan:

1. Loosen captive screw.
2. Pull firmly on handle to remove CRU.

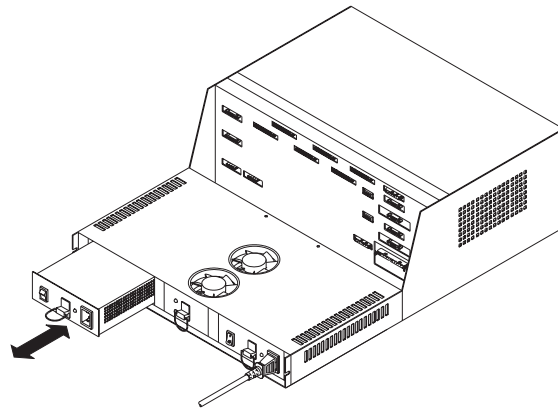
Installing the Controller CRU fan:

1. Push Controller CRU Fan firmly into slot and tighten the captive screw.

Interface connections



Removing and installing the power supply



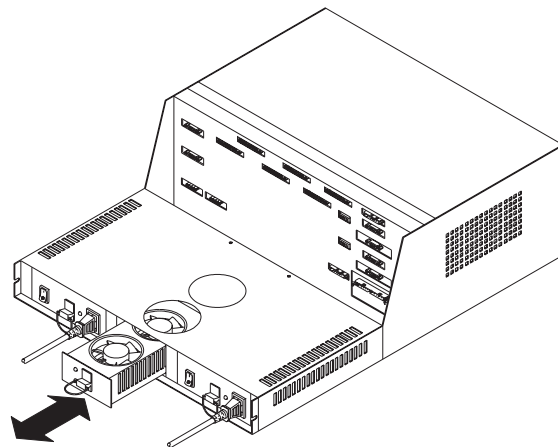
Removing the power supply CRU:

1. Power off the power supply CRU.
2. Disconnect the power cord from the power supply CRU.
3. Pull the pull ring lever up to unlatch the CRU.
4. Pull the CRU out of the controller unit.

Installing the power supply CRU:

1. Install the new power supply CRU into the controller unit.
2. The lever snaps down when the CRU is seated properly in the chassis. If the lever remains up, push on the power supply CRU until the lever snaps into place.
3. Connect the power cord, power on the controller unit and check all LEDs.

Removing and installing the power supply fan



Removing the power supply fan:

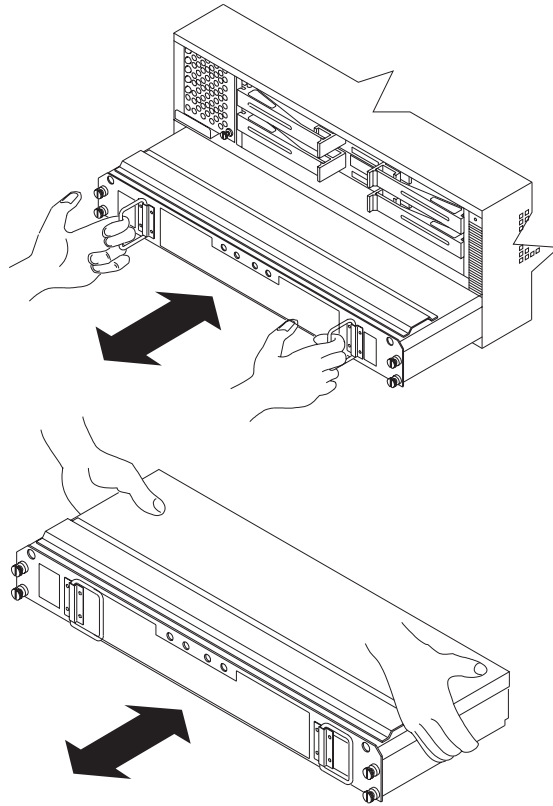
1. Pull the pull ring lever up to unlatch the CRU.
2. Pull the CRU out of the controller unit.

Installing the power supply fan:

1. Install the new power supply fan CRU into the controller unit.

2. The lever snaps down when the CRU is seated properly in the chassis. If the lever remains up, push on the power supply fan CRU until the lever snaps into place.

Replacing the battery



Removing the battery CRU:

Unpack the battery CRU. Save the shipping material for transporting the used battery CRU. Find the "Battery Support Information" label on the front of the new battery CRU.

1. Record today's date on the blank line next to "Date of Installation".
2. Remove the front cover of the controller unit.

Important

The battery CRU weighs approximately 24 lbs. Make sure you are prepared to support its weight when you remove it from the chassis.

3. Turn the captive screws on the battery CRU counterclockwise. If they are too tight, use a flat blade screwdriver to loosen the screws.
4. Pull battery CRU out about 2 inches.
5. Grasp the battery sides with *both hands* and slide out.

Installing the Battery CRU:

1. Slide the battery CRU into the slot and tighten all captive screws.
2. Replace the front cover.
3. Allow the system to run for at least 24 hours in order to properly charge the battery.

When properly charged, both Full Charge LEDs will be lit on the front of the battery CRU.

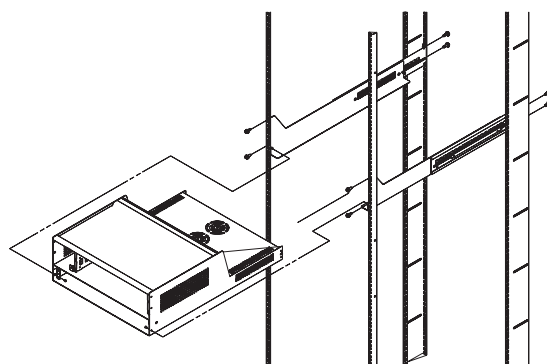
Important

Dispose of the used battery CRU according to local and federal regulations, which may include hazardous material handling procedures.

Important

If the used battery CRU is leaking electrolyte gel, *do not* ship it to a recycling center. Handle damaged batteries according to your local regulations, which may include procedures for handling batteries as hazardous waste.

Installing the rack



Note: Before removing or placing the controller unit in the rack, carefully remove the battery from the controller unit. See “Replacing the battery” on page 60.

1. Loosen the adjustment screws on both side rails and adjust to fit the rack.
2. Secure the side rails to the rack cabinet using eight M6 screws and eight rack mounting nuts. Make sure both side rails are parallel and level to one another in the rack cabinet.
3. Tighten the rail adjustment screws.
4. After the side rails are secured to the rack, carefully slide the controller unit onto the side rails.
5. Secure the controller unit with two screws on the front sides of the battery compartment.

Symptom-to-FRU index

The Symptom-to-FRU index lists symptoms and the possible causes. The most likely cause is listed first.

The PD maps found in the *Fibre Channel Problem Determination Guide* also provide you with additional diagnostic aids.

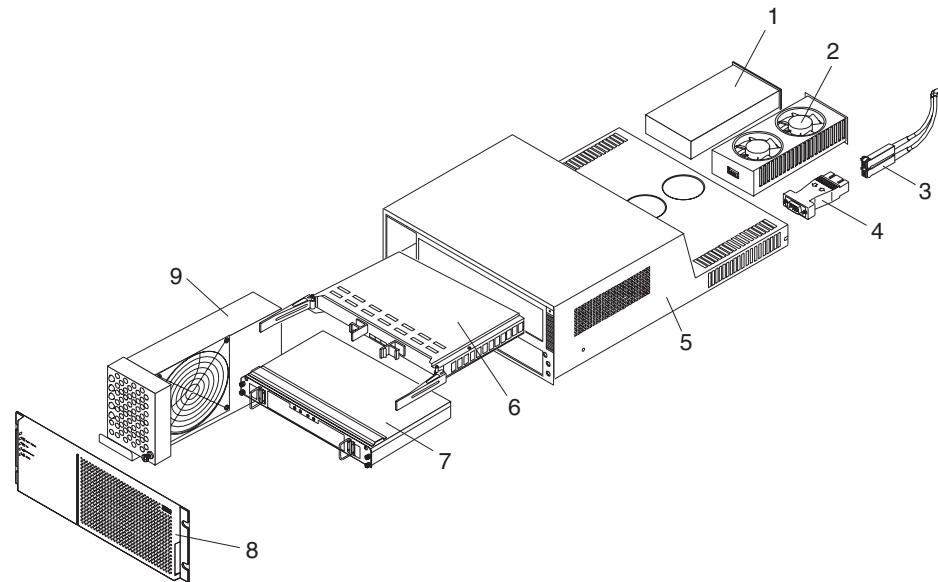
Note:

1. Always start with the “General checkout” on page 43. For IBM devices not supported by this index, refer to the manual for that device.
2. Do *not* look directly into any fiber cable or GBIC optical output. Read Appendix B, “Related service information,” on page 369. To view an optical signal, use a mirror to view the reflected light.

Table 12. Symptom-to-FRU index for Type 3526 Fibre Channel RAID controller.

Problem	FRU/Action
Controller LED (front cover) is on.	<ol style="list-style-type: none"> 1. Reseat Controller CRU 2. Place Controller online using SM7 GUI 3. If in passive mode, check Fibre path/GBIC 4. Controller CRU
Software issued a controller error message.	<ol style="list-style-type: none"> 1. Check Controller Fan 2. Controller CRU
Software errors occur when attempting to access controllers or drives.	<ol style="list-style-type: none"> 1. Check appropriate software and documentation to make sure the system is set up correctly and the proper command was executed. 2. Power to the Controller 3. Interface cables 4. ID settings 5. Controller 6. Drive 7. Controller backpanel
Fan LED (front cover) is on.	<ol style="list-style-type: none"> 1. Power supply fan CRU 2. Controller fan CRU
Controller and Fan fault LEDs (front cover) are on.	<ol style="list-style-type: none"> 1. Check both Fan and Controller CRUs for fault LED and replace faulty CRU.
Fault-A or Fault-B LED (battery CRU) is on. Note: The Fault-A or Fault-B LED <i>will</i> be on during battery charging.	<ol style="list-style-type: none"> 1. Battery CRU
Full Charge-A or Full Charge-B LED (battery CRU) is off.	<ol style="list-style-type: none"> 1. Power on Controller and allow batteries to charge for 24 hours until the Full Charge LEDs are on. 2. Battery CRU 3. Both power supplies
No power to controller (all power LEDs off)	<ol style="list-style-type: none"> 1. Check power switches and power cords 2. Power supplies
Power Supply LED is off.	<ol style="list-style-type: none"> 1. Check and reseat power supply 2. Check for overheating. Wait ten minutes for the power supply CRU to cool down. See "Recovering from a power supply shutdown" on page 44. 3. Power supply CRU
Power Supply CRU LEDs are on, but all other CRU LEDs are off.	<ol style="list-style-type: none"> 1. DC power harness

Parts listing (Type 3526 Fibre Channel RAID Controller)



Index	Fibre Channel RAID Controller (Type 3526)	FRU
1	350-Watt Power Supply	01K6743
2	Rear Fan Assembly (Power Supply Fan)	01K6741
3	Optical Cable - 5 Meters (option)	03K9202
3	Optical Cable - 25 Meters (option)	03K9204
4	Media Interface Adapter (MIA)	03K9280
5	Frame Assembly with Midplane	10L6981
6	Controller Assembly with 32 MB memory /128 MB cache	10L6993
7	Battery Backup Assembly	01K6742
8	Bezel Assembly	10L7043
9	Front Fan Assembly (Controller CRU Fan)	01K6740
	128 MB cache module	10L5862
	Battery Cable	03K9285
	Fan Cable	03K9281
	Power Cable	03K9284
	Miscellaneous Hardware Kit	01K6739
	Rail Kit	10L6982

Chapter 7. Type 3552 FASt500 RAID controller

Note: The problem determination (PD) maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

The IBM FASt500 RAID controller is compatible with the following IBM products:

- IBM FASt Host Adapter (FRU 09N7292)
- IBM FASt EXP500 enclosure
- Type 2109 Fibre Channel Switch
- Type 3534 Managed Hub

General checkout

Use the indicator lights, the “Symptom-to-FRU index” on page 132, and the connected server HMM to diagnose problems.

The problem determination (PD) maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

Checking the indicator lights

The controller unit indicator lights display the status of the controller unit and its components. Green indicator lights mean normal operating status; amber indicator lights mean a possible failure.

It is important that you check all the indicator lights on the front and back of the controller unit when you turn on the power. After you turn on the power, the indicator lights might blink intermittently. Wait until the controller unit completes its power up before checking for faults. It can take up to 15 minutes for the battery to complete its self-test and up to 24 hours to fully charge, particularly after an unexpected power loss of more than a few minutes.

Use the following procedure to check the controller unit indicator lights and operating status.

1. To view the indicator lights, remove the controller unit bezel.
2. Check the indicator lights on the front of the controller unit.
3. Check the indicator lights on the back of the controller unit.
4. Check the indicator lights on the mini hubs.
5. If all indicator lights show a normal status, replace the bezel; otherwise, run the storage-management software to diagnose and repair the problem.

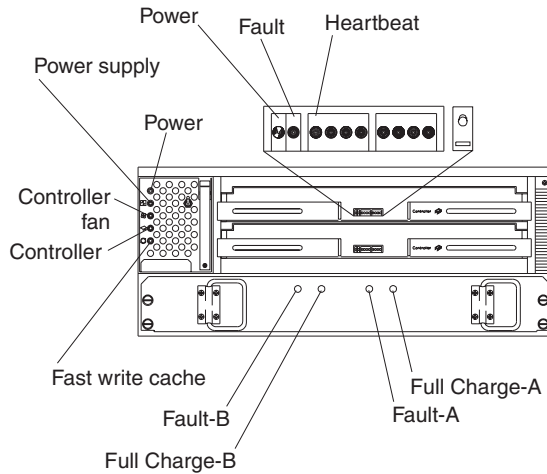


Table 13. Type 3552 FAST500 RAID controller indicator lights.

Indicator light	Color	Normal Operation	Problem Indicator	Possible Conditions indicated by the problem indicator (1)
Component: controller CRU				
Power	Green	On	Off	<ul style="list-style-type: none"> No power to controller unit No power to storage subsystem Cables are loose or the switches are off Power supply has failed, is missing, or is not fully seated Overtemperature condition
Fault	Amber	Off	On	Controller failure; controller fault condition
Heartbeat	Green	Blinking (2)	Not blinking (2)	No controller activity
Status (eight lights including Heartbeat)	Green	Various patterns depending on the condition	Various patterns depending on the condition	If the second, third, sixth, and seventh lights are on or if all eight lights are on, there is a memory fault indicating that the controller CRU has failed.
Component: controller fan				
Power	Green	On	Off	<ul style="list-style-type: none"> No power to controller unit No power to storage subsystem Cables are loose or the switches are off Power supply has failed, is missing, or is not fully seated in controller unit Overtemperature condition
Power supply fault	Amber	Off	On	<ul style="list-style-type: none"> Power supply has failed Overtemperature Power supply is turned off, disconnected, or not fully seated in controller unit No power to controller unit or storage subsystem (all indicator lights are off)

Table 13. Type 3552 FASt500 RAID controller indicator lights.

Indicator light	Color	Normal Operation	Problem Indicator	Possible Conditions indicated by the problem indicator (1)
Controller fan fault	Amber	Off	On	<ul style="list-style-type: none"> Controller fan has failed Fan and communications module is missing, unplugged, or has failed Circuitry failure Overtemperature condition
Controller fault	Amber	Off	On	Controller has failed; one or more memory modules failed (SIMMs or DIMMs)
Fast write cache	Green	Steady or blinking (3)	Software dependent (3)	Normal operation is off if: <ul style="list-style-type: none"> Cache is not enabled Battery is not ready
Component: battery				
Fault-A or Fault-B	Amber	Off	On	<ul style="list-style-type: none"> Left or right battery bank has failed Battery is either discharged or defective
Full Charge-A or FullCharge-B	Green	On (4)	Off	<ul style="list-style-type: none"> Left or right battery bank is not fully charged Power has been off for an extended period and has drained battery power Batteries are weak
<ol style="list-style-type: none"> Always use the storage-management software to identify the failure. There are eight status lights (the Heartbeat and seven others) that glow in various patterns, depending on the controller status. The fast write cache indicator light is on when there is data in cache and blinks during a fast write operation. If either Full Charge-A or Full Charge-B indicator light blink, the battery is in the process of charging. 				

The indicator lights are located on the back of the controller unit.

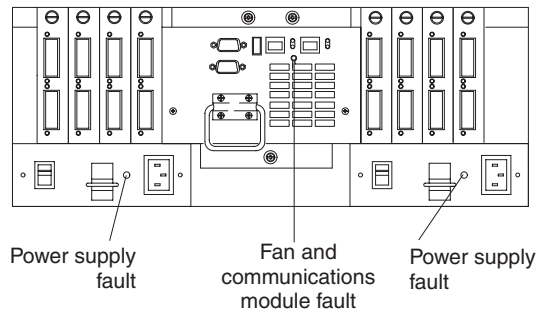


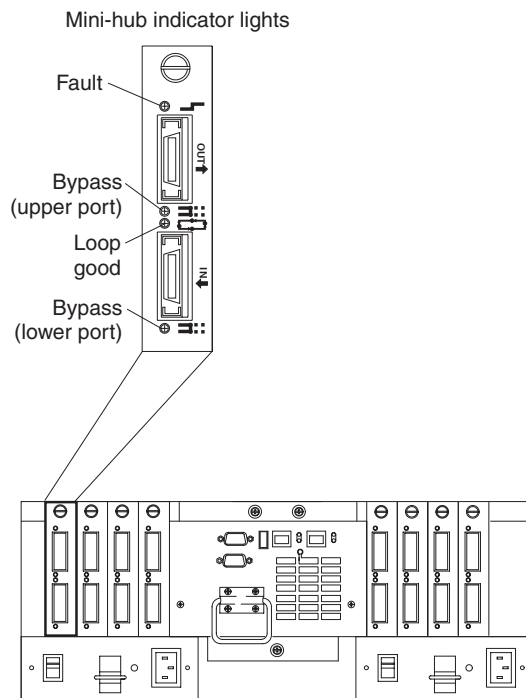
Table 14. Type 3552 FASt500 RAID controller indicator lights.

Indicator light	Color	Normal Operation	Problem Indicator	Possible Conditions indicated by the problem indicator (1)
Fan and communications module				
Fan and communication fault	Amber	Off	On	<ul style="list-style-type: none"> Fan and communications module has failed or is installed incorrectly Overtemperature condition

Table 14. Type 3552 FAStT500 RAID controller indicator lights.

Indicator light	Color	Normal Operation	Problem Indicator	Possible Conditions indicated by the problem indicator (1)
Power supply				
Power supply	Green	On	Off	<ul style="list-style-type: none"> No power to controller unit No power to storage subsystem Power supply has failed Overtemperature condition
1. Always use the storage-management software to identify the failure.				

The mini hub indicator lights on the back of the controller unit are shown in the following figure.



The following table describes the mini hub indicator lights.

Table 15. Mini hub indicator lights.

Icon	Indicator light	Color	Normal Operation	Problem Indicator	Possible condition indicated by the problem indicator
Component: mini hub (host-side)					
	Fault	Amber	Off	On	Mini hub or GBIC has failed Note: If a host-side mini- hub is not connected to a controller, this fault light is always on.

Table 15. Mini hub indicator lights.








Icon	Indicator light	Color	Normal Operation	Problem Indicator	Possible condition indicated by the problem indicator
	Bypass (upper port)	Amber	Off	On	<ul style="list-style-type: none"> Upper mini hub port is bypassed Mini hub or GBIC has failed, is loose, or is missing Fiber-optic cables are damaged <p>Note: If the port is unoccupied, the light is on.</p>
	Loop good	Green	On	Off	<ul style="list-style-type: none"> The loop is not operational Mini hub has failed or a faulty device might be connected to the mini hub Controller has failed <p>Note: If a host-side mini hub is not connected to a controller, the green light is always off and the fault light is always on.</p>
	Bypass (lower port)	Amber	Off	On	<ul style="list-style-type: none"> Lower mini hub port is bypassed Mini hub or GBIC has failed, is loose, or is missing Fiber-optic cables are damaged <p>Note: If the port is unoccupied, the light is on.</p>
Component: mini hub (drive-side)					
	Fault	Amber	Off	On	<p>Mini hub or GBIC has failed</p> <p>Note: If a drive-side mini hub is not connected to a controller, this fault light is always on.</p>
	Bypass (upper port)	Amber	Off	On	<ul style="list-style-type: none"> Upper mini hub port is bypassed Mini hub or GBIC has failed, is loose, or is missing Fiber-optic cables are damaged <p>Note: If the port is unoccupied, the light is on.</p>

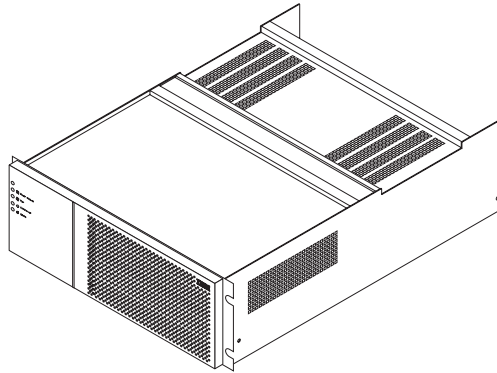
Table 15. Mini hub indicator lights.

Icon	Indicator light	Color	Normal Operation	Problem Indicator	Possible condition indicated by the problem indicator
	Loop good	Green	On	Off	<ul style="list-style-type: none"> The loop is not operational Mini hub has failed or a faulty device might be connected to the mini hub Drive has failed <p>Note:</p> <p>If a drive-side mini hub is not connected to a controller, the green light is always off and the fault light is always on.</p>
	Bypass (lower port)	Amber	Off	On	<ul style="list-style-type: none"> Lower mini hub port is bypassed Mini hub or GBIC has failed, is loose, or is missing Fiber-optic cables are damaged <p>Note:</p> <p>If the port is unoccupied, the light is on.</p>

Features

The controller unit is used with rack-mounted drive enclosures (also referred to as expansion units) for Fibre Channel.

The following figure shows the IBM FAST500 RAID Controller. The following list summarizes the features of the Type 3552 Fibre Channel RAID Controller.



The controller unit comes with the following items:

- Hardware
 - Two RAID controllers
 - Two power supplies
 - Battery
 - Two host mini hubs and two drive mini hubs
 - Two power cords or two high voltage rack jumpers
 - One rack-mounting hardware kit:
 - Two rails (right and left)
 - Eight black M6 hex-head screws
 - Eight clip nuts
 - Eight cage nuts
 - Software and documentation including:
 - IBM FAStT Storage Manager Version 7.01 CD
 - IBM FAStT Storage Manager 7.01
 - Publications and online help in Adobe Acrobat PDF format
- Rack Mounting Assembly including
 - Rack Mounting Installation Instructions
 - Rack Mounting Template
 - White tape dots
 - Fibre Channel Cabling Instructions
- Controller unit components

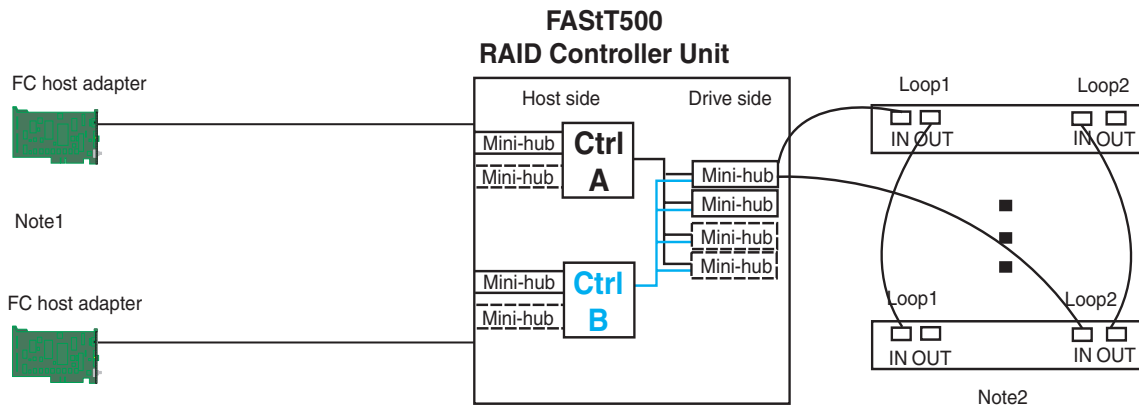
The controller unit has the following removable components, called customer-replaceable units (CRUs). All CRUs are accessible from either the front or back of the controller unit.

 - Bezel (front cover)
 - Controller fan
 - Battery
 - Controller (two each)
 - Power supply (two each)
 - Host mini hub (comes with two, four maximum)
 - Drive mini hub (comes with two, four maximum)
 - Fan and communications module

Tested configurations

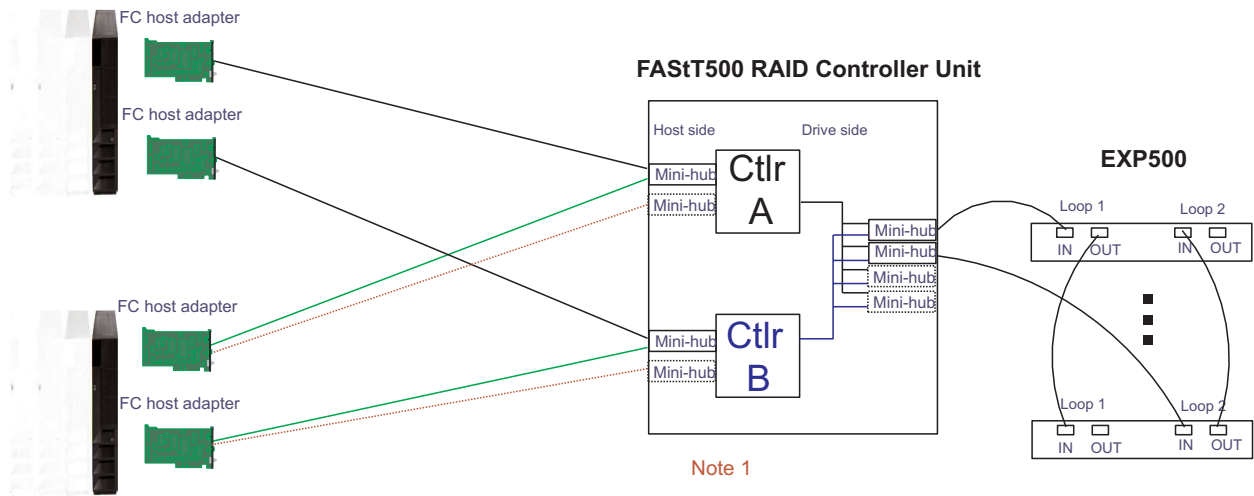
The following configurations are for the Type 3552 IBM FAStT500 RAID Controller.

Basic Configuration



- Note 1: Adapters can be in the same or different systems
- Note 2: Redundant drive loops are shown and required
- Note 3: Mini-hubs in dashes are options
- Note 4: For dual redundant loops connect to the optional set of mini-hubs shown as dashed on the drive side

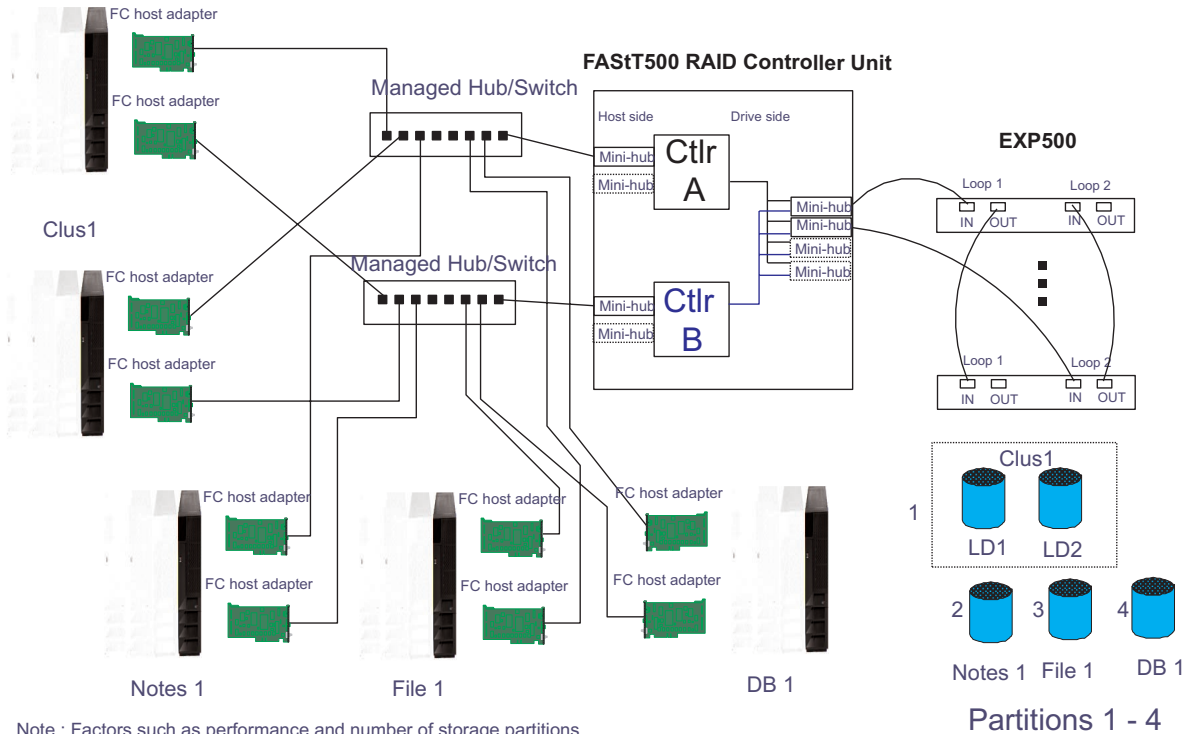
Simple Fully Redundant



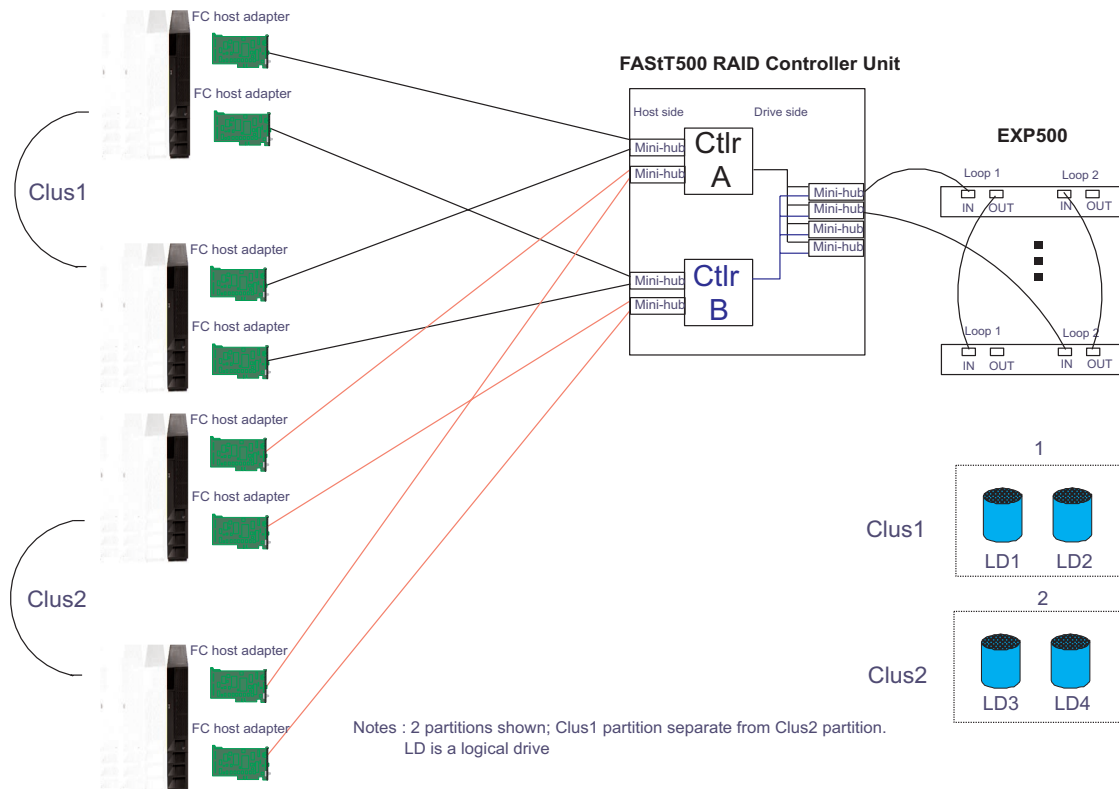
Redundant Servers

- Note 1: Since disks are seen from multiple places some form of protection such as MSCS, storage partitioning, Sanergy, Oracle etc **must** be used.
- Note 2: For max bandwidth wire dotted red lines instead of green

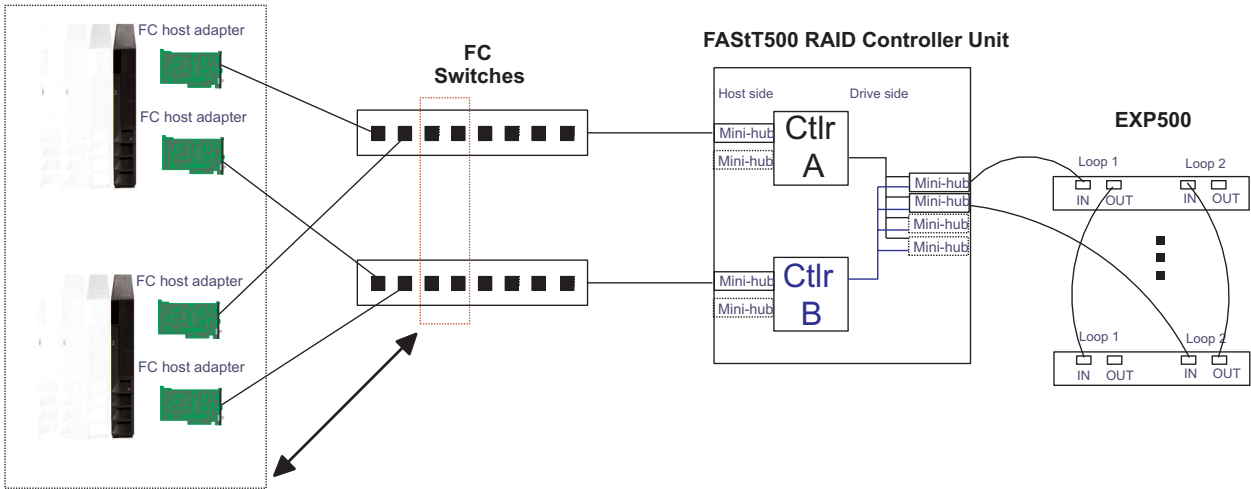
Cluster/Non-Cluster Share



Multi-MSCS No External Hubs

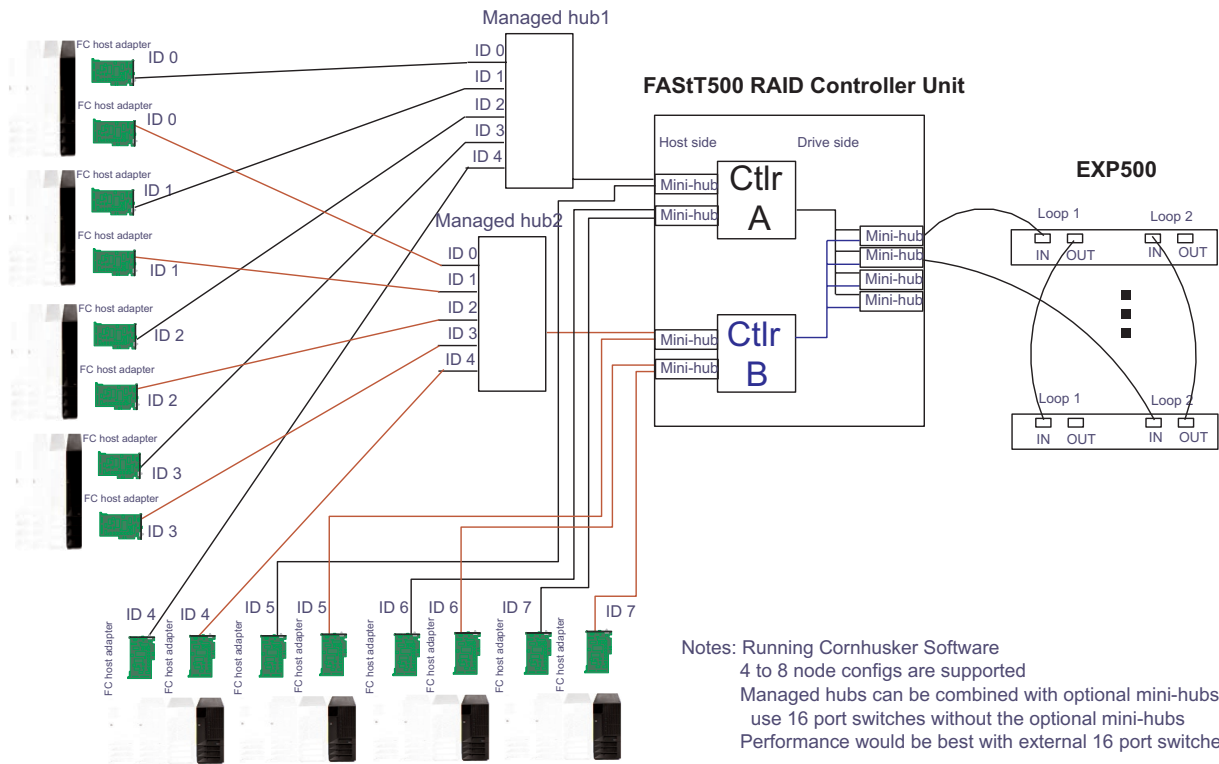


Multi-MSCS extended



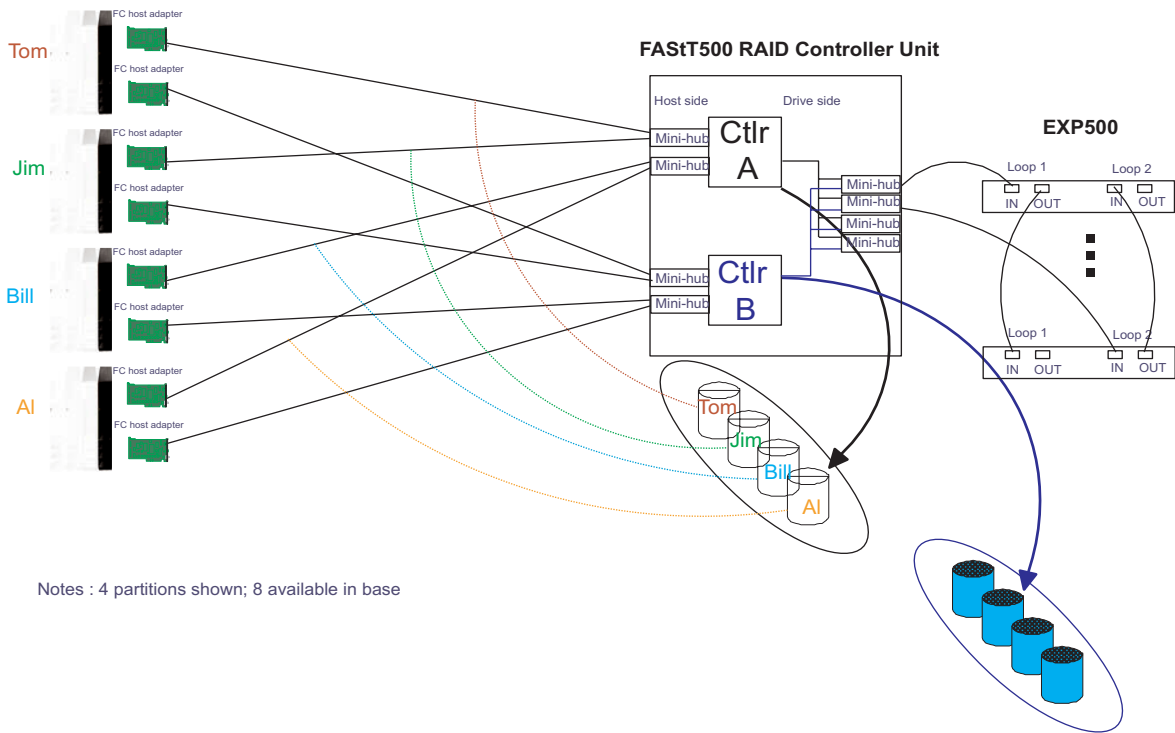
- Notes :
- Each group of 4 ports on the switches (red dash box) can support one cluster element (black dash box)
 - Storage partitioning is used to separate clusters
 - 16 port switches allow more clusters but this has to be within performance needs and available partitions

Cornhusker configuration

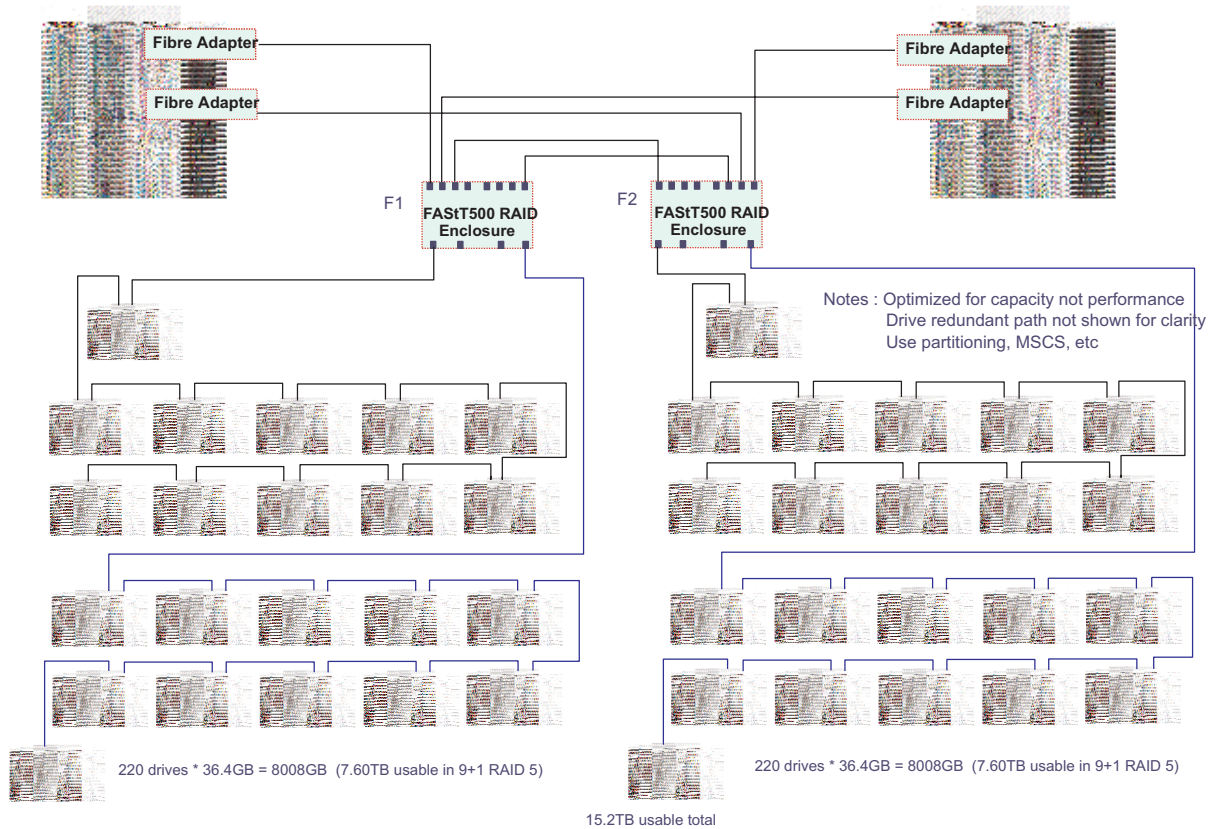


- Notes: Running Cornhusker Software
- 4 to 8 node configs are supported
 - Managed hubs can be combined with optional mini-hubs or use 16 port switches without the optional mini-hubs
 - Performance would be best with external 16 port switches

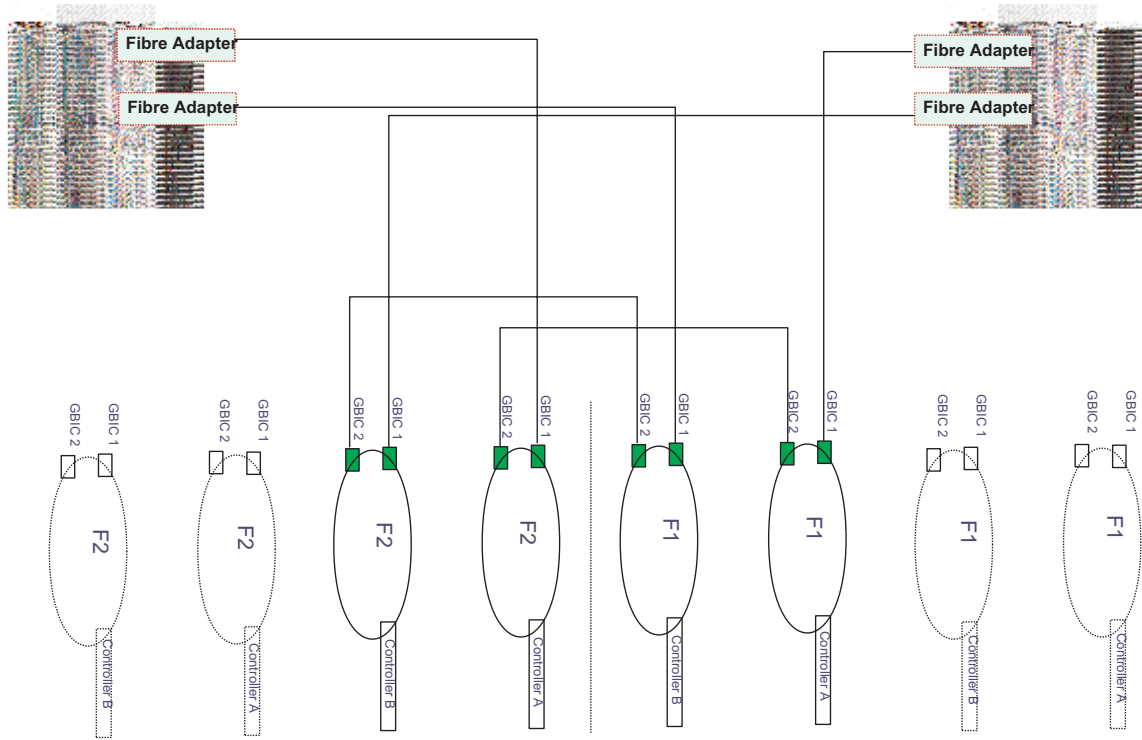
Base Storage Partitions



Capacity Configuration

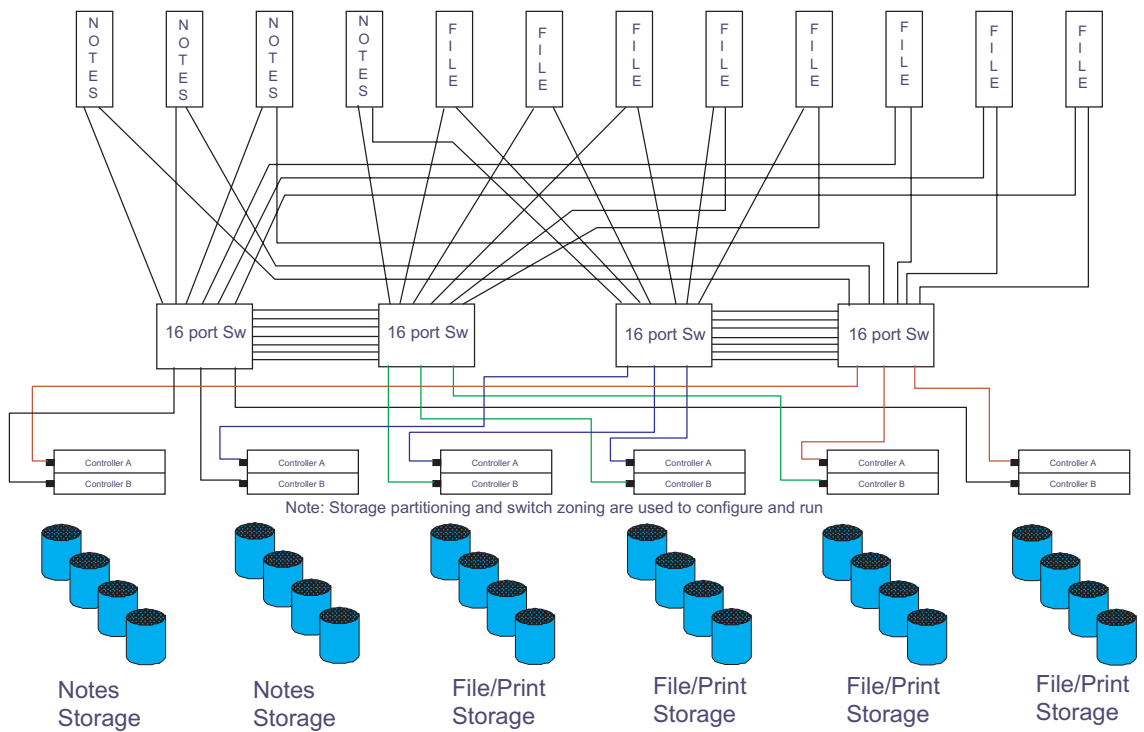


Capacity Configuration - host detail

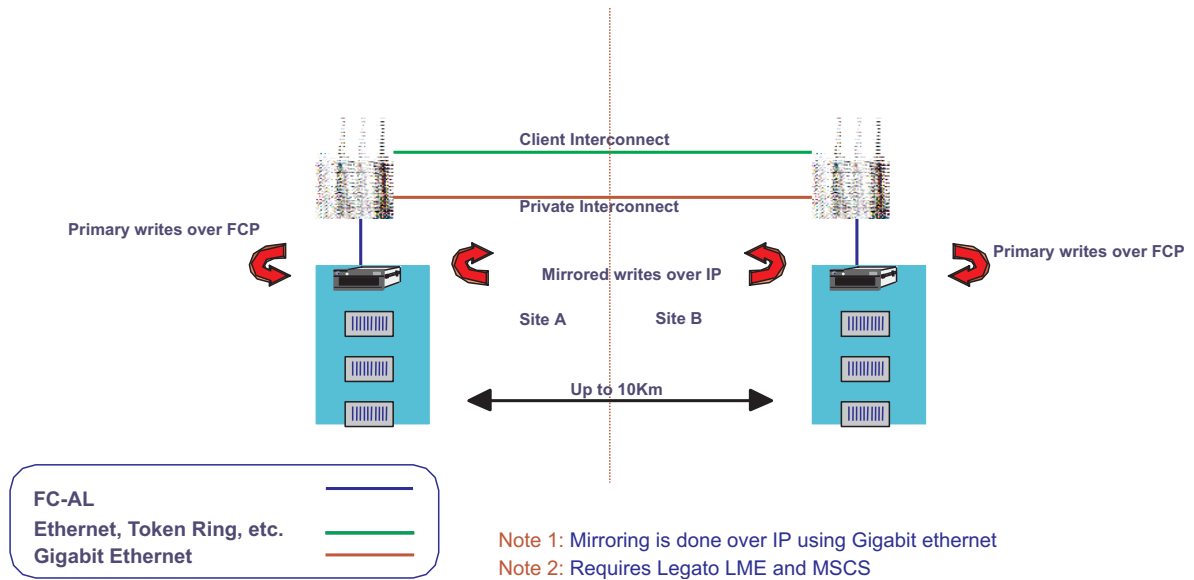


Host-side view

SAN - Using Partitions of Clusters Servers



Legato HA/Replication for MSCS



Preparing for installation

Use the following list to prepare a controller unit for installation.

1. Prepare the site to meet all area, environmental, power, and site requirements.

Floor space

The floor area at the installation site must provide:

- Enough stability to support the weight of the controller unit and associated equipment.
- Sufficient space to install the controller unit.

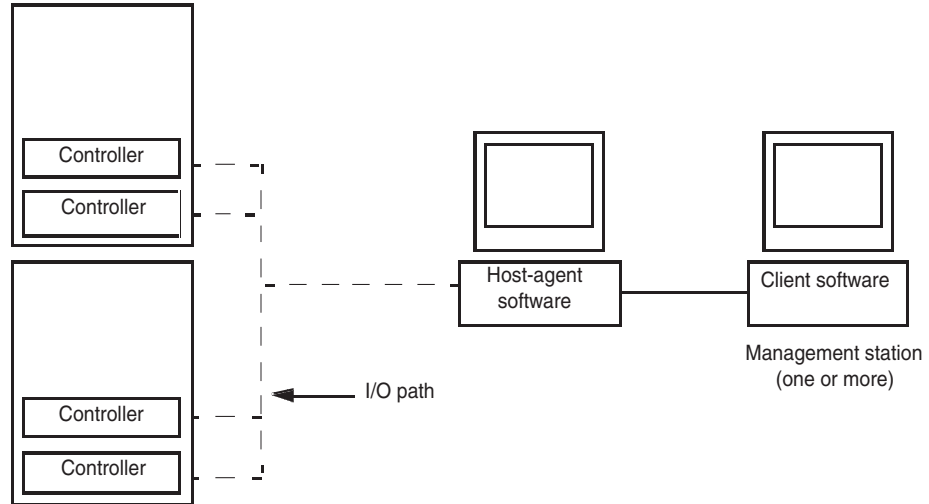
Weight

The controller unit total weight depends on the number of components installed in the chassis. The maximum weight equals a controller unit containing two RAID controllers, two power supplies, one battery, one controller fan, one fan and communications module, and eight mini hubs. The empty weight of a controller unit with all the CRUs removed is 15.5 kg (34 lbs). Maximum weight of a controller unit equals 38.6 kg (85 lbs).

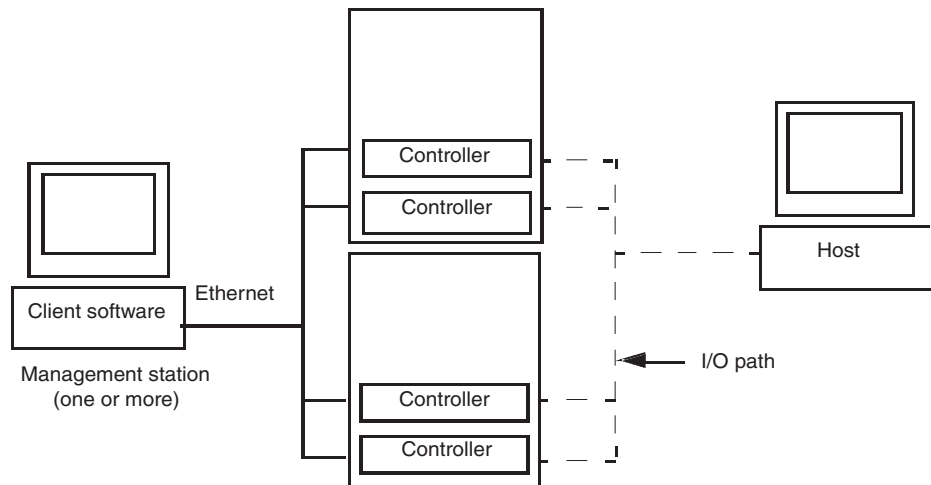
2. Move the controller unit and its rack cabinet to the site.
3. Remove the controller unit from its shipping container and check the contents. If any items are missing, contact your IBM reseller before proceeding.
4. Assemble the tools and equipment you will need for installation. These might include:
 - Power cords (come with the controller)
 - Screwdrivers and wrenches (various sizes)
 - Antistatic protection (such as a grounding wrist strap)
 - Fibre Channel (FC) and Ethernet interface cables and cable straps
 - Rack-mounting hardware (comes with the controller unit)
 - Storage-management software to configure the storage subsystems (comes on an Installation CD with the controller unit)

- Install additional hardware, based on the method of storage subsystem management. You can manage the storage subsystems using the host-agent or direct manage method, as shown in the following figures.

If you are using the **Host-agent method** (uses host-agent software installed on the host machine), install at least one management station and a software-agent host.

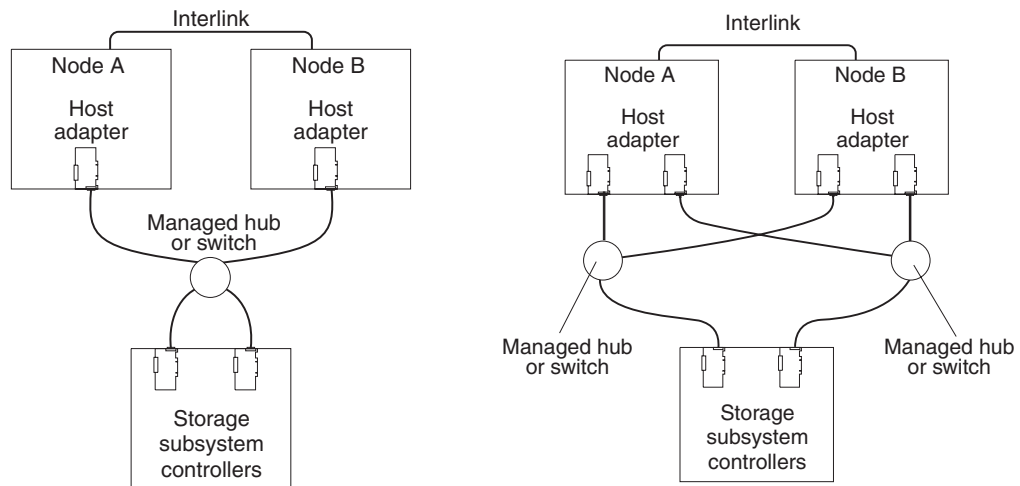


If you are using the **Direct manage method** (uses Ethernet connections from a management station to each controller), then install at least one management station and attach Ethernet cables to each management station (one pair per controller unit). You will connect the cables to each controller later when you install the controller unit. When you finish, continue with the next step.



- Determine the type of Fibre Channel network environment into which you are installing the storage subsystem. Note that a cluster server, acting as a host, has two nodes for failover support.
- Install the applicable host adapters, based on your path configuration. See the following table and figure for an example of installing a storage subsystem on a Fibre Channel network in a single-path or dual-path configuration.

Path configuration	Action
Single-path - each node connects to only one controller.	Install a single-channel host adapter on each node.
Dual-path - each node connects to both controllers, providing the greatest redundancy protection if a connection problem occurs.	Install two single-channel host adapters in each node.



- Refer to the documentation provided with your host adapters for installation requirements and procedures.
- Use the correct host adapter driver. Refer to the software installation guide and README file on the storage-management software installation CD for information on supported host adapters and drivers.

Note: Make sure each host adapter and controller has a unique ID.

When finished, continue with the next step.

8. 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.
9. Continue with “Handling static sensitive devices”.

Handling static sensitive devices

When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

Preparing the rack

To prepare the rack for installation, review the following list and complete all applicable preparatory procedures.

1. Move, unpack, and level the rack at the installation site.
2. Remove external rack panels.
3. Stop all I/O activity to the devices in the rack.

4. Turn off all drive enclosure and rack power. Disconnect existing power, network, and other external cables.
5. Install additional interface cables and power cables.
6. Install support rails for mounting the controller unit and drive enclosures.
7. Remove, add, or reconfigure drive enclosures or devices in the rack.

Important

Before installing the controller unit in a rack, it is important that you do the following:

- Review the documentation that comes with your rack enclosure for safety and cabling considerations.
- Install the controller unit in a maximum 35° C environment.
- To ensure proper air flow, do not block the air vents; 15 cm (6 in.) of air space is sufficient.
- To ensure rack stability, load the rack starting at the bottom.
- If you install multiple components in the rack, do not overload the power outlets.
- Always connect the controller unit to a properly grounded outlet.

Preparing the drive enclosures

Prepare the drive enclosures that you are attaching to the controller unit. This could involve any or all of the following tasks:

- Moving the drive enclosures to the installation site
- Unpacking the drive enclosures from their shipping cartons
- Checking the shipping contents
- Removing all customer replaceable units (CRUs)
- Setting the Bridge Enable switch, as necessary

For detailed instructions on preparing the drive enclosures, refer to the hardware documentation that comes with each device. When you finish preparing the drive enclosures, continue with “Preparing the controller unit”.

Preparing the controller unit

You will need an antistatic wrist strap and a cart or level surface (to hold the CRUs).

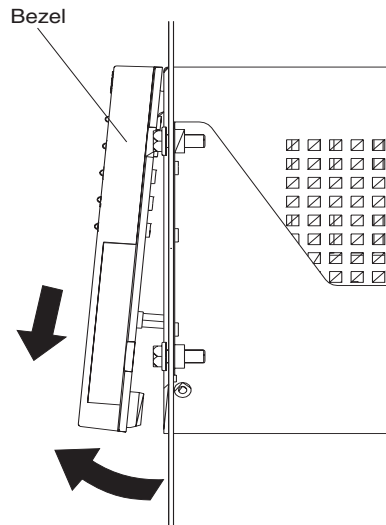
Use this procedure to prepare a controller unit for installation. These instructions assume that you have completed all applicable site, rack cabinet, and drive enclosure preparations previously described.

It is easier to lift the controller unit and install it in a rack if you remove all CRUs first. A fully loaded controller unit with a controller fan, battery, fan and communications module, two controllers, two power supplies, and 8 mini hubs installed weighs 38.6 kg (85 lbs). If you remove all the CRUs, you can reduce the overall weight.

To gain access to the CRUs, cables, indicator lights, and switches inside the controller unit, you must remove the bezel.

Attention: Pulling the bezel out too far can damage the hooks at the top. To avoid damaging the plastic hooks, place the controller unit on a flat surface. Be sure the front of the controller unit extends approximately two inches beyond the edge.

1. Carefully pull out the bottom of the bezel to release the pins; then, slide down the bezel, as shown in the following figure.



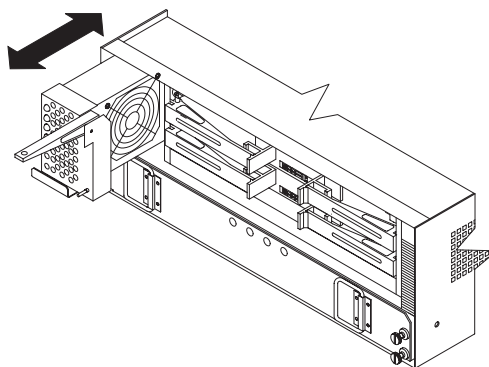
Note: To replace the bezel, slide the top edge under the lip on the chassis; then push the bezel bottom until the pins snap into the mounting holes.

2. Check the contents of the shipping container.

The power cords attach the controller unit to the ac power sources inside the cabinet or to an external power source.

Attention: When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

3. Remove the controller fan controllers, battery, power supply, fan and communication module, and mini hubs.
 - a. Pull up on the fan lever to unlock the fan; then, grasp the lip handle and pull out firmly.

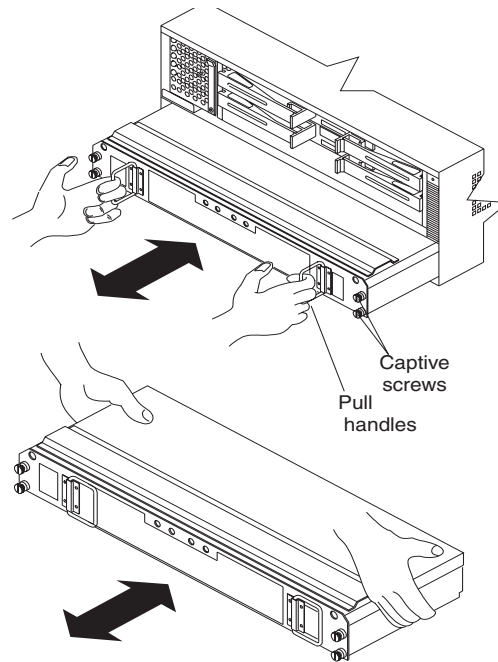


- b. Unlock and open the controller levers; then, using the levers, pull the controller out a couple of inches. Grasp both sides of the controller and remove it.

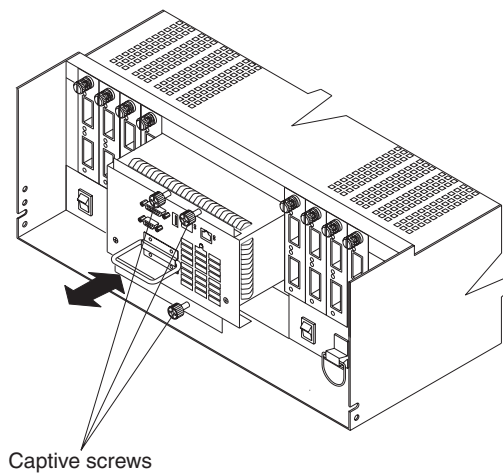
Important

To prevent data loss, replace controller A in the upper slot and controller B in the lower slot.

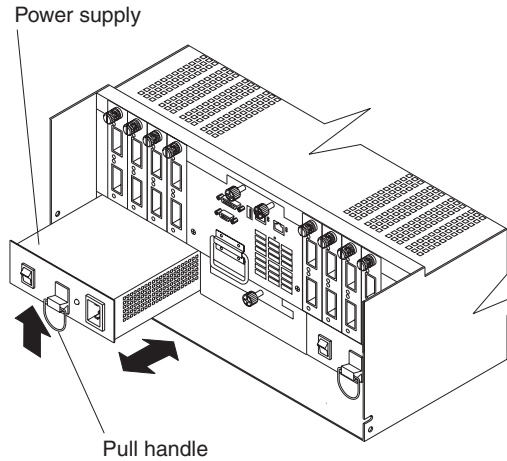
- c. Loosen the screws and pull the battery out a few inches. Grasp both sides of the battery and remove it.



Using the pull tab handle, lift up and pull to release each power supply; then, slide out the power supply.



- d. Loosen the captive screws; then, grasp the screw and pull the mini hub from the chassis.



Installation procedures

Installing the support rails

To install the controller unit in a rack, use the rails and mounting hardware supplied with your controller unit.

Where you place the support rails in or on the cabinet depends on where you intend to position the controller unit.

Use the rack mounting installation assembly package that comes with the controller unit to locate the rack mounting holes and install the unit into a rack. If you misplace the template installation assembly package, you can use the following steps to install the controller unit.



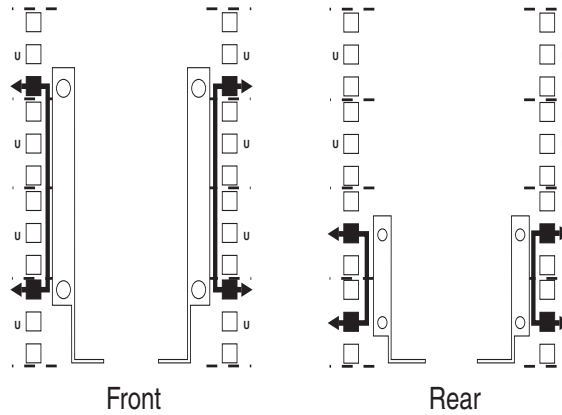
CAUTION:

The Power Control button on the device and the power switch on 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.

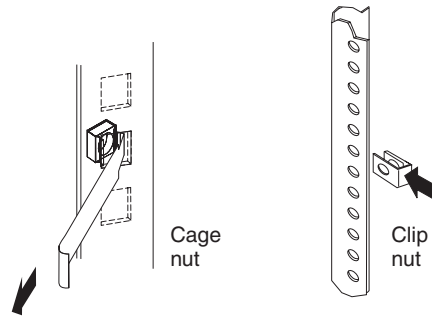


1. Stop all I/O activity to the devices in the rack in which you are installing the controller unit. If your rack has ac distribution boxes, turn off the power switches.

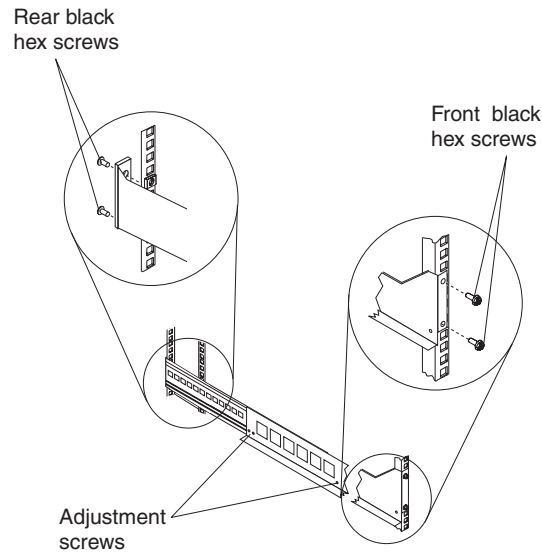
- Use the following figure of front and rear rack-mounting flanges to determine the appropriate rack-mounting holes for installing cage nuts or clip nuts to secure the controller unit rails.



Note: Use clip nuts if your rack has round holes. If your rack has square holes, you can use the cage nut insertion tool or a flat-blade screwdriver to install cage nuts.

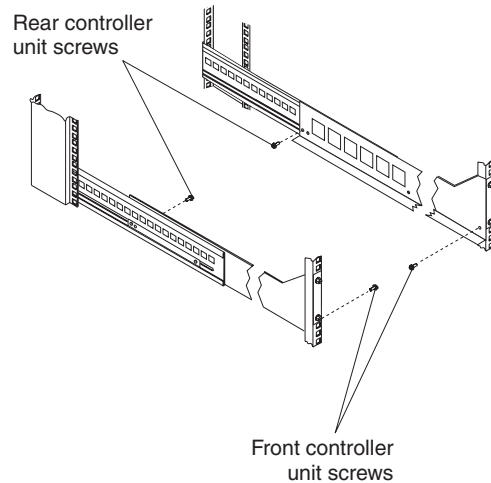


- On the rail marked R, loosen the two adjustment screws on the inside of the rail and adjust the length of the rail to the depth of your rack.



- Hold the rail against the outside of the right mounting flange on the rack and loosely insert the two front black hex screws.

5. Extend the rail outside of the rear mounting flange on the rack; then, install and tighten the two rear black hex screws.
6. Tighten the two front black hex screws; then, tighten the adjustment screws on each rail.
7. Repeat step 3 through step 6 to install the rail marked L on the left side of the rack.
8. Using the following figure, remove the front and rear controller unit screws from the rails and save them for securing the controller unit, as described in "Installing the controller unit in the rack".

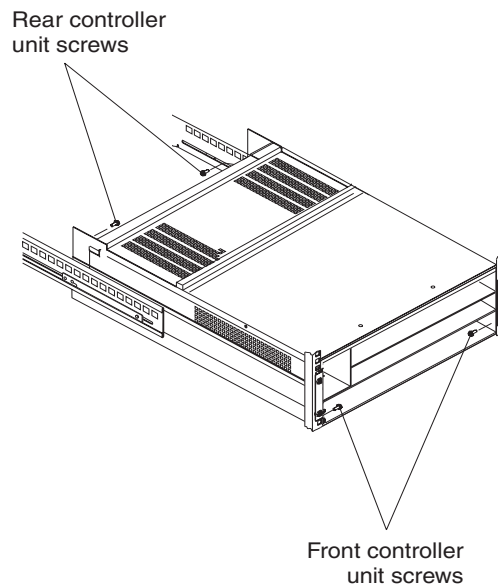


Installing the controller unit in the rack

CAUTION:
Use safe practices when lifting.

To install the controller unit in a rack, perform the following steps.

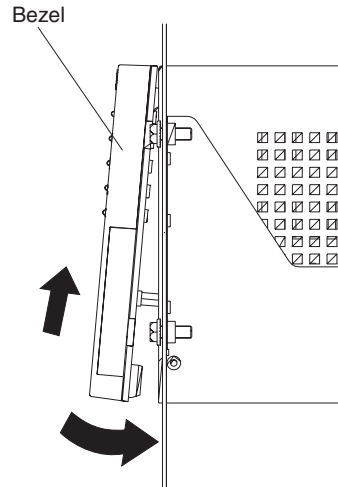
1. Slide the controller unit into the rack and secure the rear of the controller unit with two of the small screws.



2. Secure the front of the controller unit with the other two screws.
3. Install the battery, controllers, and controller fan in the front of the controller unit.

Note: If you are installing additional cache memory in a controller, you can install it now, before you install the controller back in the controller unit. See “Installing additional cache memory in a controller”.

4. Install the power supplies and fan and communications module in the back of the controller unit.
5. Install the mini hubs in the back of the controller unit.
6. To replace the bezel, slide the top edge under the lip on the chassis; then, push the bezel bottom until the pins snap into the mounting holes.



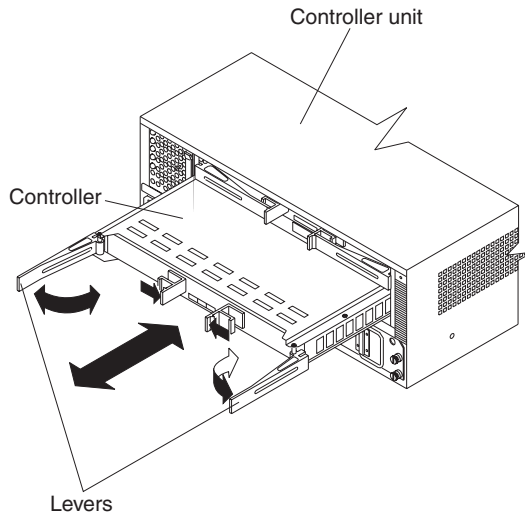
Installing additional cache memory in a controller

The controller comes with 256 MB of cache memory installed. You can add an additional 256 MB dual inline memory module (DIMM) for a total of 512 MB cache, with the IBM FASt500 256 MB Cache option.

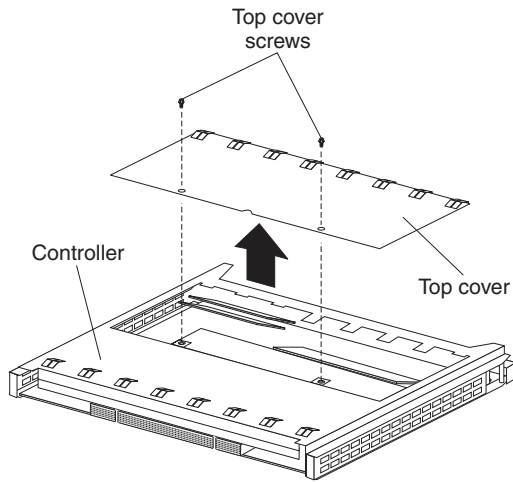
Use the following procedure to upgrade your controller cache memory. If you are installing the controller unit in a rack and have already removed the RAID controller, skip step 1.

Attention: When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD:
<http://www.ibm.com/>

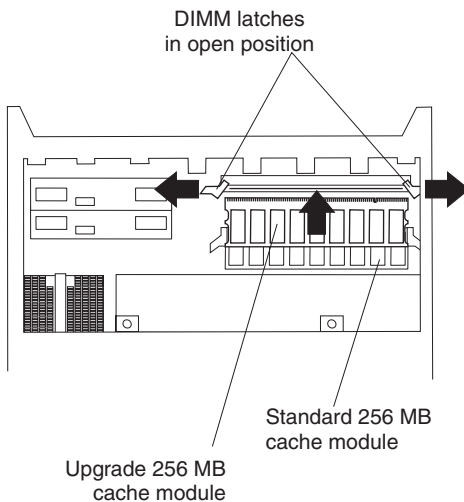
1. Unlock and open the levers on the controller; then, use the levers to pull the controller out of the controller unit a few inches. Grasp both sides of the controller to completely remove it from the controller unit.



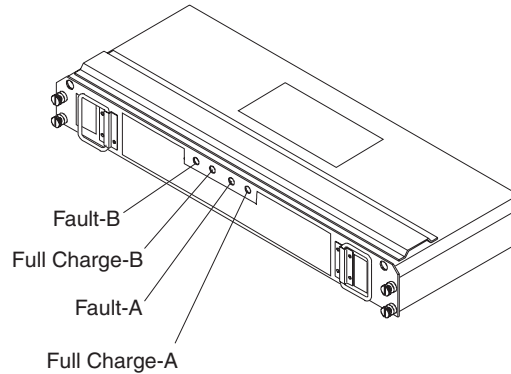
2. Remove both screws from the top cover of the controller; then, lift the cover and set it aside to install after you upgrade your cache.



3. Locate the empty DIMM socket in front of the populated one that contains the standard 256 MB cache memory module. Make sure that both DIMM latches are open to their outermost position before inserting the new memory module.



4. Carefully insert the DIMM into the empty socket, making sure that the left and right edges of the module slide inside the grooves in the DIMM latches. As you push the DIMM into place, the DIMM latches slowly close around the new module.
5. After the DIMM is fully seated in the socket, press firmly inward on the left and right DIMM latches until they lock and secure the DIMM into place.



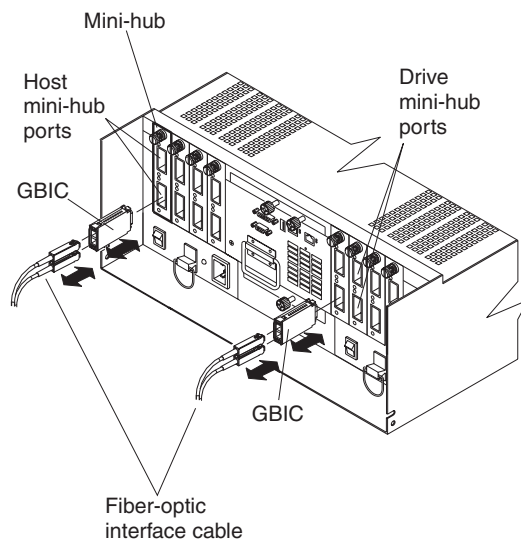
6. Install the top cover.
7. Install the controller back in the controller unit.

Connecting the controller unit to the loop

The following is a brief description of the components that connect the controller unit to the Fibre Channel Arbitrated Loop (FC-AL) and instructions for installing the interface cables.

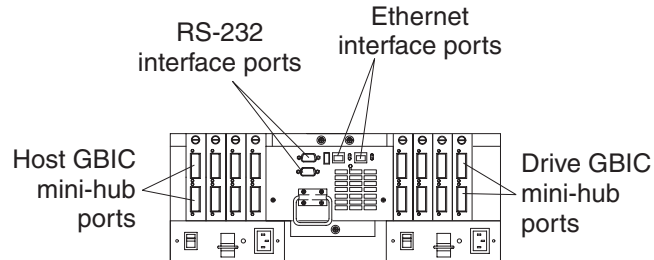
Mini hub interface connections

The interfaces that connect the controller and drive enclosures to the storage subsystem are called mini hubs. When fully configured, the back of the controller unit can accommodate four host mini hubs and four drive mini hubs. Each mini hub is a removable unit. A mini hub provides the Fibre Channel interface between a controller and hosts and drives. Each mini hub has two ports. One Gigabit Interface Converter (GBIC) connects into each mini hub port; then, a host or drive fiber-optic cable connects into the GBIC. The following figure shows the mini hub interface connections.



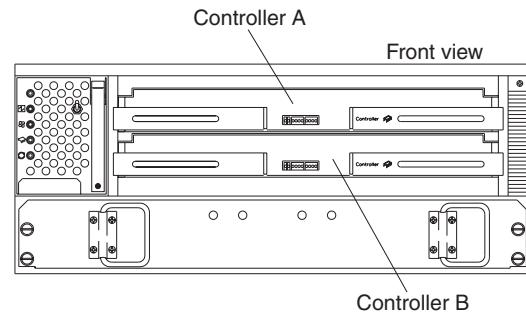
Controller unit interface ports

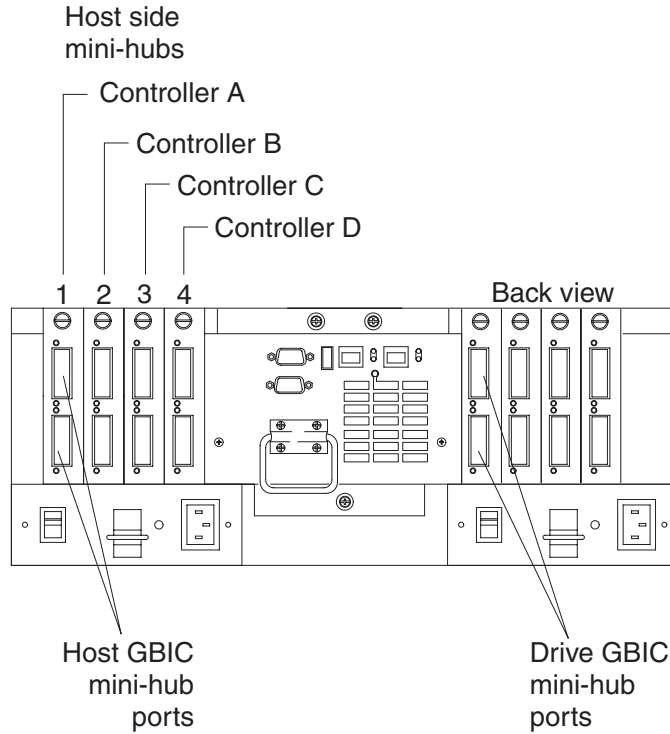
The host and drive GBIC mini hub ports are used to attach cables from the controller and drive enclosures to the storage subsystem. There are also Ethernet ports for storage subsystem-management and RS-232 (serial) ports for diagnostic services. The controller unit interface ports are shown in the following figure.



Host interface ports

Host mini hubs connect to the controller in pairs. mini hubs 1 and 3 connect to the top controller (Controller A) and mini hubs 2 and 4 connect to the bottom controller (Controller B). To ensure redundancy, you must connect each host to both controllers through the appropriate mini hub.





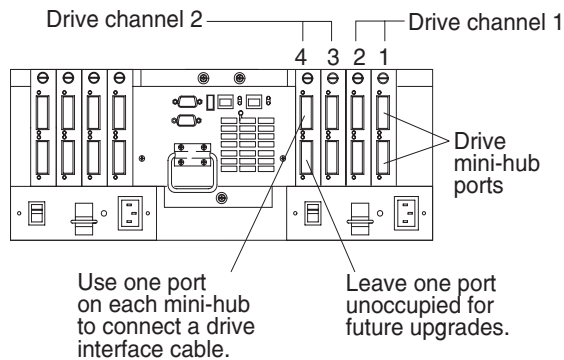
Drive mini hubs

Each drive mini hub connects to Controller A and Controller B and each drive mini hub represents a single drive channel. The drive channels are set up in pairs to support redundant drive loop configurations (two datapaths per drive enclosure). Each pair supports up to 11 drive enclosures, containing 10 drives each, or a maximum of 110 drives. A fully configured controller unit supports a maximum of 22 drive enclosures (11 drive enclosures per channel pair), or 220 drives.

Important

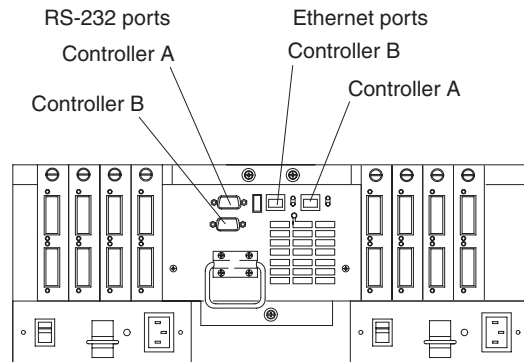
These large configurations are for capacity purposes and might not provide the best performance.

The drive channel cables connect to GBICs, which connect to either the upper or lower port on each mini hub. Leave the remaining port on each mini hub unoccupied for future upgrades.



Ethernet and RS-232 ports

There is one Ethernet port and one RS-232 (serial) port on each controller (Controller A and Controller B). Use the Ethernet ports if you want to directly manage storage subsystems and use the RS-232 ports for diagnostic services. The following figure shows the location of these ports.



Installing GBICs and fiber-optic cables

A Gigabit Interface Converter (GBIC) is used to connect each mini hub port to hosts and drives.

Installation tips:

- The GBIC module housing has an integral guide key designed 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 port 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.

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.

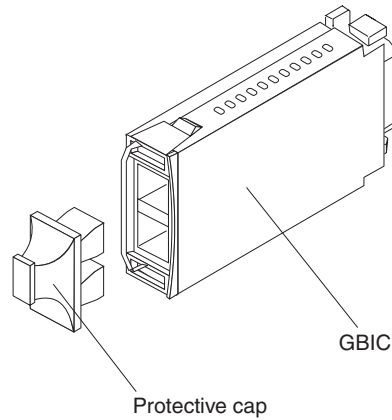
DANGER

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 figure.



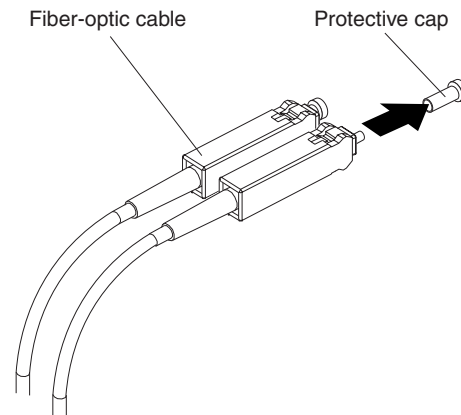
2. If the GBIC you are installing has a metal latch, move the latch to the unlocked (center) position. Slide the GBIC into the port; then, rotate the latch outward to the locked position (flush with the rear of the GBIC).

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

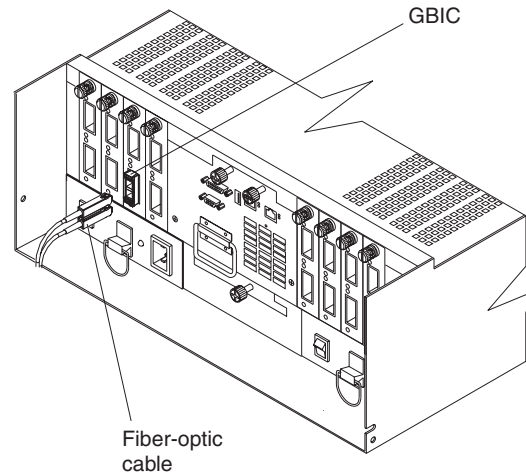
- Do not route the cable along a folding cable-management arm.
- When attaching to a device on slides, leave enough slack in the cable so that it does not bend to a radius smaller than 76 mm (3 inches) when extended or become pinched when retracted.
- Route the cable away from places where it can be snagged by other devices in the rack.
- Do not overtighten the cable straps or bend the cables to a radius smaller than 76 mm (3 inches).
- 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 two protective caps from one end of the fiber-optic cable.



2. Connect the fiber-optic cable to a GBIC that is installed in a mini hub.



After you install the cables, the Fibre Channel-Arbitrated Loop is operational.

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

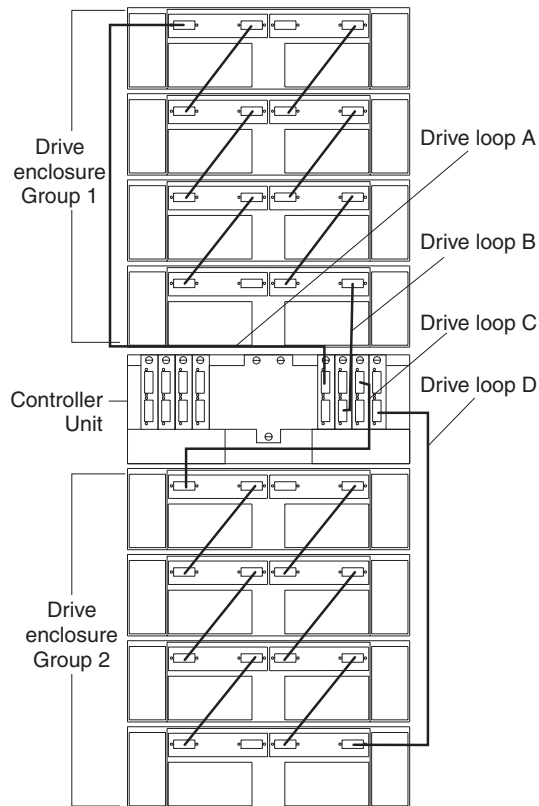
1. Remove the fiber-optic cables from the GBIC; then, replace the protective caps.
Note: If you are using IBM GBICs, you must remove the fiber-optic cables from the GBIC before you can remove the GBIC from the mini hub port.
2. Move the metal latch on the GBIC to the unlocked (center) position.
3. Pull the GBIC out of the port.
4. Insert the protective cap on the GBIC.

Controller unit and drive enclosure cabling overview

The controller unit supports redundant drive loops. A redundant drive loop consists of one or more drive enclosures connected to a controller using two sets of data cables. If one data path fails, the controller uses the other data path to maintain I/O to the drive group.

The following figure shows a storage subsystem containing one controller and two drive groups with four drive enclosures each. Each drive group uses redundant drive loops to connect to the controller unit. Loop A and Loop B make up one redundant pair of drive loops. Loop C and Loop D make up a second redundant pair.

Attention: To prevent loss of drive enclosure redundancy, cable the drive enclosures as shown in the following figure.



Configuring the drive loops

The procedure and figures in this section show an example of cabling a group of drive enclosures into a redundant drive loop. For an example of a drive loop that has only one drive enclosure, skip this procedure and go to “Connecting drive cables to the controller unit” on page 96.

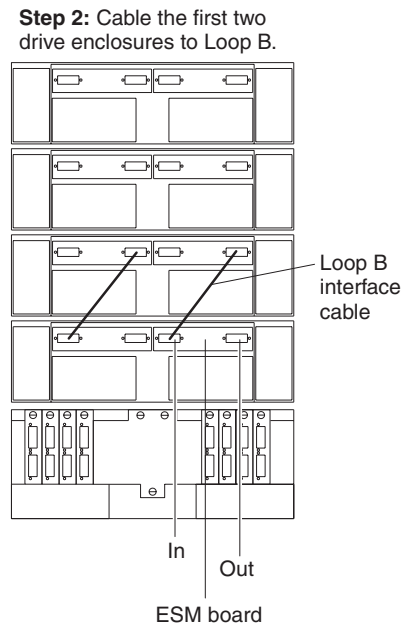
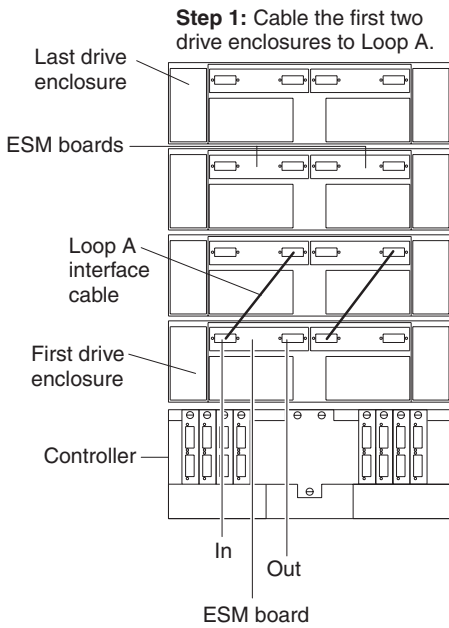
Attention: To complete this procedure, you will need two Fibre Channel interface cables. Handle and install fiber-optic cables properly to avoid degraded performance or loss of communications with devices. When working with fiber-optic cables, do not pinch them, step on them, or locate them in aisles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

1. Connect the first two drive enclosures to drive Loop A.

Starting with the first drive enclosure, connect an interface cable from the In port on the left environmental services monitor (ESM) board to the Out port on the left ESM board in the second (next) drive enclosure.

2. Connect the same first two drive enclosures to drive Loop B.

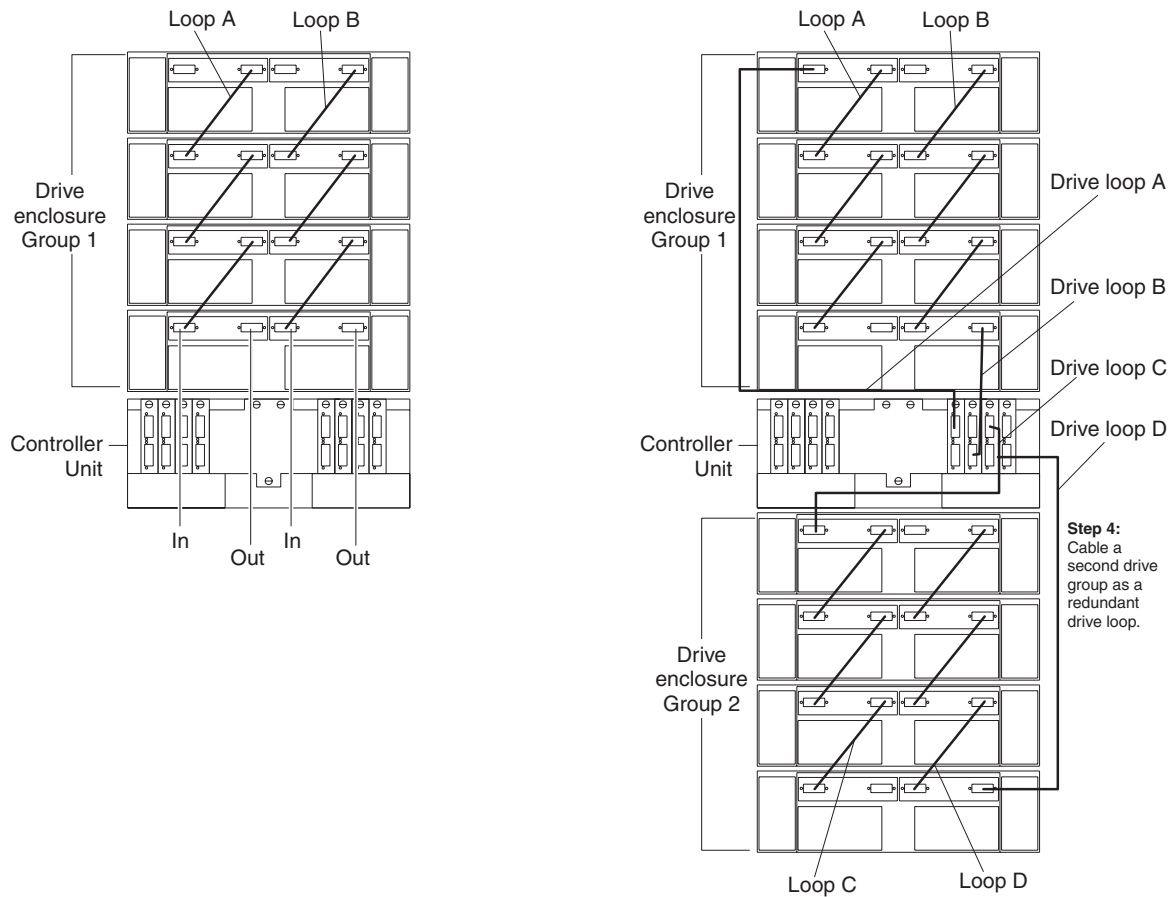
Starting with the first drive enclosure, connect an interface cable from the In port on the right ESM board to the Out port on the right ESM board in the second (next) drive enclosure. If you want to cable more drive enclosures into Loops A and B, continue with the next step; otherwise, go to “Connecting drive cables to the controller unit” on page 96.



3. Connect additional drive enclosures to drive Loops A and B.

Starting with the second drive enclosure, cable each additional drive enclosure into Loops A and B in the same manner. Leave unoccupied the In ports on the last drive enclosure in the loop and the Out ports on the first drive enclosure. If you want to cable a second drive group, repeat this step for the second drive otherwise, go to “Connecting drive cables to the controller unit” on page 96.

4. Repeat step 1 through step 3 to cable a second drive group (Loop C and Loop D on Drive Group 2) in the same manner, as shown in the following figure. When you finish, go to “Connecting drive cables to the controller unit” on page 96.



Connecting drive cables to the controller unit

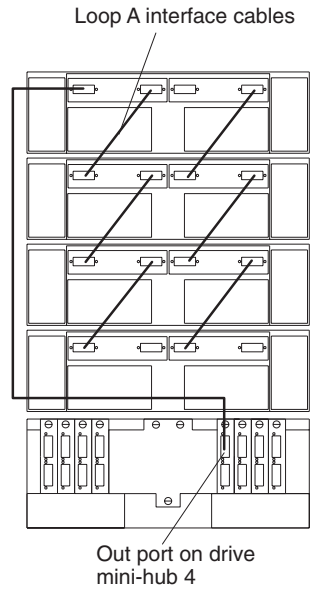
Use the following procedure to connect a redundant drive loop to the controller unit. You will need two Fibre Channel interface cables for each redundant pair of loops (for example, Loop A and Loop B) that you are connecting to the controller unit.

1. Connect drive Loop A to the controller unit.

Starting with the last drive enclosure in Loop A, cable the In port on the left ESM board to the Out (upper) port on drive mini hub 4 on the controller unit.

Leave the In port on the right ESM board on the last drive enclosure and the In (lower) connector on drive mini hub 4 unoccupied.

Step 1: Connect drive Loop A to the controller unit.



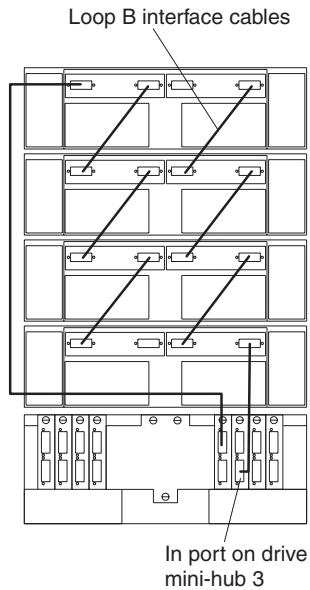
2. Connect drive Loop B to the controller unit.

Starting with the first drive enclosure in the loop, cable the Out port on the right ESM board to the In (lower) port on drive mini hub 3.

Leave the Out port on the left ESM board and the Out (upper) port on drive mini hub 3 unoccupied.

To connect a second redundant drive enclosure group to the controller unit, continue with the next step; otherwise, go to "Connecting hosts directly to the controller unit" on page 99.

Step 2: Connect drive Loop B to the controller unit.



3. Connect drive Loop C to the controller unit.

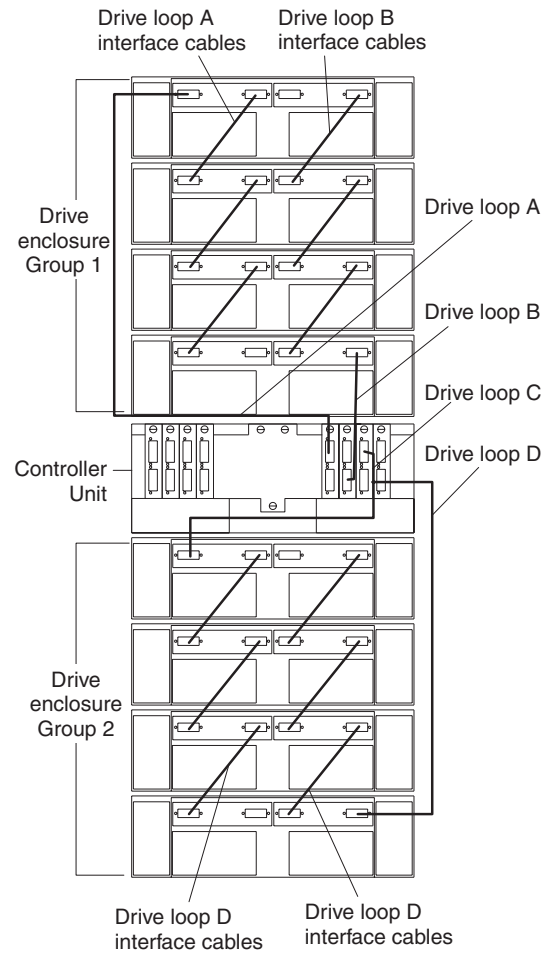
Starting with the first drive enclosure, cable the In port on the left ESM board to the Out (upper) port on drive mini hub 2.

Leave the In port on the right ESM board and the In (lower) port on the drive mini hub 2 unoccupied.

4. Connect drive Loop D to the controller unit.

Starting with the last drive enclosure, cable the Out port on the right ESM board to the In (lower) port on mini hub 1.

Leave the Out port on the left ESM board on the last drive enclosure and the Out (upper) port on drive mini hub 1 unoccupied.



5. Go to "Connecting hosts directly to the controller unit" on page 99.

Connecting hosts directly to the controller unit

Use this procedure to connect up to four hosts, with two host adapters each, directly to the controller unit. If you are connecting five or more hosts to the controller unit, go to “Connecting hosts using external devices” on page 100.

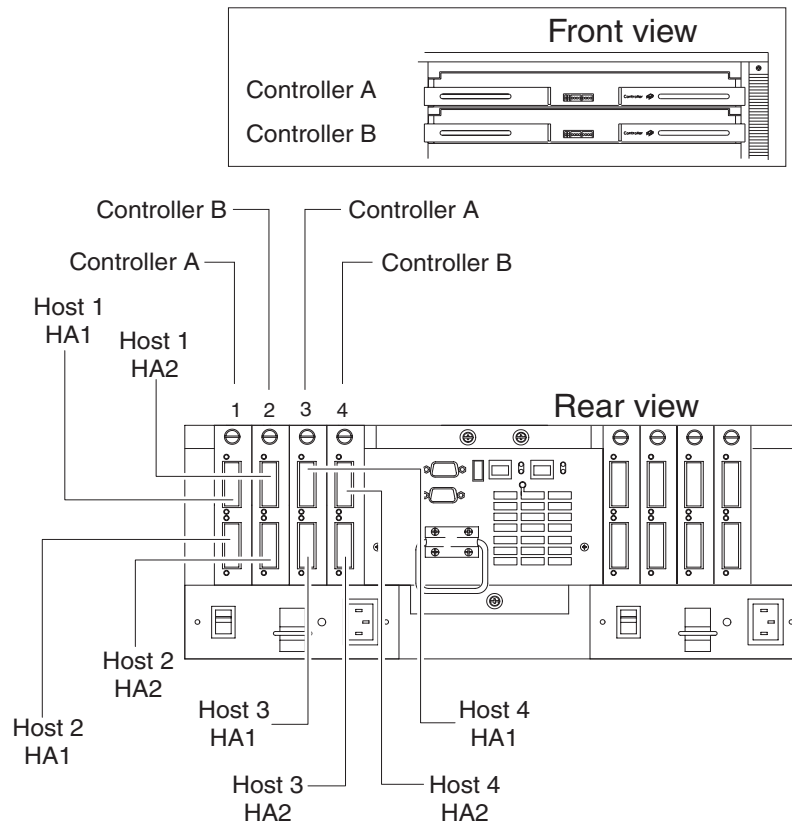
Before proceeding, make sure that you connect Fibre Channel interface cables to all host adapters that you are connecting to the controller unit.

Important

Host mini-hub 1 and mini-hub 3 correspond to Controller A (top) and mini-hub 2 and mini-hub 4 correspond to Controller B (bottom). To ensure redundancy, connect each host to both controllers. You can use either the upper or lower ports on either mini-hub. The example in the following procedure uses the upper ports for Hosts 1 and 4 and the lower ports for Hosts 2 and 3.

1. Connect the first host (Host 1) to the controller unit.
Connect Host Adapter 1 (HA1) from Host 1 to a port on host mini hub.
 - a. Connect HA2 from Host 1 to mini hub.
 - b. To connect a second host, continue with step 2; otherwise, go to “Connecting secondary interface cables” on page 101.
2. Connect a second host (Host 2) to the controller unit.
Attach HA1 from Host 2 to the unoccupied port on mini hub.
 - a. Attach HA2 from Host 2 to the unoccupied port on mini hub.
 - b. To connect a third host, continue with step 3; otherwise, go to “Connecting secondary interface cables” on page 101.
3. Connect a third host (Host 3) to the controller unit.
 - a. Attach HA1 from Host 3 to mini hub 3.
 - b. Attach HA2 from Host 3 to mini hub 4.

To connect a fourth host, continue with step 4; otherwise, go to “Connecting secondary interface cables” on page 101.
4. Connect a fourth host (Host 4) to the controller unit.
Attach HA1 and HA2 from Host 4 to the two unoccupied ports on mini hub 3 and mini hub 4.
5. Go to “Connecting secondary interface cables” on page 101.



Connecting hosts using external devices

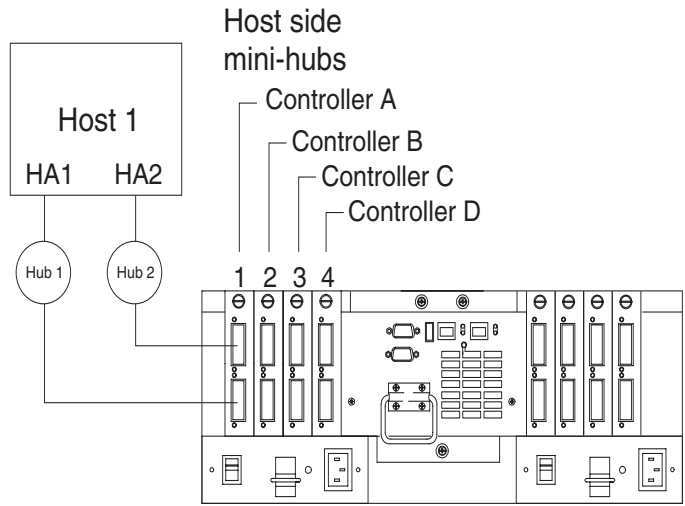
Use this procedure to connect five or more hosts to the controller unit. Using external managed hubs, the controller unit supports up to 32 hosts (64 host adapters) per controller or up to 64 hosts (128 host adapters) for redundant controllers. Before starting, make sure to connect each host to its respective mini hub.

Important

Host mini-hub 1 and host mini-hub 3 correspond to Controller A (top). Mini-hub 2 and mini-hub 4 correspond to Controller B (bottom). To ensure redundancy, connect each host to both controllers. You can use either the upper or lower connectors on either mini-hub.

Note: Throughout this book, the use of hub or external hub refers to a managed hub.

1. Connect the first host (Host 1) to the controller unit, as shown in the following figure. Connect Host Adapter 1 (HA1) from Host 1 (through Hub 1) to host mini hub 1. Connect HA2 from Host 1 (through Hub 2) to mini hub 2.



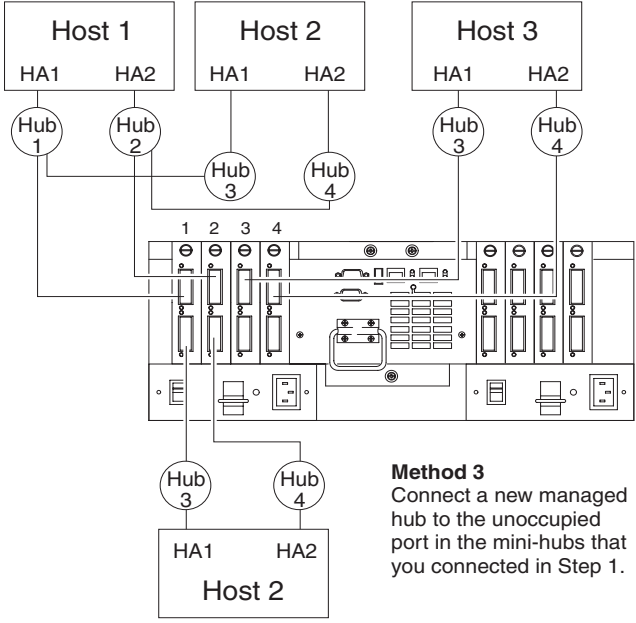
2. Connect additional hosts to the controller unit, using the method shown in the following figure.

Method 1

Connect a new managed hub to an available port on each hub that you connected in Step 1.

Method 2

Connect a new managed hub to either port on each remaining host mini-hub.



Method 3

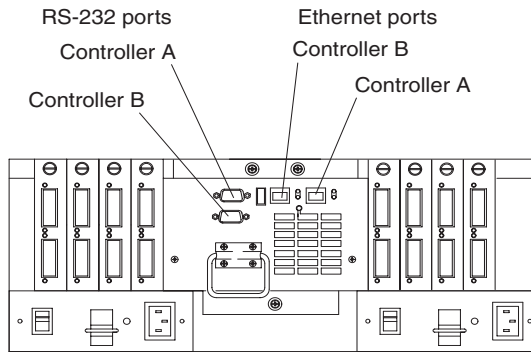
Connect a new managed hub to the unoccupied port in the mini-hubs that you connected in Step 1.

3. Go to “Connecting secondary interface cables”.

Connecting secondary interface cables

Use this procedure to connect Ethernet or RS-232 (serial) interface cables to the controller unit.

1. To directly manage a storage subsystem, connect a pair of Ethernet cables from the management station to the Ethernet ports for Controller A or Controller B on the back of the controller unit.



2. To perform diagnostic procedures, connect an RS-232 interface cable to an RS-232 port (see the preceding figure for the location of these ports).

Starting the controller unit

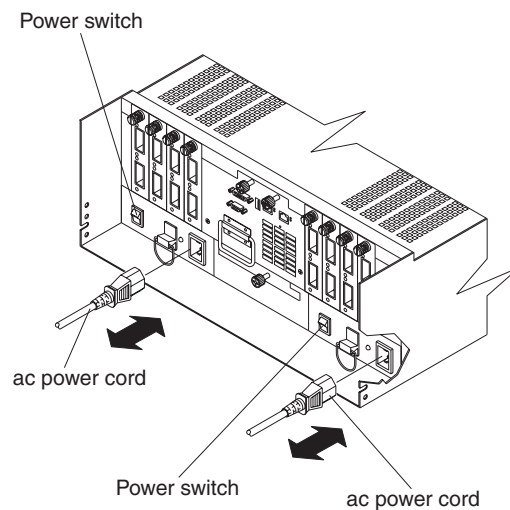
After you install the controller unit in a rack and connect it to the Fibre Channel Arbitrated Loop, you are ready to complete the installation. This section describes how to connect the power cords, turn on and off the power, check the indicator lights, and complete the installation.

Turning on the power

Use this procedure to connect the power cords to the controller unit and to the ac power source. If you are restoring power to the controller unit after an emergency shutdown or power outage, go to “Overtemperature condition and power supply shutdown” on page 111.

1. Make sure both power switches on the controller unit are off.
2. Plug both controller unit power cords into the controller unit.
3. Plug both controller unit power cords into the ac outlets.

To maintain power redundancy, plug each power cord into an independent power source, such as the ac distribution box inside a cabinet or an external receptacle.



Important

You must turn on the drive enclosures before or at the same time as turning on the controller unit. The controllers might not recognize the correct configuration if the drives are powered up after the controller unit. If you plan to use the main breaker to turn on all enclosures at the same time, make sure that the switches on each drive enclosure and each controller unit are on before turning on the main breaker. For instructions on powering up the drive enclosures, refer to the drive enclosure documentation.

Note: Always wait at least 30 seconds between the time you turn off a power switch and the time you turn on the power again.

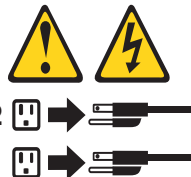
4. Turn on both power switches on the back of the controller unit. You must turn on both switches to take advantage of the redundant power supplies.

Turning off the power



CAUTION:

The Power Control button on the device and the power switch on 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.



Attention: The controller unit is designed to run continuously, 24 hours a day. Except in an emergency, never turn off the power if any controller unit fault indicator lights are lit. Use the proper troubleshooting or servicing procedure to correct the fault before turning off the power. This ensures that the controller unit powers up correctly later.

Use the following procedure to turn off power to the controller unit.

1. Prepare the controller unit for shutdown, as follows:
 - a. Stop all I/O activity to the controller unit and attached drive enclosures. Logically disconnect the controller and drive enclosures from the hosts. Make sure that the fast write cache indicator light on each controller unit front panel and all applicable drive active indicator lights on each drive enclosure front panel are off (not blinking).

Note: If a parity check is in progress, it might take a long time for the drive indicator lights to stop blinking.
 - b. Make sure that all amber fault indicator lights on the controller unit are off. If any fault indicator lights are on, correct the problem before turning off the power.

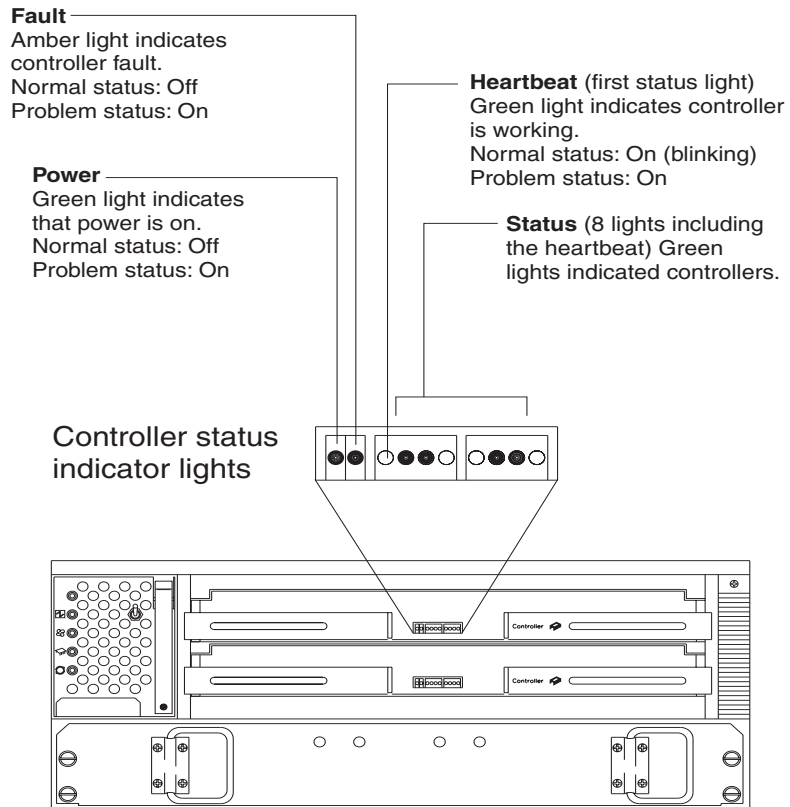
2. Turn off the power switches on the back of the controller unit.
3. Turn off any drive enclosures attached to the controller unit.

Turning on the controller unit alarm

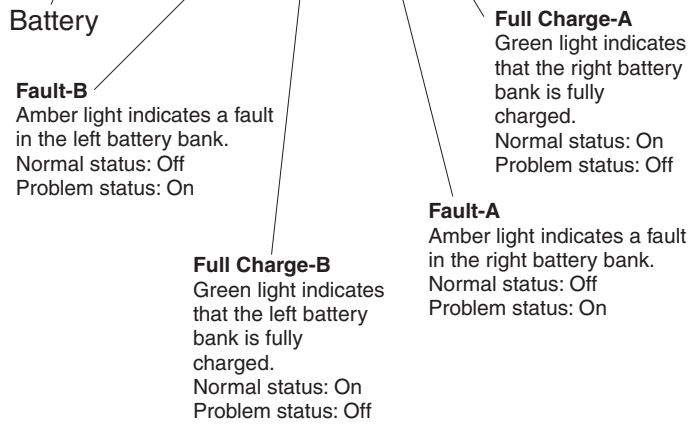
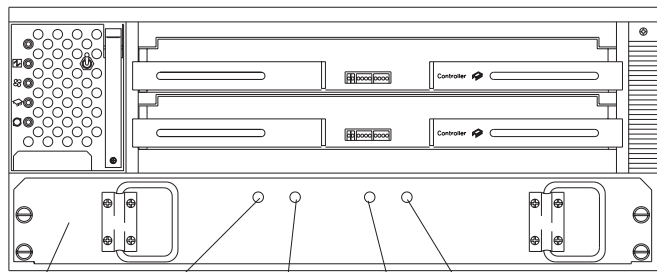
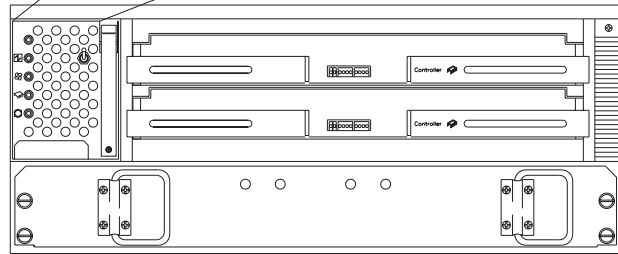
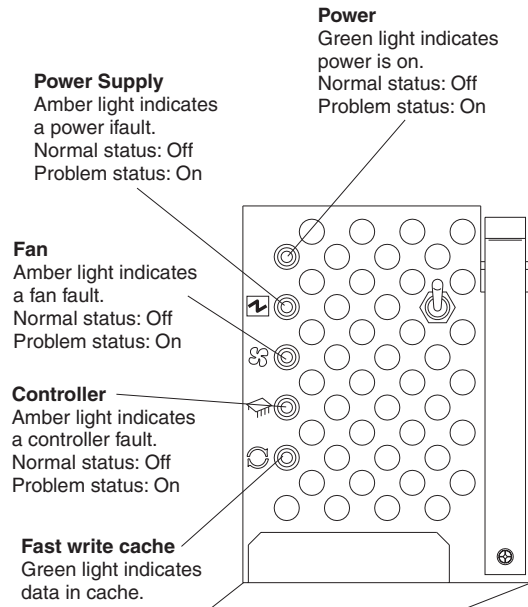
You can arm the alarm that is located on the controller fan by setting the switch in the up position, as shown in the following figure. When the switch is armed, the alarm sounds when a hardware problem occurs.

Controller unit indicator lights

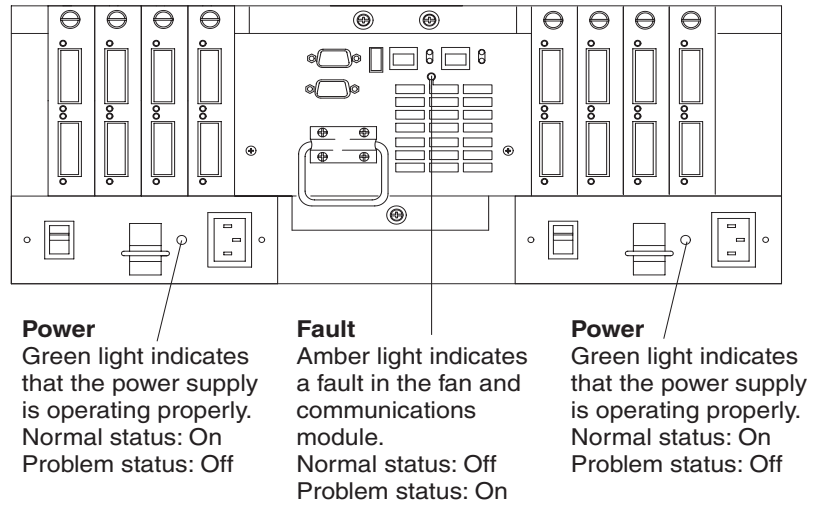
The indicator lights are located on the front the controller unit.



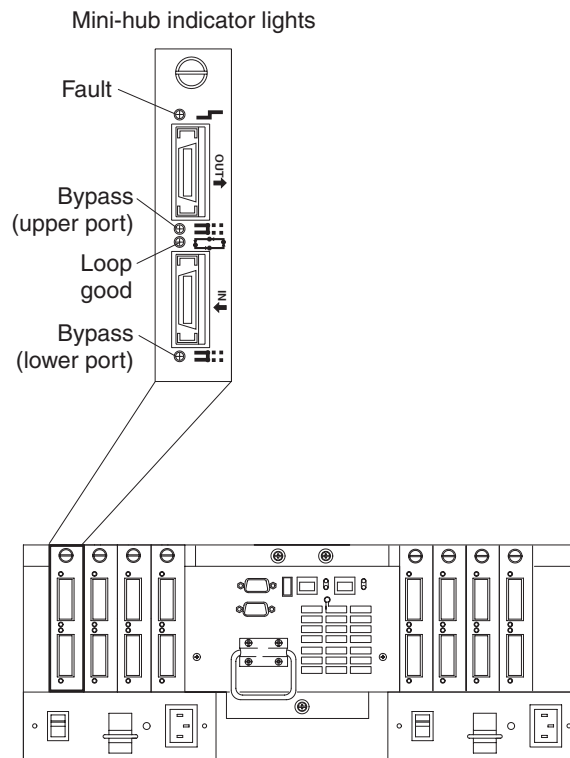
Note: Status lights might blink when I/O activity is in progress. If the Heartbeat light blinks continuously, then the other status lights will glow in various patterns to show the status or an error condition. The pattern shown depends on whether the controller is active or passive (offline). For more information, refer to *IBM FAStT500 RAID Controller User's Reference* and *IBM FAStT Storage Manager for Windows NT Installation and Support Guide*.



The indicator lights on the back of the controller unit are shown in the following two figures.



The mini hub indicator lights on the back of the controller unit are shown in the following figure.



The following table describes the mini hub indicator lights.

Table 16. mini hub indicator lights.





Icon	Indicator light	Color	Normal Operation	Problem Indicator	Condition Indicated
	Fault	Amber	Off	On	There is a fault in the mini hub.

Table 16. mini hub indicator lights.

Icon	Indicator light	Color	Normal Operation	Problem Indicator	Condition Indicated
	Bypass (upper port)	Amber	Off	On	The upper mini hub port is bypassed. Note: If the port is unoccupied, the light is on.
	Loop good	Green	On	Off	The drive loop is operational.
	Bypass (lower port)	Amber	Off	On	The lower mini hub port is bypassed. Note: If the port is unoccupied, the light is on.

Completing the installation

Use the following procedure to check the controller unit for problems.

1. Check the indicator lights on the front of the controller for faults.
2. When all status indicators show "normal status," replace the controller unit front cover.

For operating instructions, refer to the *IBM FAST500 RAID Controller User's Reference*.

Locations and replacement procedures

Controller unit

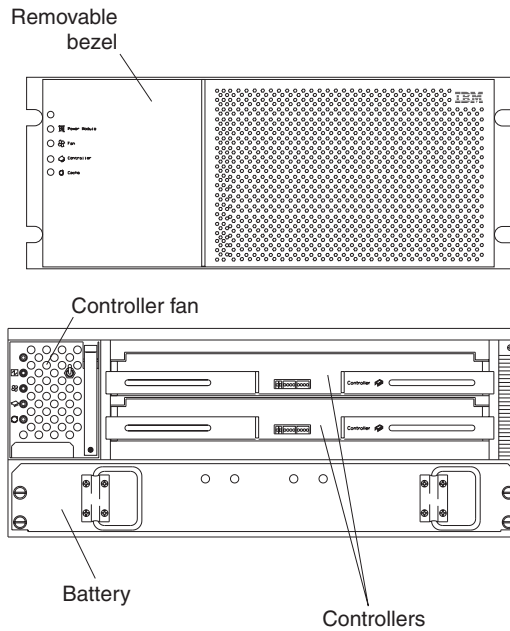
The controller unit supports direct attachment of up to four hosts containing two host adapters each, and is designed to provide maximum host- and drive-side redundancy. Using an external hub, the controller unit can support up to 64 host adapters per controller (up to 128 host adapters per controller unit).

Each controller unit contains several removable components, called customer replaceable units (CRUs), that you can access from either the front or back of the unit. These CRUs include the battery, RAID controllers, controller fan, power supplies, fan and communications module, mini hubs, and Gigabit Interface Converters (GBICs). The controller unit also has a removable front bezel.

Front view

The following figure shows the controller unit front view and the following components:

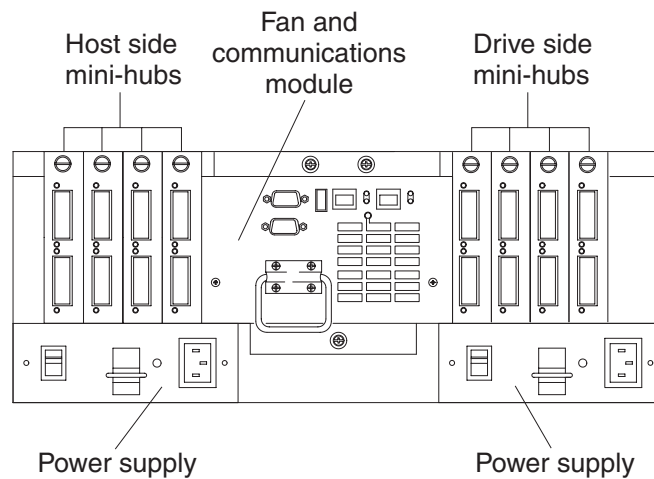
- Bezel - Removable front cover with holes for viewing the status lights and for boosting air circulation.
- Controller fan - One removable unit that contains two cooling fans and status indicator lights.
- Battery - One removable unit that contains a battery and battery charger circuitry.
- Controllers - Two removable units, each contains one RAID controller.



Back view

The following figure shows the controller unit back view and the following components:

- Host side and drive side mini hubs - Up to eight removable mini hubs to which you can connect GBICs and fiber-optic host and drive interface cables for the controller unit.
- Power supplies - Two removable units that contain the power supplies.
- Fan and communications module - One removable unit that contains the power supply cooling fans, Ethernet ports, and RS-232 (serial) ports.



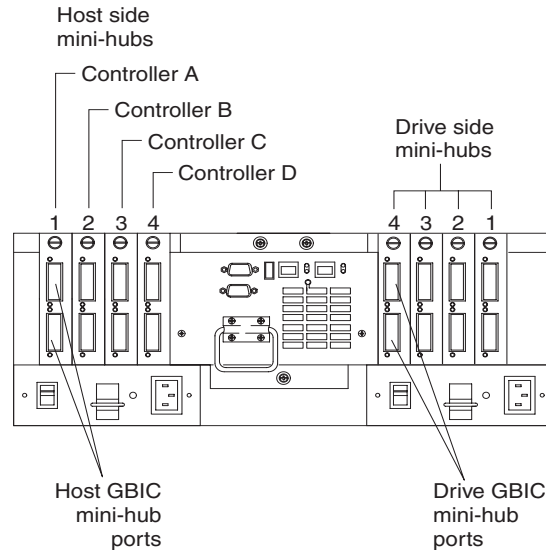
Interface ports

The controller unit has the following types of interface ports:

- Host
- Drive

- Ethernet
- RS-232 (serial)

The following figure shows the host and drive mini hub ports.



For more information about connecting the controller unit and drive enclosures (also referred to as expansion units) using the host and drive interface ports, refer to the IBM FASt500 RAID Controller Installation Guide.

Host mini hubs

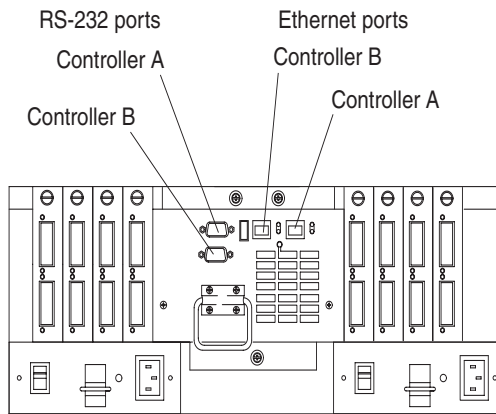
There are up to four host side mini hubs, two per controller. mini hubs 1 and 3 correspond to the top controller (Controller A) and mini hubs 2 and 4 correspond to the bottom controller (Controller B). Each pair of mini hubs accommodates one host channel. Each mini hub provides host loop connectivity and self-diagnostic features. To ensure redundancy, you must connect each host to a Controller A and Controller B mini hub.

Drive mini hubs

The controller unit has four drive channels. Each channel accommodates one drive side mini hub. All mini hubs on the drive side attach to both Controller A and Controller B.

Ethernet and RS-232 interface ports

Each controller has an Ethernet interface port and an RS-232 (serial) interface port. Use the Ethernet ports if you want to directly manage the controllers. Use the RS-232 ports for diagnostic service. The following figure shows the location of these interface ports.

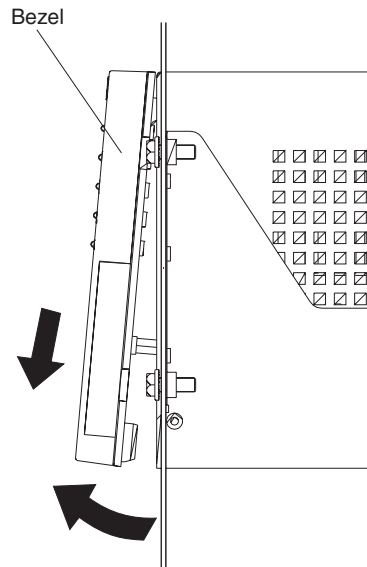


Accessing the controls

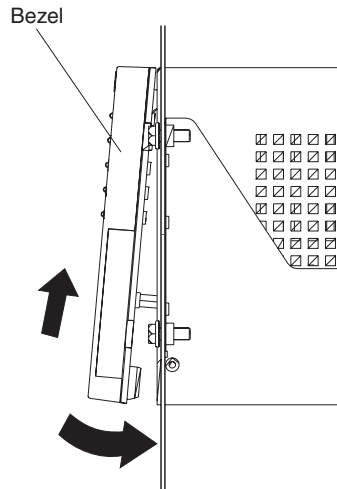
To access the controllers, battery, controller fan, and indicator lights, you must remove the controller unit bezel.

Attention: Pulling the cover out too far can damage the plastic hooks at the top. To avoid damaging the hooks, place the controller unit on a flat surface. Be sure the front of the controller unit extends beyond the edge approximately 5 cm (2 in.).

1. Carefully pull the bottom of the bezel out to release the pins; then, slide the bezel down, as shown in the following figure.



2. To replace the bezel, slip the top edge of the bezel under the lip on the chassis; then, push the bottom of the bezel until the pins snap into the mounting holes, as shown in the following figure.



Monitoring status through software

To monitor controller unit status, always run the storage-management software and check it frequently. Be sure to enable the management alerts that you need. The storage-management software provides the best way to diagnose and repair controller unit failures. This software can help you:

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

Although the controller unit has fault indicators, these lights are summary indicators and might not identify the specific component that has failed or needs replacing, or which type of recovery procedure you must perform. In some cases (such as loss of redundancy in controller unit components), the fault light does not come on. Only the storage-management software can detect the failure.

Recovering from a controller unit failure might require you to perform procedures other than replacing the component. The storage-management software gives these procedures.

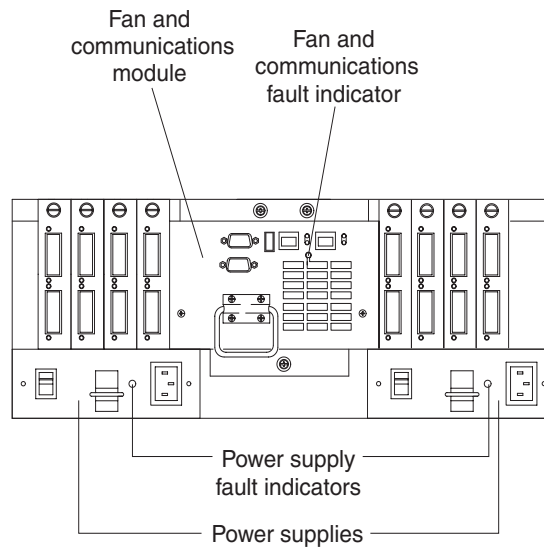
Note: Always follow the software recovery procedures to prevent data loss.

For more information about the storage-management software, refer to the following:

- *IBM FAStT Storage Manager for Windows NT Installation and Support Guide*
- *IBM Fibre Channel Storage Manager Concepts Guide*
- IBM FAStT Storage Manager online help:
 - Enterprise Management Online Help
 - Subsystem Management Online Help

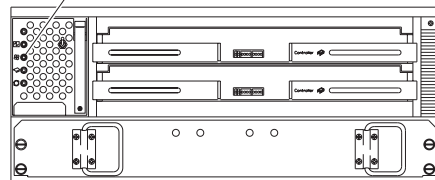
Overtemperature condition and power supply shutdown

If the fan and communications module fails or is unable to maintain an internal temperature below 70° C (158° F), one or both of the power supplies in the controller unit might shut down. If both power supplies shut down, the controller unit is not operational.



The storage-management software causes the fault indicator to light before the temperature has risen sufficiently to shut down the power supplies. The light comes on when the controller unit temperature exceeds 45° C (113° F). The controller unit shuts down if the temperature rises to 70° C (158° F). If both power supplies shut down, the fault indicator cannot come on.

Controller fan fault indicator



Turning on the power after an overtemperature shutdown

If your controller unit shuts down unexpectedly, use the storage-management software to determine whether the controller unit is overheated. If an overtemperature shutdown is indicated, use the following procedure to regain normal system operation.

1. Turn off the power switches and cool the controller unit (for example, replace the fans, use external fans to cool the room, and so on).
2. After the air temperature is below the upper operating temperature of 45° C (113° F), turn on the power switches.
3. Check the controller unit for faults or damage. Use the storage-management software to check the overall status of the controller unit and its components. Repair any faults found.

Turning on the power after an emergency shutdown

Use this procedure to regain normal system operation after a power failure or emergency shutdown.

1. After the emergency situation is over or power is restored to the building, check all components and cables for damage. If there is no visible damage, continue with step 2; otherwise, have your system serviced.
2. Make sure the power cords are plugged in.

3. Turn on the circuit breakers in the cabinet and turn on the power switches on all drive enclosures attached to the controller unit. If the system is off because of a power outage, the power switches are already on.

Important

You must turn on the drive enclosures before, or at the same time as, the controller unit. The controllers might not recognize the correct configuration if the attached drives are powered up after the controller unit. If you plan to use the main breaker to turn on all enclosures at the same time, make sure that the switches on each drive enclosure and each controller unit are on before turning on the main breaker. For instructions on powering up the drive enclosures, refer to the drive enclosure documentation.

4. Turn on both power switches on the back of the controller unit.
5. Check the status of the controller unit and other devices. Make sure all fault indicator lights are off on the front and back of the controller unit.
For more information, see “Checking the indicator lights” on page 65.
6. When all the devices on the system are powered up, check the overall system status using the storage-management software.

Preparing to move the controller unit

Remove each component CRU before moving the controller unit to a new location or before removing the chassis from its cabinet. This helps safeguard the equipment and ensures a smoother transition to the new environment.

If you are moving the controller unit a short distance (within the same building), and you have sufficient assistance (one or more additional helpers) or equipment (such as a fork lift), you might be able to move the controller unit without removing each component CRU. If you do not have sufficient assistance or equipment, use the procedure in “Removing and installing the components”.

If you are moving the controller unit a significant distance (for example, to another building or city), be sure to pack it in its original shipping container.

For more information about assembling or disassembling the controller unit, refer to the IBM FAStT500 RAID Controller Installation Guide.

Removing and installing the components

Use the following procedure to remove all component CRUs before moving or relocating the controller unit. Replace the CRUs after you complete the procedure.

1. Prepare the controller unit for shutdown, as follows:
 - a. Stop all I/O activity to the controller unit and attached drive enclosures.
 - b. Logically disconnect the controller and drive enclosures from the hosts.
 - c. Make sure that the fast write cache indicator light on the front bezel is off (not blinking).
 - d. Make sure that all applicable drive active indicator lights on each drive enclosure front panel are off (not blinking).
Note: If a parity check is in progress, it can take a long time for the drive indicator lights to stop blinking.
2. Remove the controller unit bezel.

3. Make sure that all amber fault indicator lights on the controller unit are off. If any fault indicator lights are on, correct the problem before turning off the power. For more information, see “Checking the indicator lights” on page 65.

CAUTION:

The Power Control button on the device and the power switch on 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.

4. Turn off both power switches and unplug the power cords from the controller unit.
5. If you are shutting down the system, turn off the main circuit breakers or power switches.
6. Disconnect the interface cables and label the host Fibre Channel cables.

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).

7. Disconnect and label all remaining cables from the controller unit, so that you can correctly reconnect them later.

Attention: When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

8. Remove all CRUs from the controller unit.
9. Remove the two screws from the inside rear of the controller unit; then, remove the two screws from the inside front of the controller unit. Save the four screws for later.

Attention: Do not remove the black hex head screws. These secure the rails that support your controller unit.

CAUTION:

Use safe practices when lifting.

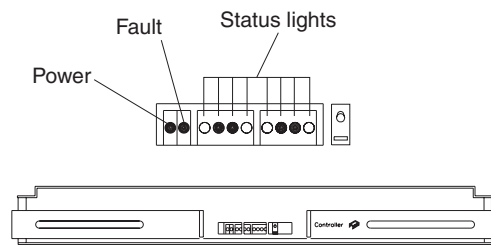
10. Slide the controller unit out of the rack and set it on a level, dry surface.
11. If you are shipping the controller unit to another location, replace all CRUs in the controller unit. Carefully pack the unit in its original shipping container. You are finished with this procedure.
12. If you are moving the controller unit to another cabinet, remove the support rails and power cords from the old cabinet and install them in the new one.
13. To replace the controller unit and components, using the proper cautions, reverse step 1 through step 10, of the controller removal procedure with the following steps.
 - a. Slide the controller unit into the rack.
 - b. Insert and tighten two of the screws that you previously removed on the inside front of the controller unit.
 - c. Insert and tighten the remaining two screws on the inside rear of the controller unit.
 - d. Replace all CRUs in the controller unit.
 - e. Connect the interface cables and host Fibre Channel cables.
 - f. Connect the remaining cables to the controller unit.

- g. Turn on the main circuit breakers or power switches.
- h. Plug in the power cords to the controller unit; then, turn on both power switches.
- i. Make sure that all amber fault indicator lights on the controller unit are off. If any fault indicator lights are on, correct the problem.
- j. Replace the controller unit bezel.
- k. Check the indicator lights.

RAID controller

The controller unit supports redundant array of independent disks (RAID) technology. The controller unit contains two RAID controllers.

Each controller comes in a removable, portable unit, called a controller CRU. The controller CRUs slide into one of two controller slots on the front of the controller unit and attach to hosts through Fibre Channel connections. Two handles lock the controller in place. Each controller slot has a controller slot designation that identifies the physical location of the controller in the chassis: controller slot A (top) or controller slot B (bottom). Each controller CRU has ten indicator lights: one power, one fault, and eight status indicator lights, as shown in the following figure.



Servicing notes

Consider the following when servicing the controllers in the controller unit:

- The controller unit supports two controller CRUs that attach to hosts through Fibre Channel connections.
- You can hot-swap or replace a failed controller while the controller unit is in operation as long as the failed controller is one of a redundant pair (two controllers attached to the same host) and has a passive or offline status in the storage-management software.
- If cache mirroring is enabled in redundant controllers and one controller fails, the second controller assumes processing functions without data loss. However, some or all data might be lost if cache mirroring is disabled and a failure occurs before data is written from cache memory to disk.
- If you replace the controller CRU and still experience problems, the controller unit might have defective components or connections. Check the storage-management software for indications of other component failures.
- If a controller CRU fails, the fault light on the affected controller glows. For more information about indicator lights, see “Checking the indicator lights” on page 65.
- Firmware between the two controllers is automatically synchronized when you replace a controller.

Replacing a failed controller

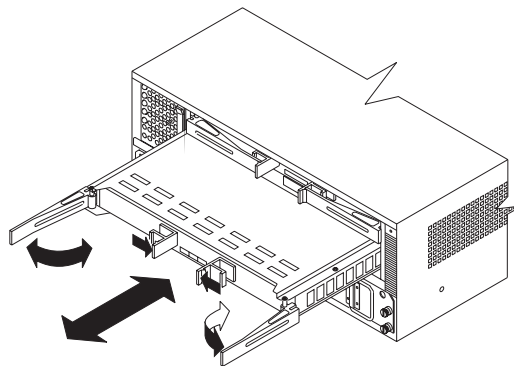
When instructed by the storage-management software, replace a controller CRU using the following procedure.

Attention: When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

1. Remove the controller unit bezel, as shown in the following figure.

Attention: Removing a controller that is operating normally (not failed) can result in data loss. Only remove a controller that:

- Has a fault indicator light that is glowing.
 - Is marked as Failed (offline) through the storage-management software.
2. Using the following figure as a guide, remove the controller that has failed.
 - a. Squeeze the two center tabs and open the handles.
 - b. Remove the controller.
 - c. Close the handles and snap into place.



Attention: To avoid potential data loss, make sure that the new controller has the same memory size as the one you are replacing. If you install a controller with a different memory size, the storage-management software suspends cache mirroring and issues an error message. If the memory size is not the same, you need to upgrade the cache memory. For more information, see “Installing additional cache memory in a controller” on page 86.

3. Unpack and check the new controller.

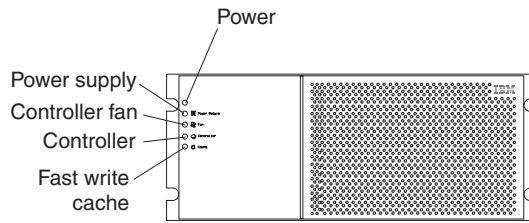
Using the proper handling precautions, remove the new controller from the packing material. Check the shipping invoice and the controller to make sure that it has the same memory size as the controller that you just removed.

4. Install the new controller as follows:

- a. Squeeze the two center tabs and open the handles.
- b. Using the handles, slide the controller into the slot until the back edge hooks onto the frame.
- c. Close the handles and snap into place.

Attention: When you replace a failed 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.

5. Check the controller indicator lights.



- a. If the green power indicator is on and the amber fault indicator is off, go to step 6.
 - b. If the green power indicator remains off or the fault indicator is on after a few seconds, make sure that the controller CRU is locked into place. If the fault indicator remains on, go to step c.
 - c. Use the storage-management software to check the status of both controllers. If applicable, perform the recovery procedures required by the software. If this corrects the fault and the controller unit is operating without error, go to step 6. If not, go to step d.
 - d. Replace the controller CRU. If the problem is not corrected, replace the controller unit bezel faults. Go to step 6.
6. Redistribute arrays.

Battery

The battery CRU contains rechargeable batteries and a battery-charger board. The battery CRU plugs into the front of the controller unit where it provides backup power to the controllers cache memory. During a power outage, a properly charged battery CRU maintains electrical current to the controllers for up to five days with 256 MB cache memory installed and up to 3 days with 512 MB cache memory installed. Therefore, all data stored in memory is preserved as long as the batteries can sustain power to the cache memory. However, the battery does not provide power to the rest of the system during a power outage. Therefore, the system is not able to write data to drives without a backup power source.

Servicing notes

Consider the following when servicing the battery in the controller unit:

- The battery has a three-year life expectancy. Replace the battery every three years or whenever it fails to hold a charge. Using the controller unit in a hot environment (above 35° C or 95° F) lowers the life expectancy of the battery. Under these conditions, you might need to replace the battery more often.
- The service label on the battery provides a blank line for recording the last date on which the battery was serviced. Check this label to determine when to replace the battery. For information about using the software to track battery age, refer to the FAStT Storage Manager documentation and online help.
- If a battery fails, the fault light on the battery glows. For more information about indicator lights, see “Checking the indicator lights” on page 65.
- If you replace the battery and still experience battery problems (for example, loss of battery power to the controllers or batteries not charging properly), the controller unit might have defective components or connections. Check the storage-management software for indications of other component failures.

Replacing a failed battery

When instructed by the storage-management software, replace the battery.

1. Use the storage-management software to check that there is no data in cache and that all caching has stopped. Data in cache is unprotected if a power outage occurs while the battery CRU is out of operation.

Attention: When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

2. Prepare the new battery.

Unpack the battery CRU. Save the packing material for shipping the used battery CRU to a disposal facility. Find the "Battery Support Information" label on the front of the new battery CRU, as shown in "Checking the battery service date" on page 120.

3. Fill in the following information:

- Date of Installation - Record today's date on the blank line.
- Replacement Date - Record the expiration date (three years from today's date) on the blank line.

4. Remove the controller unit bezel.

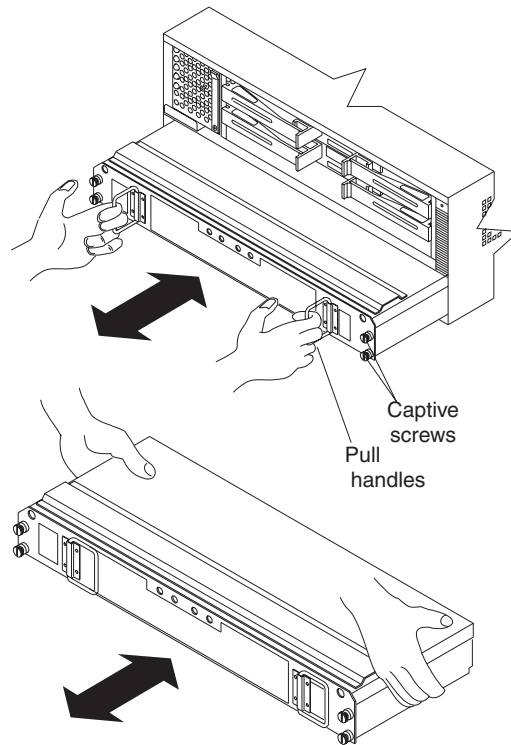
Attention: Be careful when removing the battery. The battery weighs approximately 6.4 kg (14 lbs).

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.

- a. Loosen the four captive screws on the battery. If they are too tight, use a flat blade screwdriver to loosen the screws.
- b. Using the pull handles, slide out the battery about 5 cm (2 in.).
- c. Using both hands, grasp the sides of the battery and pull out.

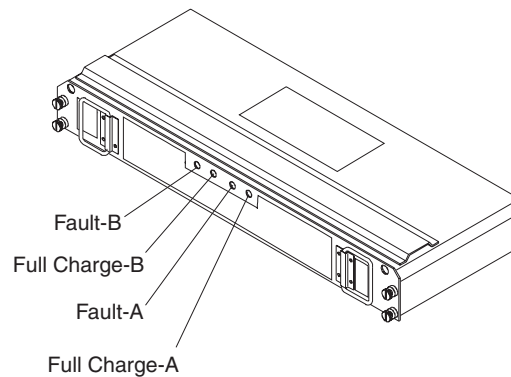


5. Install the new battery.
 - a. Using both hands, slide the battery about 5 cm (2 in.) into the slot.
 - b. Using the pull handles, push the battery into the slot completely.
 - c. Tighten the four captive screws.

6. Replace the controller unit bezel.
7. Run the system for at least 24 hours to properly charge the battery.

The battery can take up to 15 minutes to complete its self-test and up to 24 hours to fully charge, especially after a power loss of more than a few minutes. When properly charged, both full-charge indicator lights on the front of the battery are on.

8. Check the battery indicator lights.



Note: If either the Full Charge-A or the Full Charge-B indicator light is blinking, the battery is in the process of charging.

9. Reset the battery installation date using the storage-management software. The software continues to issue battery-related errors if the installation date is not reset.

Attention: 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.

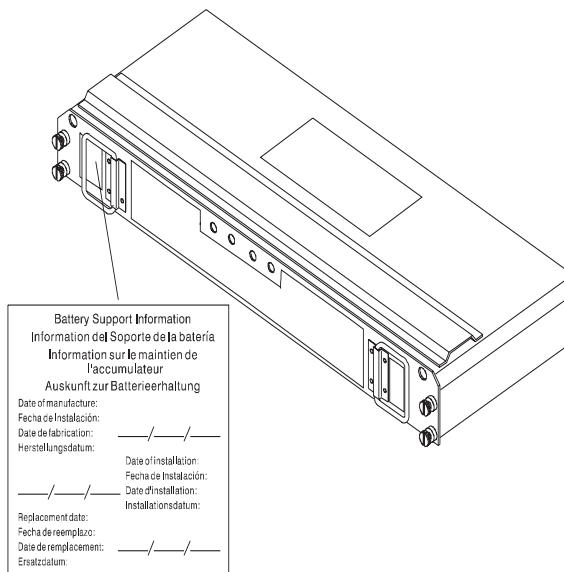
10. Dispose of the used battery CRU according to local and federal regulations, which might include hazardous material handling procedures.

Checking the battery service date

Note: Replace the battery whenever it fails to hold a charge or every three years. Using the controller unit in a hot environment (above 35° C or 95° F) lowers the battery life expectancy. Under these conditions, you might need to replace the battery more often.

To check the battery service date, do the following:

1. Remove the controller unit bezel.
2. Check the Battery Support Information label, as shown in the following figure.



The Battery Support Information label on the front of the battery has three dates:

- Date of Manufacture - Date the battery was built at the factory
 - Date of Installation - Date the battery was installed in the controller unit
 - Replacement Date - Date to replace the battery (see the note at the beginning of this section)
3. Look at the replacement date and do the following:
 - If it is time to replace the battery, install a new battery.
 - If it is not time to replace the battery, replace the controller unit bezel.

Controller fan

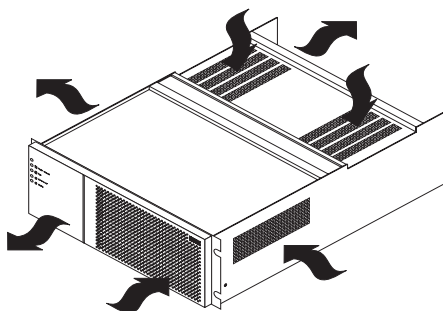
The controller fan is a single, removable unit containing two cooling fans and temperature monitoring circuitry. The controller fan plugs directly into a slot on the

front of the controller unit, to the left of the controllers. Five indicator lights provide overall system status information. The dual fans in the controller fan provide a redundant cooling system to both controller CRUs. If one fan fails, the other continues to operate, providing sufficient air circulation to prevent the controllers from overheating until you can replace the entire controller fan.

To prevent cooling problems, the controller unit must have proper air circulation throughout the chassis. Cooling problems include any malfunctions or obstructions that impede air flow and cause one or more components in the controller unit to overheat. Make sure that the ambient air temperature around the controller unit is within the environmental requirements. To boost air circulation, the controller unit chassis has air vents along its top and sides. These vents serve as air intake and exhaust passages. Always keep vents clean and free of obstructions.

The following figure shows the controller unit air flow. Make sure your installation site allows adequate ventilation to the controller unit during operation.

Note: Allow at least 60 cm (2 ft) of clearance in front of and behind the controller unit for proper ventilation.



Servicing notes

Consider the following when servicing the controller fan:

- Both fans failing simultaneously in the controller fan is unlikely. Such a failure will cause either one or both controllers to overheat. Under these circumstances, the amber controller light on the front panel might turn on. Shut down the controller unit immediately and let the unit cool to room temperature and then replace the controller fan.
- You can hot-swap, or replace, the controller fan, as long as you complete the exchange within 15 minutes. The time limit applies to the total time that the fan is out of the chassis. The time begins when you remove the failed controller fan and ends when you install the new one. This does not include the time it takes to perform the entire procedure (for example, checking the indicator lights).
- If a controller fan fails, the fault light on the controller fan glows. For more information about indicator lights, see “Checking the indicator lights” on page 65.
- If you replace the controller fan and still experience problems, the controller unit might have defective components or connections. Check the storage-management software for indications of other component failures.

Replacing a failed controller fan

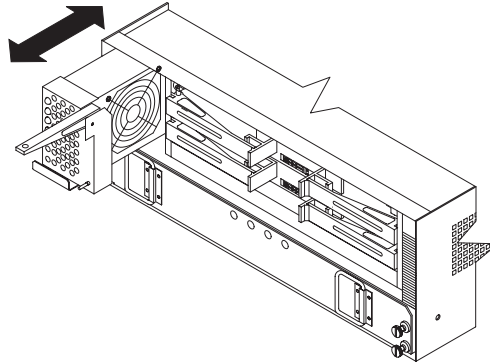
When instructed by the storage-management software, replace a controller fan.

Attention: When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD:
<http://www.ibm.com/>

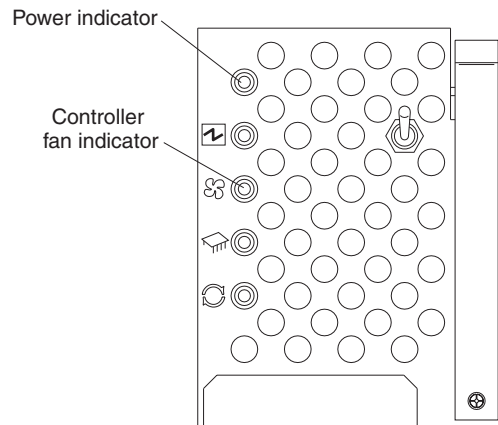
1. Unpack the new controller fan.
2. Remove the controller unit bezel.

Attention: To prevent damage to the controller unit components, do not operate the controller unit without adequate ventilation to the controllers. If it will take longer than 15 minutes to replace the controller fan, you must shut down the controller unit to prevent it from overheating. The time limit applies to the total time that the fan is out of the chassis.

3. Remove the failed controller fan.
 - a. Lift up the lever on the controller fan.
 - b. Pull firmly on the bottom lip to remove the fan.



4. Install the new controller fan.
 - a. Slide the new controller fan all the way into the slot.
 - b. Press down on the lever and snap the lever into place.
5. The following figure shows the indicator lights on the controller fan.



When the controller fan is operating properly, the green power indicator is on and the amber indicator is off.

- If the amber fan light is on or the green power indicator remains off, make sure that the controller fan is seated securely in the slot and that the lever is snapped into place.
 - If the controller fan indicator remains on, it might indicate a problem with the new controller fan. Replace the controller fan with a spare, if available. If not, turn off the controller unit to prevent it from overheating until you can replace the fan.
6. Replace the controller unit bezel.

Fan and communications module

The fan and communications module is a single, removable unit containing two cooling fans, two serial ports, and two Ethernet ports. This module plugs into a slot at the center back of the controller unit, just above the power supplies. It has a locking lever and a pull handle for securing and removing the fan and communications module. The module contains dual fans that provide a redundant cooling system to both power supplies. If one fan within the module fails, the other continues to operate. A single fan provides sufficient air circulation to prevent the power supplies from overheating until you can replace the entire fan and communications module.

Servicing notes

Consider the following when servicing the fan and communications module:

- The fan and communications module contains two serial RS-232 connections used for diagnostic purposes and two Ethernet RJ-45 connections used for direct network-management.
- You can hot-swap the fan and communications module as long as you complete the exchange within 15 minutes from when you remove the failed unit.
- It is unlikely that both fans in the fan and communications module will fail simultaneously. Such a failure causes one or both power supplies to overheat. In these circumstances, the amber power supply indicator light on the bezel turns on and the overheated power supply automatically shuts down (the green power indicator light turns off). After the ambient air temperature cools below 70° C (158° F), the power supply automatically turns on. Replace the failed fan and communications module then check the power supply indicator lights (fault indicator light on the front and power indicator light on the back). If the power supply fault indicator light remains on, replace the power supply. For more information about indicator lights, see “Checking the indicator lights” on page 65.
- If you replace the fan and communications module and still experience problems, the controller unit might have defective components or connections. Check the storage-management software for indications of other component failures.

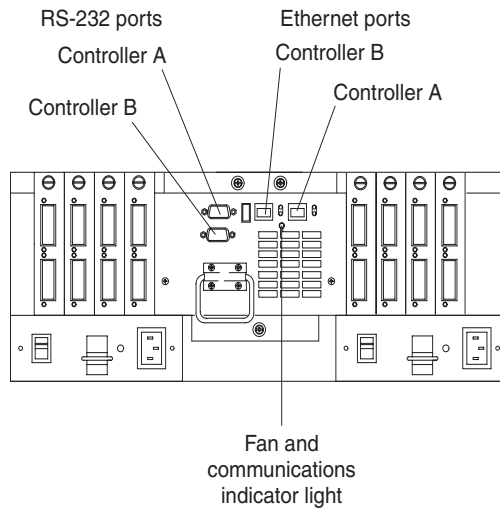
Replacing a failed fan and communications module

When instructed by the storage-management or diagnostic software, replace the fan and communications unit.

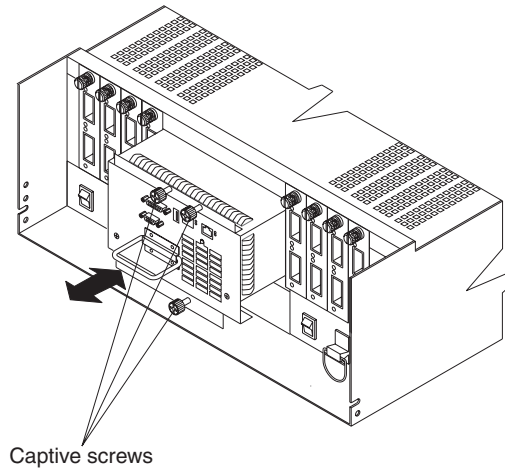
Attention: To prevent damage to the controller unit circuitry, do not operate the controller unit without adequate ventilation to the controllers. If it will take longer than 15 minutes to replace the controller fan, you must shut down the controller unit to prevent it from overheating. The time limit applies only to the total time that the fan is out of the chassis. The time begins when you remove the failed module and ends when you install the new one. This does not include the time it takes you to perform this entire procedure (for example, checking the lights).

When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

1. Unpack the new fan and communications module.
2. If you are using a diagnostic program, stop the program before disconnecting the cables.
3. Disconnect all RS-232 and Ethernet interface cables from the failed fan and communications module. The locations of the ports are shown in the following figure.



4. Remove the failed fan and communications CRU from the controller unit.



- a. Using a flat-blade screwdriver, loosen the three captive screws on the fan and communications module.
 - b. Use the pull handle to slide the module out of the slot a few inches.
 - c. Grasp the sides of the module with both hands and remove it from the controller unit.
5. Install the new fan and communications module.
Push the new fan and communications module all the way into its chassis slot. Use a flat-blade screwdriver to tighten the three captive screws on the new module, securing it into place.
 6. Check the fan and communications indicator light.
 - If the amber fault indicator light is on, make sure that the fan and communications module is inserted all the way into the chassis and secured in place.
 - If the fault indicator light remains on, one or both fans inside the fan and communications module might be malfunctioning. Replace the failed fan and communications module with a spare, if available. If not, shut down the controller unit until you can replace the failed fan and communications module with a new one.
 7. Reconnect the interface cables to the new fan and communications module.

Power supply

The controller unit power system consists of two power supplies. The power supplies slide into either of the two slots on the back of the controller unit. The power supplies provide power to the internal components by converting incoming ac voltage to dc voltage. The power supplies are interchangeable and redundant. Each power supply uses one power cord. You can plug both power cords into a common power source or plug each cord into a separate circuit for power redundancy. One power supply can maintain electrical power to the controller unit if the other power supply is turned off or malfunctions.

Servicing notes

Consider the following when servicing the power supplies:

- Each power supply has a built-in sensor that detects the following conditions:
 - Overvoltage
 - Overcurrent
 - Overtemperature

If any of these conditions occur, one or both power supplies enter shutdown mode. All power remains off until one of the following occurs:

- You cycle the power switches (turn off the power switches, wait at least 30 seconds, then turn on the power switches).
- The power supplies automatically resume operation when the ambient air temperature cools to below 70° C (158° F). When the power supplies automatically resume operation, the controller also resumes operation.

After you manually cycle the power off then on, or when the power supplies automatically resume operation, an automatic restart resets the controllers, attempts to spin up the drives (which has no effect on the drives if they are already running), and returns the controller unit to normal operation without operator intervention.

- You can hot-swap (replace) a power supply because the two power supplies provide redundancy.
- Both power supplies have built-in temperature sensors designed to prevent the power supplies from overheating. If a temperature sensor detects an ambient air temperature greater than 70° C (158° F), the overheated power supply automatically shuts down. The second power supply remains on as long as its temperature remains below 70° C (158° F). If the second power supply overheats, it turns off all power to the controller unit.

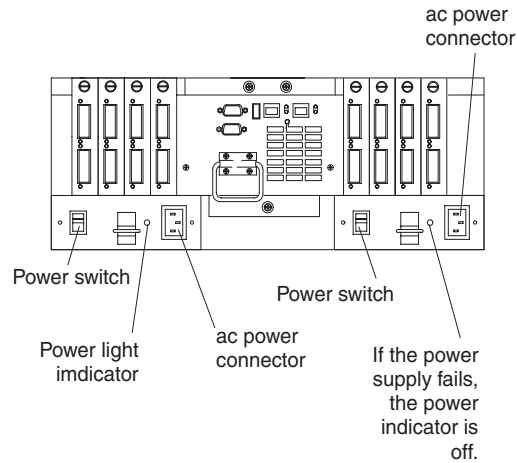
Note: There is a serious problem if the air temperature inside the cabinet is hot enough to cause the power supplies to shut down.

- The controller unit is capable of power up recovery without operator intervention. After the air temperature cools to below 70° C (158° F), the power supplies automatically restart. An automatic restart resets the controllers, attempts to spin up the drives (which has no effect on the drives if they are already running), and returns the controller unit to normal operation.
- If a power supply fails, the green power indicator light on the power supply is off and the amber power supply fault light on the controller fan on the front of the controller unit glows. For more information, see “Checking the indicator lights” on page 65.
- If you replace the power supply CRU and still experience problems, the controller unit might have defective components or connections. Check the storage-management software for indications of other component failures.

Replacing a failed power supply

When instructed by the storage-management software, replace a power supply.

1. Check the power supply indicator light on the back of the controller unit, as shown in the following figure. Be sure that the green power light on the failed power supply is off.



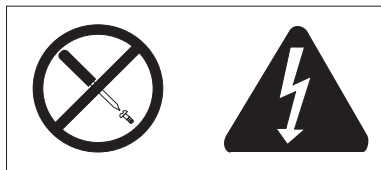
CAUTION:

The Power Control button on the device and the power switch on 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.

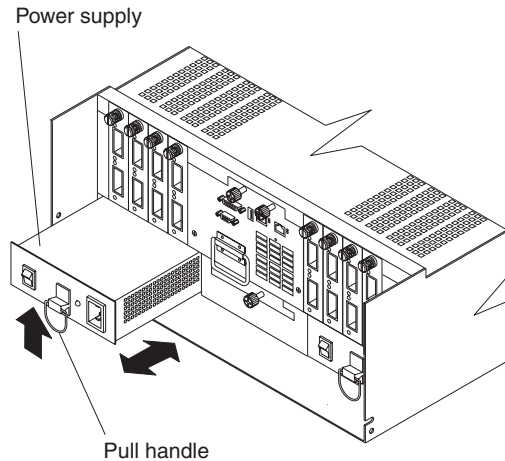
2. Turn off the power switch and unplug the power cord from the failed power supply.

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.



3. Using the following figure as a guide, remove the failed power supply.
Using the pull handle, lift up and pull out to release the power supply; then, slide it out.



Attention: When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

4. Unpack and install the new power supply. Using the pull handle, push the power supply into the slot until it locks into place.
5. Plug in the power cord and turn on the power.
6. Check the new power supply and other controller unit indicator lights for faults. For more information, see “Checking the indicator lights” on page 65.

Mini hubs

The mini hubs are located on the back of the controller unit. A mini hub is a single, removable unit that provides the Fibre Channel interface between a controller unit and hosts or drives. The back of the controller unit can accommodate eight mini hubs: up to four host side and up to four drive side mini hubs. Each mini hub has two ports. A Gigabit Interface Converter (GBIC) is installed in a mini hub port. Then a fiber-optic interface cable is connected into the GBIC. For more information, see Chapter 1, “IBM Fibre Channel,” on page 1 and “GBICs” on page 129.

Servicing notes

Consider the following when servicing mini hubs:

- You can hot-swap (replace) a failed mini hub while the controller unit is in operation.
- Four indicator lights provide status information. If a mini hub fails, the interface fault and the bypass indicator lights on the mini hub glow and the loop good indicator light is off. For more information about indicator lights, see “Checking the indicator lights” on page 65.
- If you replace the mini hub and the GBICs in them and still experience problems, the controller unit might have defective components or connections. Check the storage-management software for indications of other component failures.

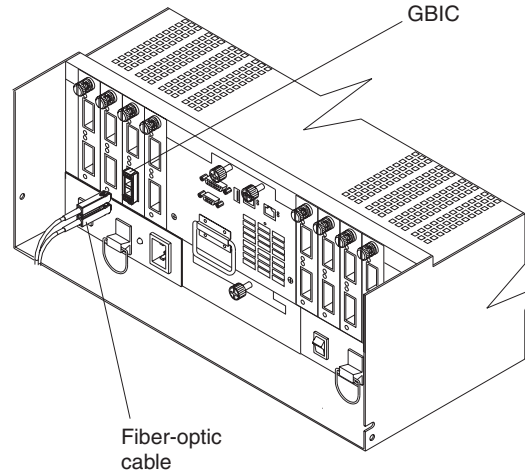
Replacing a failed mini hub

When instructed by the storage-management software, replace a mini hub. Use this procedure to replace either a failed host-side or drive-side mini hub.

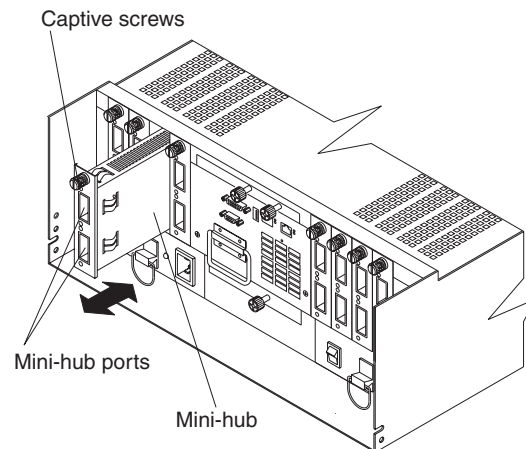
Attention: To prevent possible data loss, do not pull cables from a mini hub that has not failed.

1. On the mini hub that has failed, remove the fiber-optic cables from the GBICs; then, replace the protective caps on the cables.

Note: If you are using IBM GBICs, you must remove the fiber-optic cable from the GBIC before you can remove the GBIC from the mini hub port.



2. Remove any GBICs in the mini hub. If a GBIC you are removing has a metal latch, move the latch to the unlocked (center) position. Pull the GBIC from its mini hub port; then, replace the protective caps on the GBIC.
3. Loosen the captive screw on the mini hub; then, grasp the screw and pull the mini hub from the chassis.



Attention: When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

4. Unpack the new mini hub and slide it into the appropriate slot; then, tighten the captive screw.
5. Replace the GBICs.
 - a. Remove the protective cap from the GBIC.
 - b. If the GBIC you are installing has a metal latch, move the metal latch to the unlocked (center) position.

- c. Slide the GBIC into the mini hub port.
 - d. Rotate the metal latch outward to the locked position (flush with the rear of the GBIC).
6. Replace the fiber-optic cables.
 7. Check the indicator lights on the mini hub.

When the mini hub is operating properly, the green loop good light is on and the fault light is off. If the mini hub is connected to a Fibre Channel loop, the amber port bypass light is off. If a problem is indicated, use the storage-management software to check the controller unit status.

GBICs

GBICs (Gigabit Interface Converters) are used to connect mini hub ports to attached nodes. A GBIC slides into a mini hub port on the back of the controller unit and then a host- or drive-interface cable connects into the GBIC.

Servicing notes

Consider the following when servicing GBICs:

- You can hot-swap (replace) a failed GBIC while the controller unit is in operation.
- The operational loop performance is not affected when you install or remove a GBIC.
- Four indicator lights on a mini hub provide status information. If a GBIC fails, the interface fault and the bypass indicator lights on the mini hub glow and the loop good indicator light is off. For more information about indicator lights, see “Checking the indicator lights” on page 65.
- If you replace the GBIC and still experience problems, the controller unit might have defective components or connections. Check the storage-management software for indications of other component failures.

Replacing a failed GBIC

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.

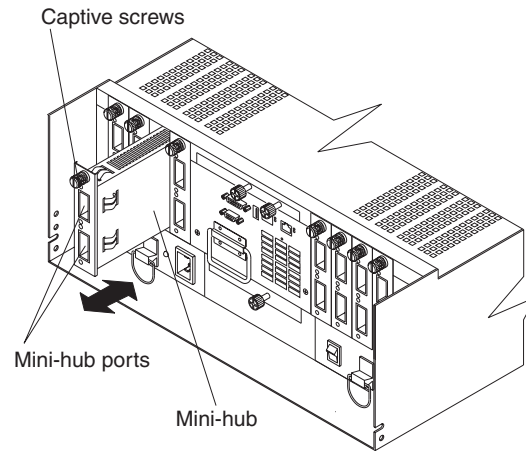
Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

When instructed by the storage-management software, replace a GBIC in the mini hub.

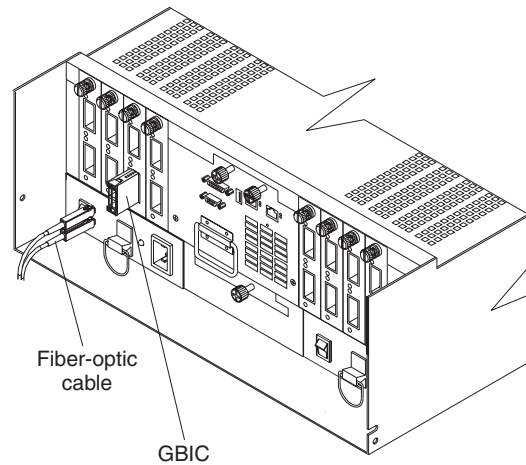
Attention: To prevent possible data loss, do not pull cables from a GBIC that has not failed.

1. Remove the fiber-optic cable from the GBIC that has failed; then, replace the protective caps on the cables.

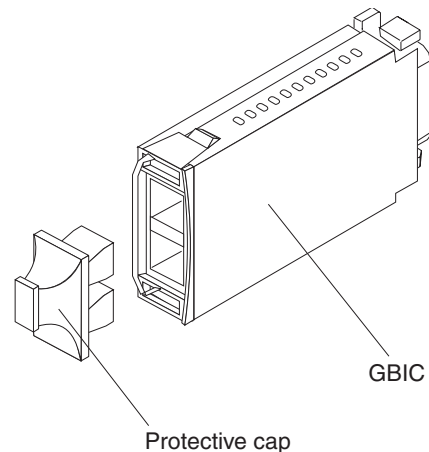
Note: If you are using IBM GBICs, you must remove the fiber-optic cable from the GBIC before you can remove the GBIC from the mini hub port.



2. Remove the GBICs from the mini hub ports. If the GBIC you are removing has a metal latch, move the latch to the unlocked (center) position. Pull the failed GBIC from its mini hub port.



3. Insert the protective cap on the GBIC.



Attention: When you handle electrostatic discharge (ESD) sensitive devices, take precautions to avoid damage from static electricity. For details about handling ESD-sensitive devices, refer to the following Web site and use a search term of ESD: <http://www.ibm.com/>

4. Unpack the new GBIC; then, do the following:
 - a. Remove the protective cap from the GBIC.
 - b. If the GBIC you are installing has a metal latch, move the metal latch to the unlocked (center) position.
 - c. Slide the GBIC into the mini hub port.
 - d. Rotate the metal latch outward to the locked position (flush with the rear of the GBIC).
5. Reconnect the interface cables.
6. Check the indicator lights on the mini hub.

When the mini hub is operating properly, the green loop good light is on and the fault light is off. If the mini hub is connected to a Fibre Channel loop, the amber port bypass light is off. If a problem is indicated, use the storage-management software to check the controller unit status.

Operating specifications

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

- **Size (with front panel and without mounting rails):**
 - Depth: 63.5 cm (25 in.)
 - Height: 17.45 cm (6.87 in.)
 - Width: 44.45 cm (17.5 in.)
- **Weight:**
 - Typical controller unit fully configured: 38.6 kg (85 lbs)
 - Electrical input
 - Sine-wave input (50 to 60 Hz) is required
 - Input voltage:
 - Low range: Minimum: 90 V ac / Maximum: 132 V ac
 - High range: Minimum: 198 V ac / Maximum: 262 V ac
 - Input kilovolt-amperes (kVA) approximately: 0.214 kVA
- **Environment:**
 - Air temperature:
 - Controller unit on: 10° to 35° C (50° to 95° F)
 - Altitude: 0 to 914 m (3000 ft)
 - Controller unit on: 10° to 32° C (50° to 90° F)
 - Altitude: 914 m (3000 ft) to 2133 m (7000 ft)
- **Humidity:** 10% to 80%
- **Acoustical noise emissions values for typical system configurations:**
 - Sound power (idling): 6.5 bels
 - Sound power (operating): 6.5 bels
 - Sound pressure (idling): 49 dBA

— Sound pressure (operating): 49 dBA

These levels are measured in controlled acoustical environments according to 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.

Symptom-to-FRU index

The Symptom-to-FRU index lists symptoms and the possible causes. The most likely cause is listed first.

The PD maps found in the *Fibre Channel Problem Determination Guide* also provide you with additional diagnostic aids.

Note: Always start with the “General checkout” on page 65. For IBM devices not supported by this index, refer to the manual for that device.

Note: Do *not* look directly into any fiber cable or GBIC optical output. Read Appendix B, “Related service information,” on page 369. To view an optical signal, use a mirror to view the reflected light.

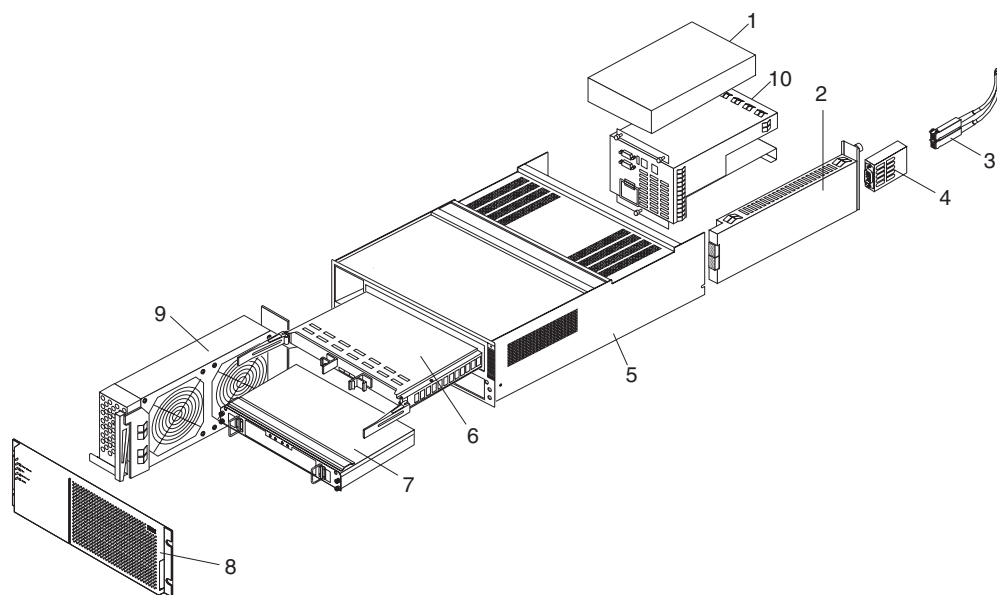
Table 17. Symptom-to-FRU index for Type 3552 FASt500 RAID controller.

Problem	FRU/Action
Controller LED (front cover) is on.	<ol style="list-style-type: none"> 1. Reseat Controller CRU. 2. Place Controller online using SM7 GUI. 3. If in passive mode, check Fibre path/GBIC. 4. Controller CRU
Software issued a controller error message.	<ol style="list-style-type: none"> 1. Check Controller Fan 2. Controller CRU
Software errors occur when attempting to access controllers or drives.	<ol style="list-style-type: none"> 1. Check appropriate software and documentation to make sure the system is set up correctly and the proper command was executed. 2. Power to the Controller 3. Interface cables 4. ID settings 5. Controller 6. Drive 7. Controller backpanel
Fan LED (front cover) is on.	<ol style="list-style-type: none"> 1. Power supply fan CRU 2. Controller fan CRU
Controller and Fan fault LEDs (front cover) are on.	<ol style="list-style-type: none"> 1. Check both Fan and Controller CRUs for fault LED and replace faulty CRU.
Fault-A or Fault-B LED (battery CRU) is on.	<ol style="list-style-type: none"> 1. Battery CRU
Full Charge-A or Full Charge-B LED (battery CRU) is off.	<ol style="list-style-type: none"> 1. Power-on Controller and allow batteries to charge for 24 hours until the Full Charge LEDs are on. 2. Battery CRU 3. Both power supplies

Table 17. Symptom-to-FRU index for Type 3552 FASt500 RAID controller.

Problem	FRU/Action
No power to controller (all power LEDs off).	<ol style="list-style-type: none"> 1. Check power switches and power cords. 2. Power supplies
Power Supply LED is off.	<ol style="list-style-type: none"> 1. Check and reseal power supply. 2. Check for overheating. Wait ten minutes for the power supply CRU to cool down. 3. Power supply CRU
Power Supply CRUs LED are on, but all other CRU LEDs are off.	<ol style="list-style-type: none"> 1. DC power harness

Parts listing (Type 3552 Fibre Channel RAID controller)



Index	Fibre Channel RAID Controller (Type 3552)	FRU
1	175W-Watt Power Supply	01K6743
2	GBIC Card Assembly	37L0096
3	Optical Cable - 1 Meter	37L0083
3	Optical Cable - 5 Meters	03K9202
3	Optical Cable - 25 Meters	03K9204
4	Short Wave GBIC	03K9206
4	Long Wave GBIC	03K9208
5	Frame Assembly with Midplane	37L0093

Index	Fibre Channel RAID Controller (Type 3552)	FRU
6	Fibre Channel Host Adapter (optional)	09N7292
7	Battery Backup Assembly	37L0099
8	Bezel Assembly	10L7043
9	Front Fan Assembly (Controller CRU Fan)	37L0094
10	Rear Fan Assembly	37L0102
	256 MB DIMM	37L0095
	Battery Cable	03K9285
	Blank Cannister	37L0098
	Line Cord Jumper, High Voltage	36L8886
	Power Cable	37L0101
	Miscellaneous Hardware Kit	37L0092
	RAID Card	37L0098
	Rail Kit	37L0085

Chapter 8. FAStT700 Fibre Channel Storage Server

Note: The problem determination (PD) maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

The IBM FAStT700 Fibre Channel Storage Server provides dual, redundant controllers with Fibre Channel interfaces to both the host and drive loops. The FAStT700 Storage Server has redundant cooling, redundant power, and battery backup of the controller cache.

Designed to provide maximum host and drive-side redundancy, the FAStT700 Storage Server supports direct attachment of up to four hosts containing two host adapters each. Using external Fibre Channel managed hubs and switches in conjunction with the FAStT700 Storage Server, you can attach up to 64 hosts with two adapters each to a FAStT700 storage server.

General checkout

Use the indicator lights, the Symptom-to-FRU index, and the connected server HMM to diagnose problems.

The problem determination (PD) maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

Checking the indicator lights

The FAStT700 Storage Server indicator lights display the status of the FAStT700 Storage Server and its components. Green indicator lights mean normal operating status; amber indicator lights mean a possible failure.

It is important that you check all the indicator lights on the front and back of the controller unit when you turn on the power. After you turn on the power, the indicator lights might blink intermittently. Wait until the FAStT700 Storage Server completes its power up before checking for faults. It can take up to 15 minutes for the battery to complete its self-test and up to 24 hours to fully charge, particularly after an unexpected power loss of more than a few minutes.

The indicator lights for the components of the FAStT700 Storage Server are described in the following sections.

Storage server indicator lights

The storage server has five indicator lights, as shown in the following figure. To view the storage server indicator lights, you do not have to remove the FAStT700 Storage Server bezel.

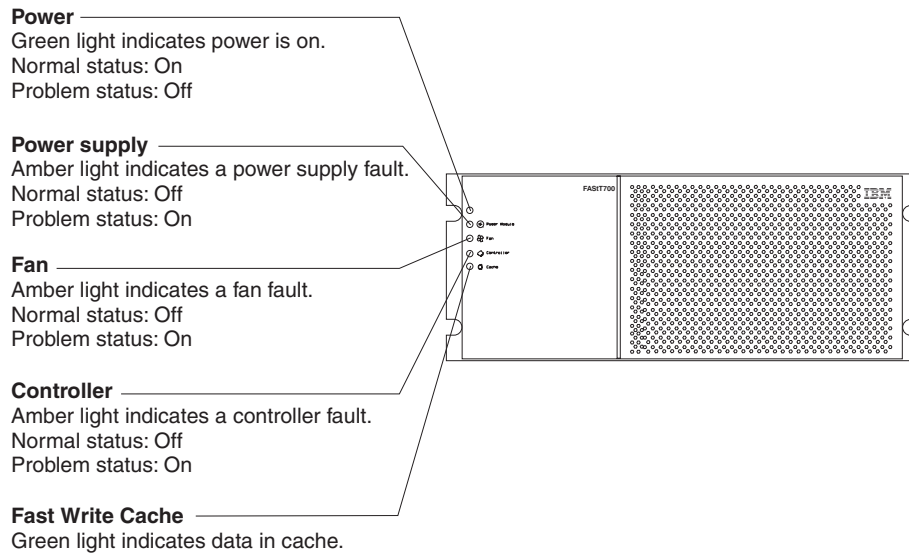


Table 18 describes the storage server indicator lights.

Table 18. Storage server indicator lights.

Indicator light	Color	Normal operation	Problem indicator	Possible conditions indicated by the problem indicator ¹
Power	Green	On	Off	<ul style="list-style-type: none"> No power to FAST700 Storage Server No power to storage subsystem Cables are loose or the switches are off Power supply has failed, is missing, or is not fully seated in FAST700 Storage Server Overtemperature condition
Power supply fault	Amber	Off	On	<ul style="list-style-type: none"> Power supply has failed or if the Power supply is turned off, disconnected, or not fully seated in FAST700 Storage Server Overtemperature No power to FAST700 Storage Server or storage subsystem (all indicator lights are off)
Storage server fan fault	Amber	Off	On	<ul style="list-style-type: none"> Storage server fan has failed Fan and communications module is missing, unplugged, or has failed Circuitry failure Overtemperature condition
Controller fault	Amber	Off	On	Controller has failed; one or more memory modules failed (SIMMs or DIMMs)
Fast write cache	Green	Steady or blinking ²	Software dependent ¹	Normal operation is off if: <ul style="list-style-type: none"> Cache is not enabled Battery is not ready

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

² The fast write cache indicator light is on when there is data in cache and blinks during a fast write operation.

RAID controller indicator lights

Each RAID controller has ten indicator lights: one power, one fault, and eight status lights, as shown in the following figure.

Note: To view the RAID controller indicator lights, remove the FAStT700 Storage Server bezel.

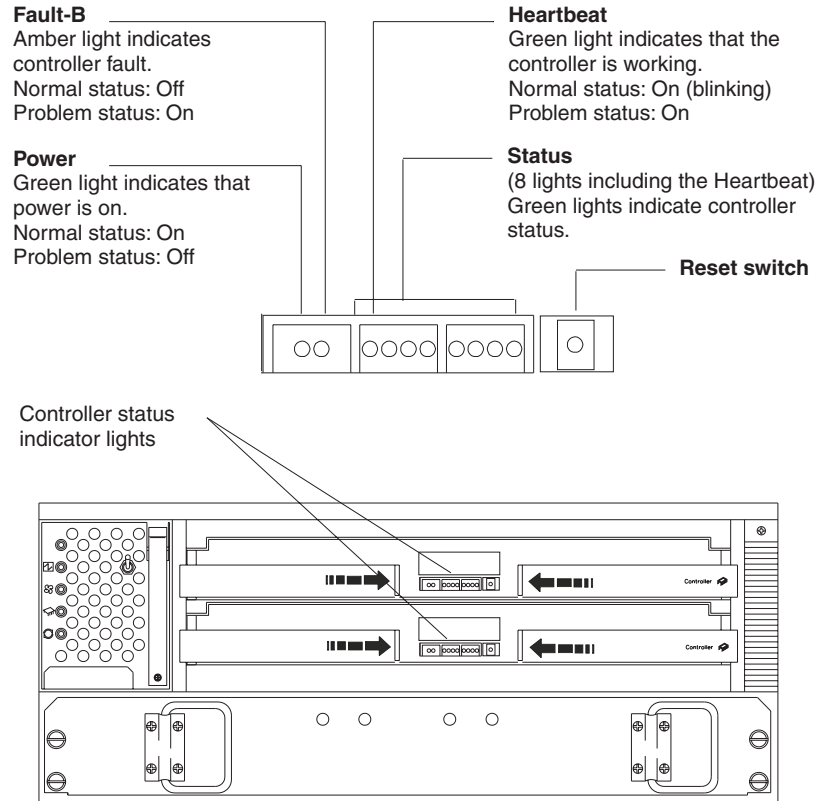


Table 19 describes the RAID controller indicator lights.

Table 19. RAID controller indicator lights.

Indicator light	Color	Normal operation	Problem indicator	Possible conditions indicated by the problem indicator ¹
Power	Green	On	Off	<ul style="list-style-type: none"> No power to storage subsystem Cables are loose or the switches are off Power supply has failed, is missing, or is not fully seated Overtemperature condition
Fault	Amber	Off	On	Controller failure; controller fault condition
Heartbeat	Green	Blinking	Not blinking	No controller activity
Status (eight lights including Heartbeat)	Green	Various patterns depending on the condition ²	Various patterns depending on the condition ^{2,3}	If the second, third, sixth, and seventh lights are on or if all eight lights are on, there is a memory fault indicating that the controller CRU has failed.

Table 19. RAID controller indicator lights.

Indicator light	Color	Normal operation	Problem indicator	Possible conditions indicated by the problem indicator ¹
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¹ Always use the storage-management software to identify the failure.

² There are eight status lights (the Heartbeat and seven others) that glow in various patterns, depending on the controller status.

³ If the controller is off line, the indicator will lite. This does not indicate failure.

Battery indicator lights

The battery has four indicator lights as shown in the following figure.

Note: To view the battery indicator lights, remove the FASTT700 Storage Server bezel.

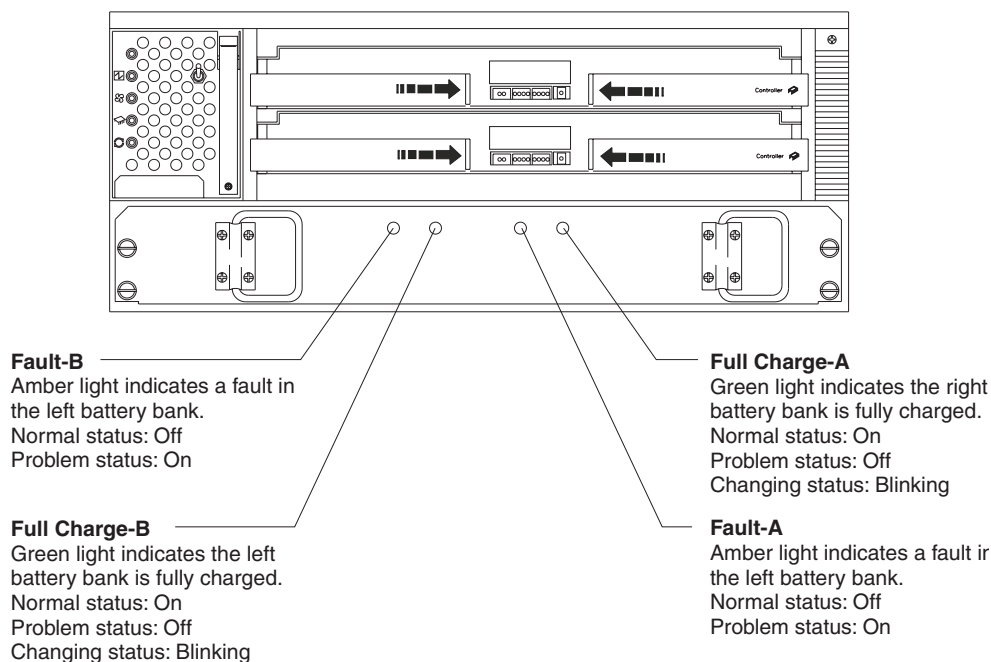


Table 20 describes the battery indicator lights.

Table 20. Battery indicator lights.

Indicator light	Color	Normal operation	Problem indicator	Possible conditions indicated by the problem indicator ¹
Fault-A or Fault-B	Amber	Off	On	<ul style="list-style-type: none"> Left or right battery bank has failed Battery is either discharged or defective
Full Charge-A or Full Charge-B	Green	On ²	Off	<ul style="list-style-type: none"> Left or right battery bank is not fully charged Power has been off for an extended period and has drained battery power Batteries are weak

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

² If either Full Charge-A or Full Charge-B indicator light is blinking, the battery is in the process of charging.

Fan and communications module indicator light

The fan and communications module has one indicator light as shown in the following figure.

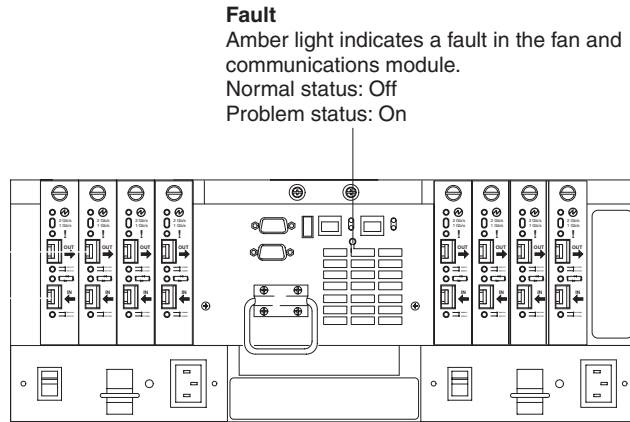


Table 21 describes the fan and communications module indicator light.

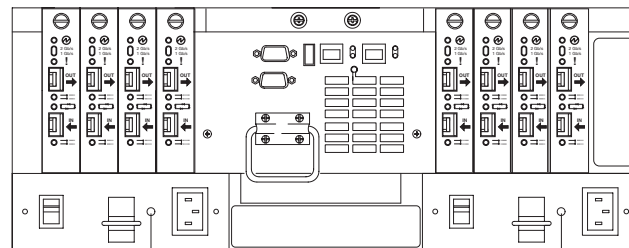
Table 21. Fan and communications module indicator light.

Indicator light	Color	Normal operation	Problem indicator	Possible conditions indicated by the problem indicator ¹
Fan and communication fault	Amber	Off	On	<ul style="list-style-type: none"> Fan and communications module has failed or is installed incorrectly Overtemperature condition

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

Power supply indicator light

The power supply has one indicator light as shown in the following figure.



Power supply
Green light indicates that the power supply is operating properly.
Normal status: On
Problem status: Off

Power supply
Green light indicates that the power supply is operating properly.
Normal status: On
Problem status: Off

Table 22 on page 140 describes the power supply indicator light.

Table 22. Power supply indicator light.

Indicator light	Color	Normal operation	Problem indicator	Possible conditions indicated by the problem indicator ¹
Power supply	Green	On	Off	<ul style="list-style-type: none"> No power to FAStT700 Storage Server No power to storage subsystem Power supply has failed or is turned off Overtemperature condition

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

Mini hub indicator lights

There are five host-side mini hub indicator lights and five drive-side mini hub indicator lights. The following figure shows the host-side indicator lights. The drive side indicator lights are the same; however, the possible conditions indicated by the problem indicators (described in Table 24 on page 141 and Table 25 on page 142) might be different.

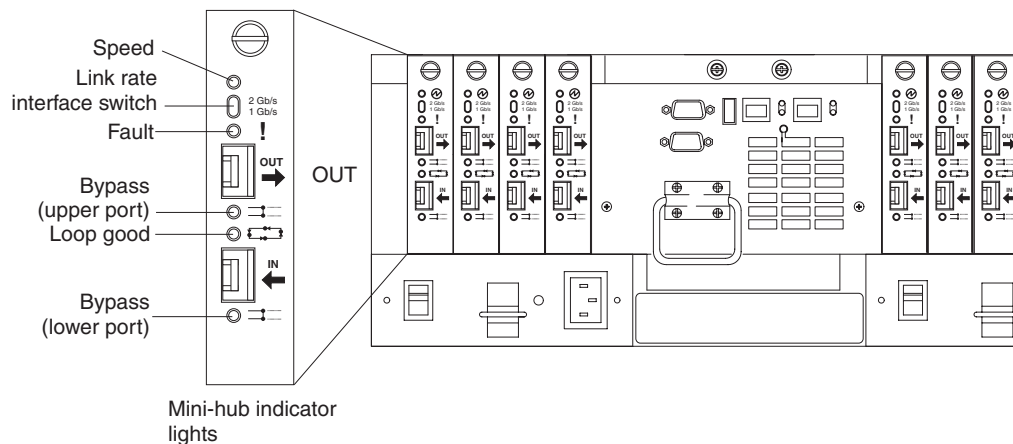


Table 23 describes indicator light status when there are no Fibre Channel connections between host-side and drive-side mini hubs to devices.

Table 23. Indicator light status.

Loop indicator light state	Host-side mini hub	Drive-side mini hub
If no SFP module is installed	Indicator light is off	Indicator light is on
If one SFP module is installed in the In or Out port	Indicator light is off	Indicator light is on
If you have two SFP modules installed	Indicator light is on	Indicator light is on

Bypass indicator light	Host-side mini hub	Drive-side mini hub
If one SFP module is installed in the In or Out port	Indicator light is off. Refer to the bypass indicator light where the SFP module is installed.	Indicator light is on. Refer to the bypass indicator light where the SFP module is installed.

Bypass indicator light	Host-side mini hub	Drive-side mini hub
If you have two SFP modules installed	Indicator light is on	Indicator light is on

Table 24 describes the host-side mini hub indicator lights.

Table 24. Host-side mini hub indicator lights.







Icon	Indicator light	Color	Normal operation	Problem indicator	Possible condition indicated by the problem indicator
	Speed	Green	On for 2 Gb Off for 1 Gb		Light on indicates data transfer rate of 2 Gb per second. Light off indicates data transfer rate of 1 Gb per second.
!	Fault	Amber	Off	On	Mini hub or SFP module has failed Note: If a host-side mini hub is not connected to a controller, this fault light is always on.
	Bypass (upper port)	Amber	Off	On	<ul style="list-style-type: none"> Upper mini hub port is bypassed Mini hub or SFP module has failed, is loose, or is missing Fiber-optic cables are damaged Note: If the port is unoccupied, the light is on.
	Loop good	Green	On	Off	<ul style="list-style-type: none"> The loop is not operational Mini hub has failed or a faulty device is connected to the mini hub Controller has failed Note: If a host-side mini hub is not connected to a controller, this fault light is always on.
	Bypass (lower port)	Amber	Off	On	<ul style="list-style-type: none"> Upper mini hub port is bypassed Mini hub or SFP module has failed, is loose, or is missing Fiber-optic cables are damaged Note: If the port is unoccupied, the light is on.

Table 25 on page 142 describes the drive-side mini hub indicator lights.

Table 25. Drive-side mini hub indicator lights.

Icon	Indicator light	Color	Normal operation	Problem indicator	Possible condition indicated by the problem indicator
	Speed	Green	On for 2 Gb Off for 1 Gb		Light on indicates data transfer rate of 2 Gb per second. Light off indicates data transfer rate of 1 Gb per second.
!	Fault	Amber	Off	On	Mini hub or SFP module has failed Note: If a drive-side mini hub is not connected to a controller, this fault light is always on.
	Bypass (upper port)	Amber	Off	On	<ul style="list-style-type: none"> Upper mini hub port is bypassed Mini hub or SFP module has failed, is loose, or is missing Fiber-optic cables are damaged Note: If the port is unoccupied, the light is on.
	Loop good	Green	On	Off	<ul style="list-style-type: none"> The loop is not operational Mini hub has failed or a faulty device is connected to the mini hub Drive has failed Note: If a drive-side mini hub is not connected to a controller, the green light is always off and the fault light is always on.
	Bypass (lower port)	Amber	Off	On	<ul style="list-style-type: none"> Lower mini hub port is bypassed Mini hub or SFP module has failed, is loose, or is missing Fiber-optic cables are damaged Note: If the port is unoccupied, the light is on.

Features

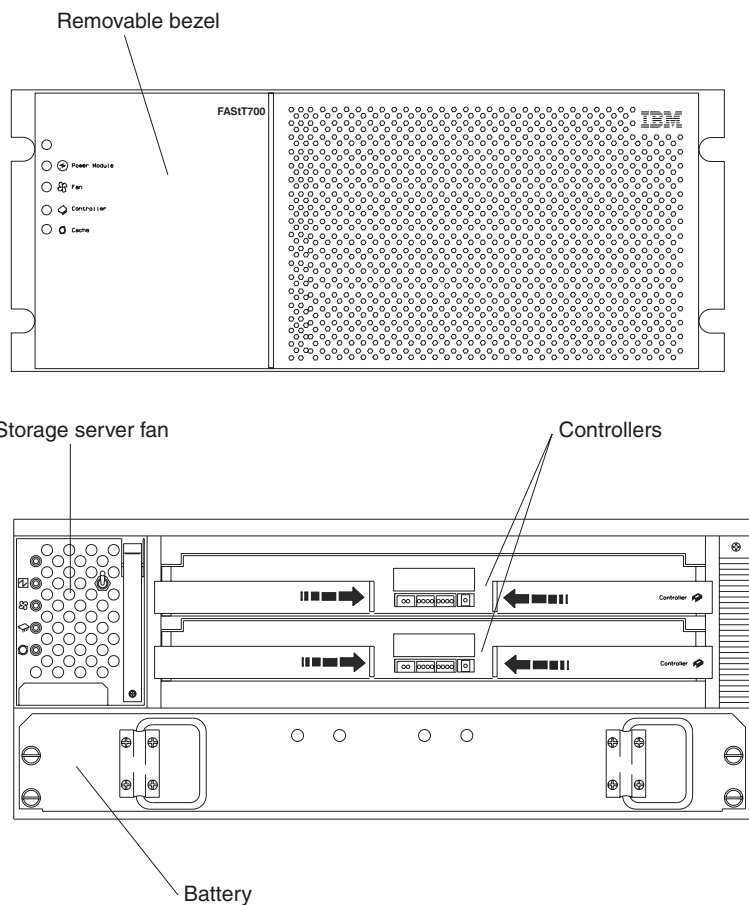
The FAStT700 Storage Server has the following removable components, called customer replaceable units (CRUs). All CRUs are accessible from the front or back of the FAStT700 Storage Server.

- Bezel (front cover)
- RAID controller (comes with two)
- Battery
- Storage server fan

- Power supply (comes with two)
- Host mini hub (comes with two, four maximum)
- Drive mini hub (comes with two, four maximum)
- Fan and communications module
- Small Form-Factor Pluggable (SFP) module (must be purchased separately)

The following figure shows the FAStT700 Storage Server front bezel. The bezel is a removable front cover with holes for viewing status lights and for boosting air circulation. The following figure also shows the IBM FAStT700 Storage Server without the front bezel, exposing the following components:

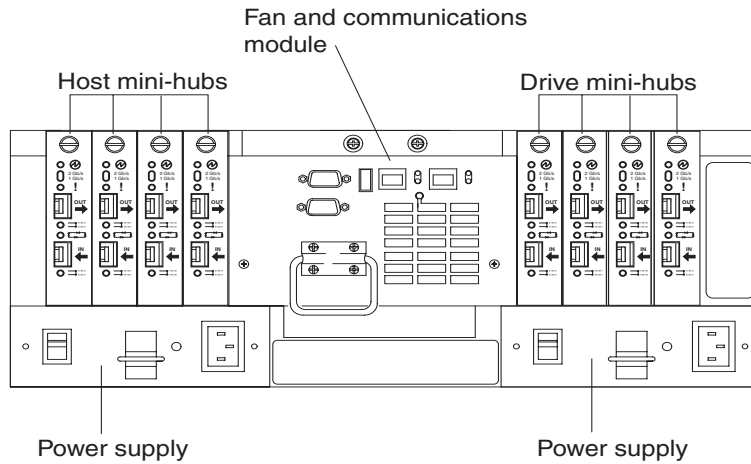
- **Storage server fan** - A removable unit that contains two cooling fans and indicator lights.
- **Battery** - A removable unit that contains the controllers cache battery, battery charger circuitry, and status indicator lights.
- **Controllers** - Two removable units, each contains one RAID controller and status indicator lights.



The following figure shows the FAStT700 Storage Server back view and the following components:

- Host-side and drive-side mini hubs - Up to eight removable mini hubs with indicator lights to which you can connect SFP modules and fiber-optic host and drive interface cables to the FAStT Storage Server (the standard FAStT700 configuration includes four mini hubs).

- **Power supplies** - Two removable units that contain two power supplies with status indicator lights.
- **Fan and communications module** - A removable unit that contains the power supply cooling fans with status indicator lights and Ethernet ports.

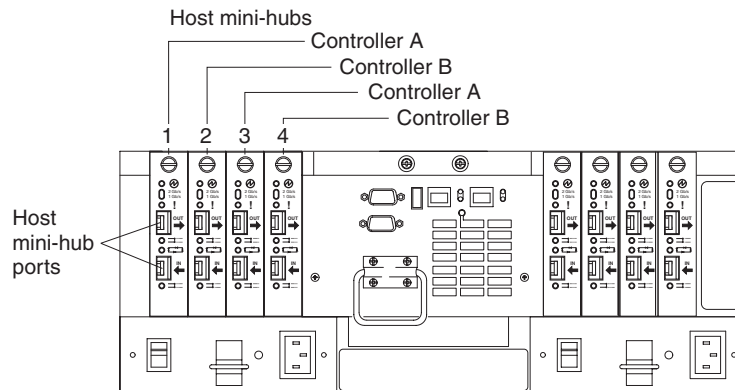


Interface ports

The FAST700 Storage Server has the following interface ports:

- Host
- Drive
- Ethernet

The following figure shows the host and drive mini hub ports.



For more information about connecting the FAST700 Storage Server and drive enclosures (also referred to as expansion units) using the host and drive interface ports, refer to the *IBM FAST700 Fibre Channel Storage Server Installation Guide*.

Host mini hubs

When fully configured, the FAST700 Storage Server can accommodate four host-side mini hubs, two per controller (as shown in the above figure). mini hubs 1 and 3 correspond to the top controller (Controller A) and mini hubs 2 and 4 correspond to the bottom controller (Controller B). Each pair of mini hubs accommodate one host

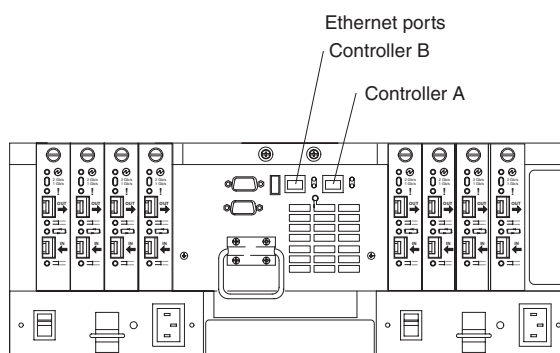
channel. Each mini hub provides host loop connectivity and self-diagnostic features. To ensure redundancy, you must connect each host to a Controller A and Controller B mini hub.

Drive mini hubs

When fully configured, the FASStT700 Storage Server can accommodate four drive channels. Each channel accommodates one drive side mini hub. All mini hubs on the drive side attach to both Controller A and Controller B.

Ethernet interface ports

There are two Ethernet interface ports, one for each controller (Controller A and Controller B). Use the Ethernet ports to directly manage storage subsystems. The following figure shows the location of the interface ports.



Preparing for installation

Use the following procedure to prepare the FASStT700 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 205.
2. Move the FASStT700 Storage Server and its rack cabinet to the site.
3. Remove the FASStT700 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 you will need for installation. These might include:
 - Power cords (comes with the FASStT700 Storage Server)
 - Number two Phillips and medium flat-blade screwdrivers
 - Antistatic protection (such as a grounding wrist strap)
 - Fibre Channel (FC) and Ethernet interface cables and cable straps
 - Rack-mounting hardware (comes with the FASStT700 Storage Server)
 - IBM FASSt Storage Manager software to configure the storage subsystems (comes with the FASStT700 Storage Server)

Handling static-sensitive devices

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

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

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

Installation procedures

This section provides information on installing the FASSt700 Storage Server. It also provides brief descriptions of the components that connect the FASSt700 Storage Server to the host bus adapters in the host computers and Fibre Channel drive enclosures, as well as instructions for installing fiber-optic cables.

Installing the FASSt700 Storage Server in a rack cabinet

The FASSt700 Storage Server comes with a rack-mounting hardware kit for installation into a rack cabinet. It is easier to lift the FASSt700 Storage Server and install it in a rack cabinet if you remove all CRUs first. A fully loaded FASSt700 Storage Server with a storage server fan, battery, fan and communications module, two RAID controllers, two power supplies, and eight mini hubs installed weighs 43.99 kg (97 lbs). If you remove all the CRUs, you reduce the overall weight.

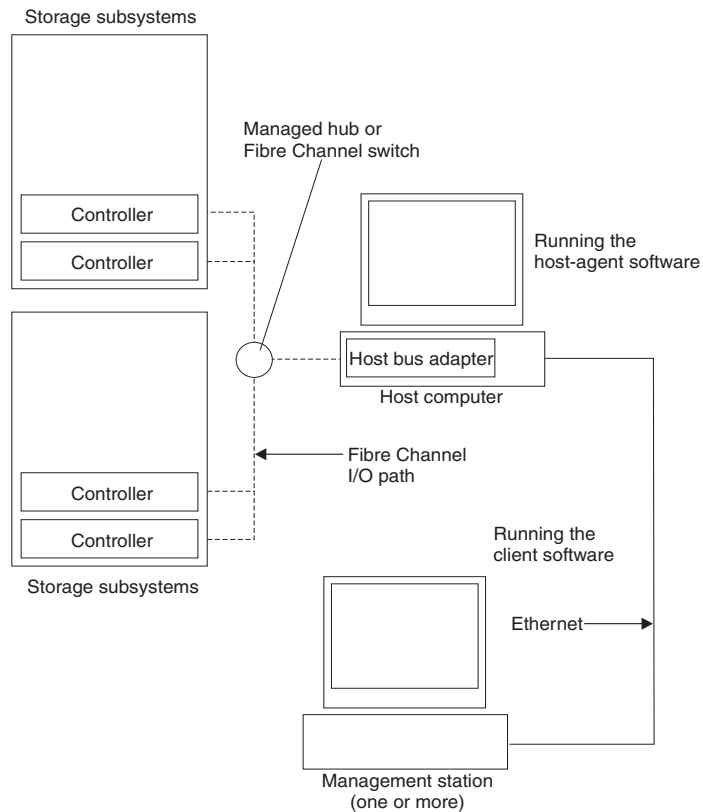
For detailed instructions about removing the CRUs and installing the FASSt700 Storage Server in a rack cabinet, refer to the *Rack Mounting Template* and *Rack Mounting Instructions* that come with the FASSt700 Storage Server. Before you begin, read "Preparing for installation" on page 145.

Installing additional hardware

You might need to install additional hardware, based on the method of storage subsystem management. Use the information in the following sections to determine the additional hardware that you need.

Installing hardware for host-agent (in-band) management

If you are using the host-agent (in-band) management method, which uses host-agent software installed on the host computer, install at least one management station and host computer. Attach the Ethernet cables from the host computer to the management station. The following figure shows host-agent (in-band) managed storage subsystems.

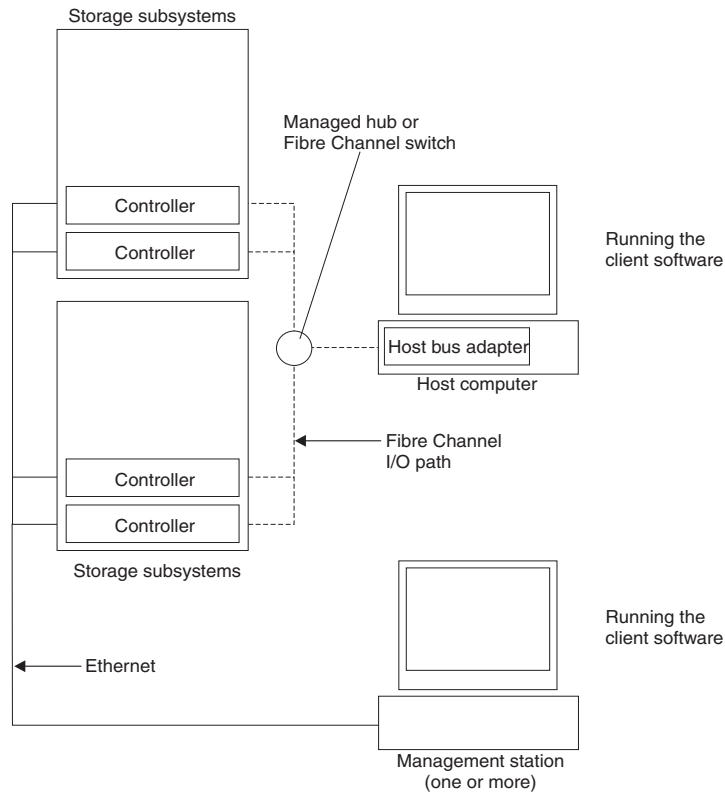


You will connect fiber-optic cables to each controller later in the installation process.

After you install the hardware, if your Fibre Channel network environment is configured for cluster servers, go to “Installing hardware for cluster servers” on page 148. Otherwise, go to “Installing drive enclosures in a rack cabinet” on page 150.

Installing hardware for direct (out-of-band) management

If you are using the direct (out-of-band) management method, which uses Ethernet connections from a management station to each controller, install at least one management station and attach Ethernet cables to each management station and two Ethernet cables per FAStT700 Storage Server. The following figure shows direct (out-of-band) managed storage subsystems.



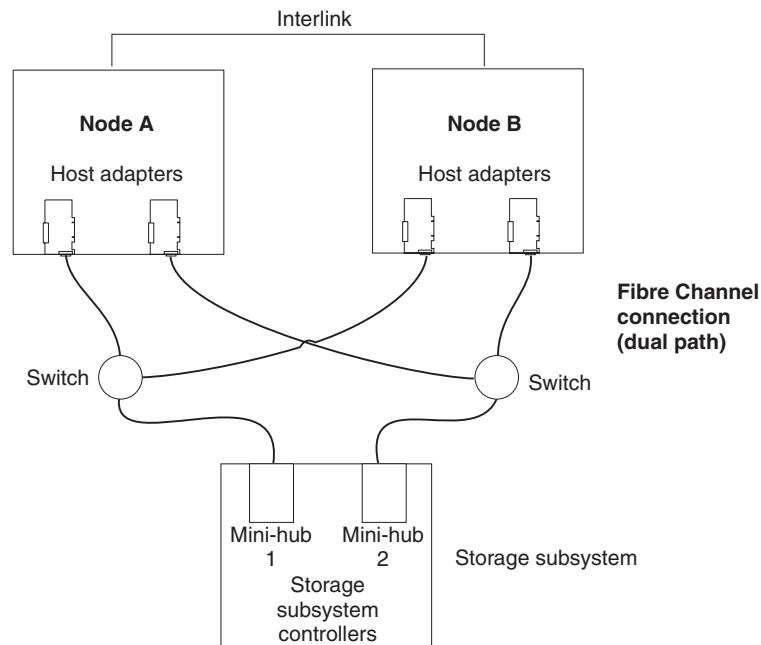
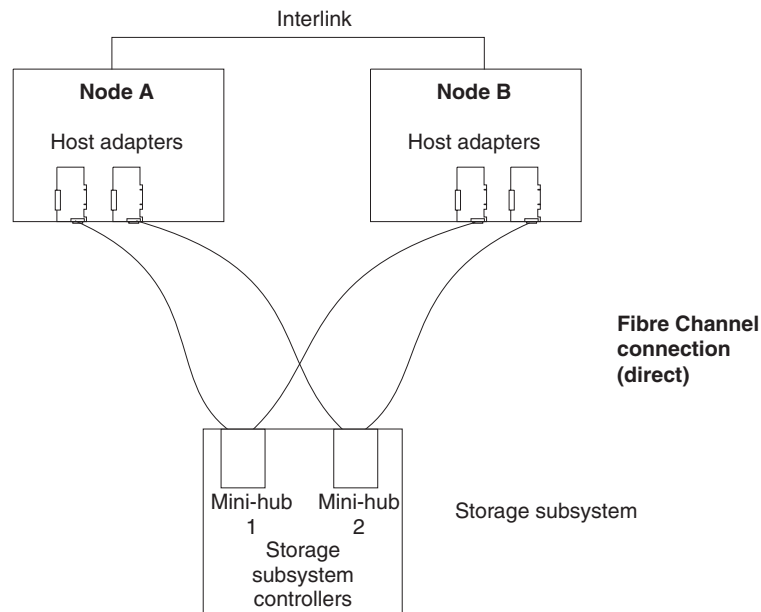
You will connect fiber-optic and Ethernet cables to each controller later in the installation process.

After you install the hardware, if your Fibre Channel network environment is configured for cluster servers, go to "Installing hardware for cluster servers". Otherwise, go to "Installing drive enclosures in a rack cabinet" on page 150.

Installing hardware for cluster servers

If the Fibre Channel network environment into which you are installing the storage subsystem is configured for cluster servers, you must install two host bus adapters per cluster node. The following figure shows Fibre Channel connections using a dual-path configuration for fully redundant environments.

Note: The interlink is used as the clustering heartbeat path.



Before you install the host adapters, note the following about the cluster server Fibre Channel network environment:

- When using a dual-path configuration, each node has two paths to the storage server providing greater redundancy protection if a connection problem occurs. Install two single-channel host adapters in each node.
- Use the correct host adapter device driver. Refer to the FAST Storage Manager Installation Guide that is appropriate for your operating system and refer to the README file for information on supported host adapters and device drivers. This information is found on the *IBM FAST Storage Manager* installation CD or at <http://www.ibm.com/pc/support/>.

Make sure each host adapter and controller has a unique Fibre Channel ID.

Refer to the documentation provided with your host adapters for installation requirements and procedures.

Installing drive enclosures in a rack cabinet

Install the drive enclosures that you are attaching to the FAStT700 Storage Server in a rack cabinet. Preparing the drive enclosures for installation in a rack cabinet might involve any or all of the following tasks:

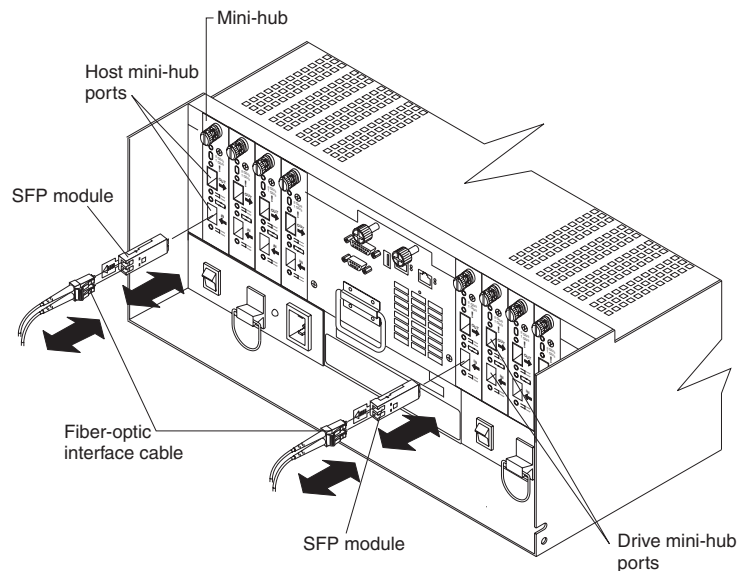
- Moving the drive enclosures to the installation site
- Unpacking the drive enclosures from their shipping cartons
- Checking the shipping contents
- Removing all customer replaceable units (CRUs)

For detailed instructions on installing the drive enclosures in a rack cabinet, refer to the documentation that comes with each device.

FAStT700 Storage Server mini hub interface connections

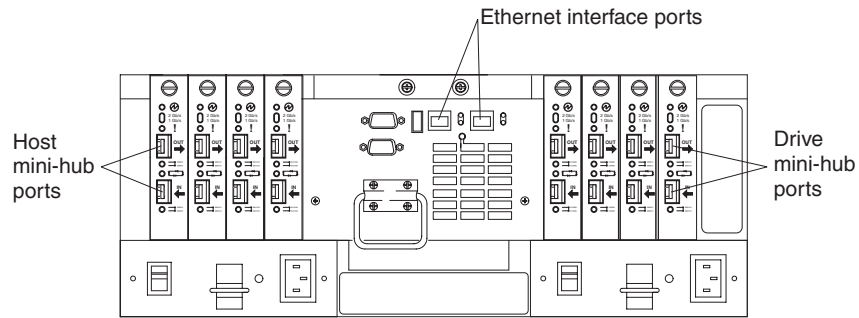
The interfaces that connect the host computers and drive enclosures to the storage server are called mini hubs. When fully configured, the back of the FAStT700 Storage Server can accommodate four host mini hubs and four drive mini hubs. Each mini hub is a removable unit. A mini hub provides the Fibre Channel interface between a controller and a host and a drive. Each mini hub has two ports. A Small Form-Factor Pluggable (SFP) module connects into each mini hub port; then, a fiber-optic cable connects into the SFP module. The following figure shows the mini hub interface connections.

Note: The illustrations in this document might differ slightly from your hardware.



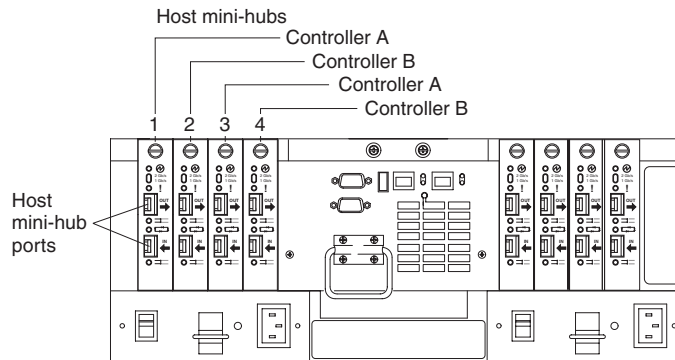
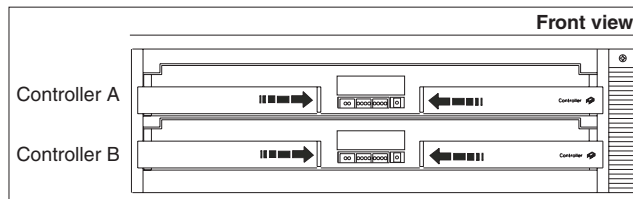
FAStT700 Storage Server interface ports

The SFP mini hub ports are used for data transfer between hosts or drive enclosures and RAID controllers in the FAStT700 Storage Server. Ethernet ports are available for storage subsystem-management. The FAStT700 Storage Server interface ports are shown in the following figure.



Host interface ports

The FAST700 Storage Server ships with host-side mini hubs 1 and 2 installed. Host mini hubs connect to the controller in pairs. mini hubs 1 and 3 connect to the top controller (Controller A) and mini hubs 2 and 4 connect to the bottom controller (Controller B), as shown in the following figure. To ensure redundancy, you must connect each host to both controllers through the appropriate mini hub.

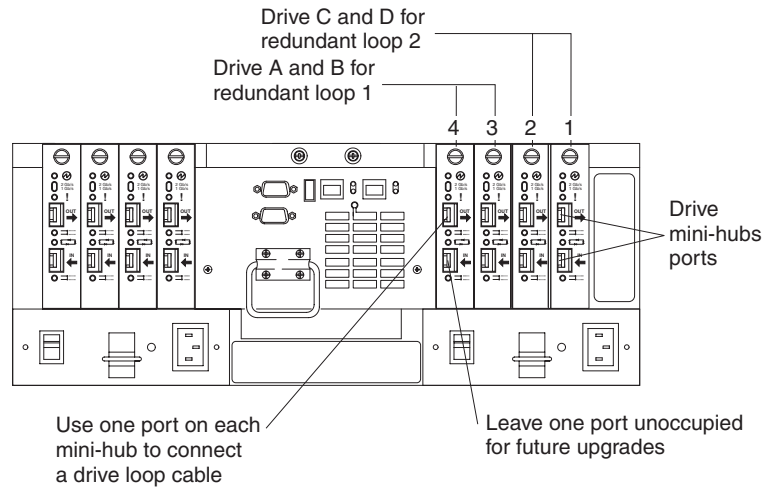


Drive interface ports

The FAST700 Storage Server ships with host-side mini hubs 1 and 2 installed. Each drive mini hub connects to Controller A and Controller B and represents a single drive loop. The drive loops are set up in pairs to support redundant drive loop configurations (two data paths per drive enclosure). Each pair supports up to 11 drive enclosures, containing 10 drives each, or a maximum of 110 drives. A fully configured FAST700 Storage Server supports a maximum of 22 drive enclosures (11 drive enclosures per drive-loop pair), or 220 drives (Machine type 3560).

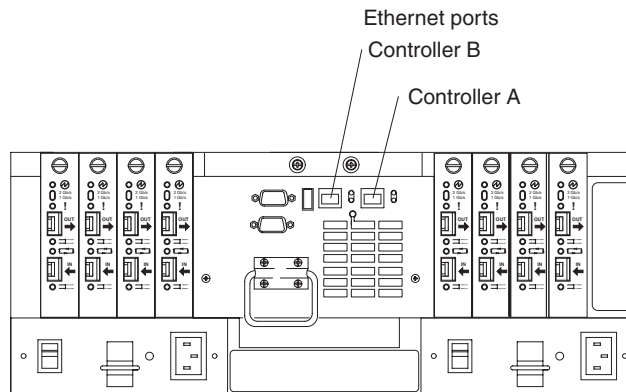
Important: These large configurations are for capacity purposes and might not provide the best performance. FAST700 Storage Servers use only redundant drive-loop configurations.

Fibre Channel cables connect to either the upper or lower port on each mini hub through SFP modules. The remaining port on each mini hub should remain unoccupied for future upgrades, as shown in the following figure.



Ethernet interface ports

There are two Ethernet interface ports, one for each controller (Controller A and Controller B). Use the Ethernet ports to directly manage storage subsystems. The following figure shows the location of these ports.



Installing SFP modules

The FASSt700 Storage Server mini hubs require Small Form-Factor Pluggable (SFP) Modules. SFP modules are used to convert electrical signals to optical signals that are required for Fibre Channel transmission to and from RAID controllers. After you install the SFP modules, you will use fiber-optic cables to connect the FASSt700 Storage Server to other Fibre Channel devices.

Before installing SFP modules and fiber-optic cables, read the following information:

- The SFP module housing has an integral guide key designed to prevent you from inserting the SFP module improperly.
- Use minimal pressure when inserting the SFP module into a mini hub port. Forcing the SFP module into a port could cause damage to the SFP module or the port.
- You can insert or remove the SFP module while the port is powered on.

- The operational loop performance is not affected when you install or remove an SFP module.
- You must insert the SFP module into a mini hub port before you connect the fiber-optic cable.
- You must remove the fiber-optic cable from the SFP module before you remove the SFP module from the mini hub. Refer to “Removing SFP modules” on page 154 for more information.

To install an SFP module, complete the following steps.

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.



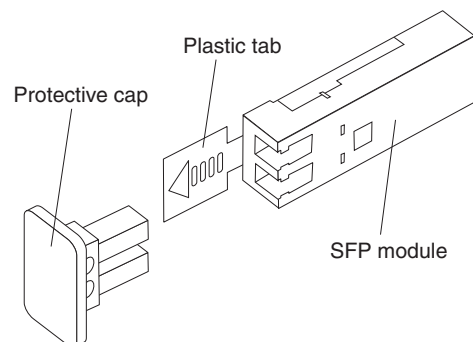
DANGER

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

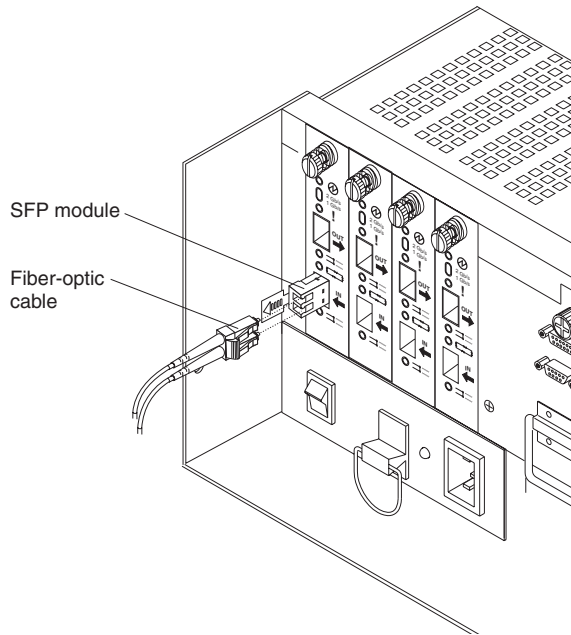
Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 145.

1. Remove the SFP module from its static-protective package.
2. Remove the protective cap from the SFP module, as shown in the following figure. Save the protective cap for future use.



3. Remove the protective cap from the mini hub port. Save the protective cap for future use.
4. Insert the SFP module into the mini hub port until it clicks into place.



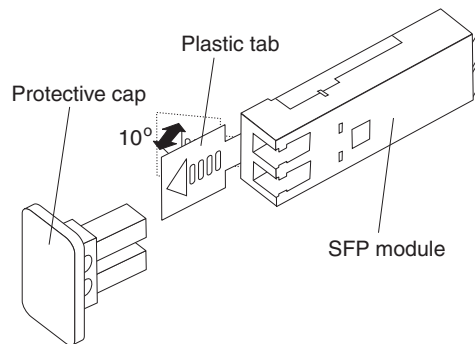
5. Connect an LC-LC Fibre Channel cable. For information about the LC-LC cable, see "Using LC-LC Fibre Channel cables" on page 155.

Removing SFP modules

To remove the SFP module from the mini hub, do the following:

Attention: To avoid damage to the cable or SFP module, make sure you unplug the LC-LC Fibre Channel cable *before* you remove the SFP module.

1. Remove the LC-LC Fibre Channel cable from the SFP module. For more information, see "Handling fiber-optic cables" on page 155 and "Using LC-LC Fibre Channel cables" on page 155.
2. Unlock the SFP module latch by pulling the plastic tab outward 10°, as shown in the following figure.



3. With the SFP latch in the unlocked position, slide the SFP module out of the mini hub port.
4. Replace the protective cap on the SFP module.

5. Place the SFP module into a static-protective package.
6. Replace the protective cap on the mini hub port.

Handling fiber-optic cables

Before using fiber-optic cables, read the following precautions.

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

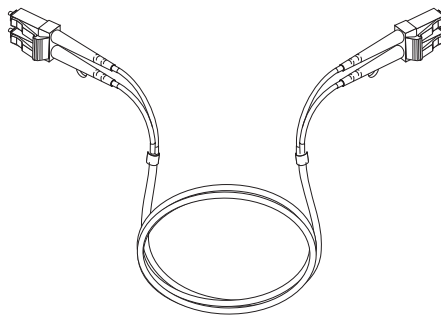
Using LC-LC Fibre Channel cables

The LC-LC Fibre Channel cable is a fiber-optic cable that is used to connect into one of the following devices:

- SFP module installed in a FAStT700 Storage Server mini hub
- SFP module installed in an IBM Fibre Channel switch
- Optical interface connector on an IBM FAStT FC-2 Host Bus Adapter (Part number 19K1246)

For more information about connecting to these devices, see the documentation that comes with the device.

The following figure shows an LC-LC Fibre Channel cable.



The following sections provide the procedures for properly connecting and removing an LC-LC Fibre Channel cable.

Note: If you are connecting a FAStT700 Storage Server to a FAStT EXP500 expansion unit or to an IBM FAStT host adapter, you must also use an LC-SC Fibre Channel cable adapter. For more information about using the Fibre Channel cable adapter, see “Using LC-SC Fibre Channel cable adapters” on page 158.

Connecting an LC-LC cable to an SFP module

To connect an LC-LC Fibre Channel cable to an SFP module, complete the following steps.

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.

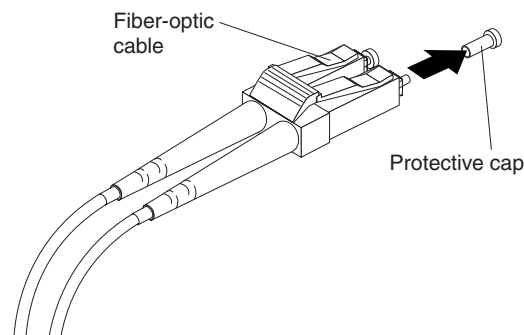


DANGER

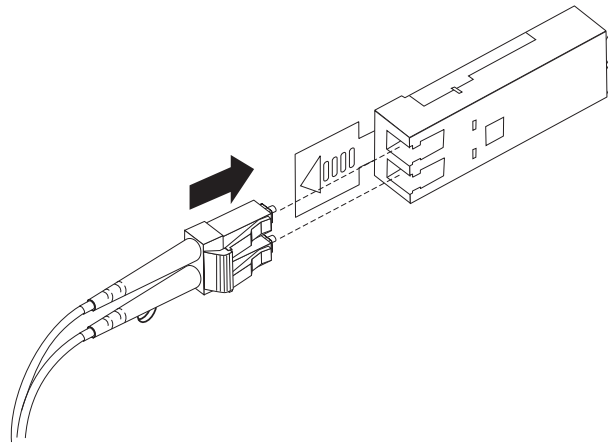
Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

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

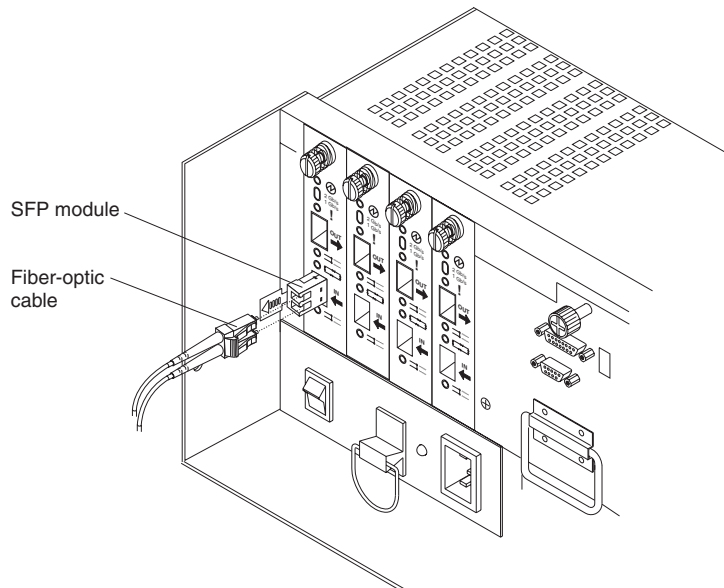
1. Read the information in “Handling fiber-optic cables” on page 155.
2. If necessary, remove the protective cap from the SFP module. Save the protective cap for future use.
3. Remove the two protective caps from one end of the LC-LC cable, as shown in the following figure. Save the protective caps for future use.



4. Carefully insert that same end of the LC-LC cable into an SFP module that is installed in a FAST700 Storage Server mini hub. The cable connector is keyed to ensure it is inserted into the SFP module correctly. Holding the connector, push in the cable until it clicks into place.



The following figure shows an LC-LC Fibre Channel cable connecting into an SFP module that is installed in a FAST700 Storage Server mini hub.



5. Remove the two protective caps from the other end of the LC-LC cable. Save the protective caps for future use.
6. Connect the LC-LC Fibre Channel cable to one of the following devices:
 - SFP module that is installed in an IBM Fibre Channel switch
 - Optical interface connector on an IBM FAStT FC-2 Host Bus Adapter (Part Number 19K1246)
 - LC-SC Fibre Channel cable adapter (For information about using an LC-SC cable adapter, see “Using LC-SC Fibre Channel cable adapters” on page 158.)

For more information about connecting to these devices, see the documentation that comes with the device.

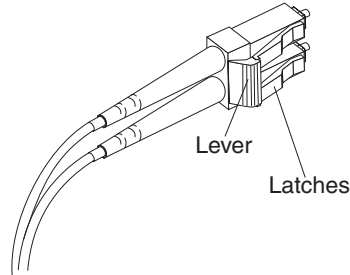
Removing an LC-LC Fibre Channel cable

To remove an LC-LC Fibre Channel cable, do the following:

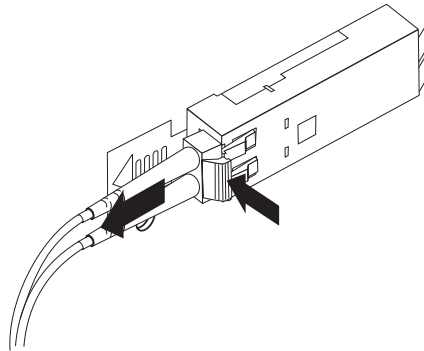
Attention: To avoid damaging the LC-LC cable or SFP module, make sure you press and hold the lever to release the latches before you remove the cable from the SFP

module. Ensure that the levers are in the released position when removing the cable. When removing the cable from the SFP module, make sure you do not grasp the SFP module plastic tab.

1. On the end of the LC-LC cable that connects into the SFP module or host bus adapter, press down and hold the lever to release the latches, as shown in the following figure.



Carefully pull on the connector to remove the cable from the SFP module, as shown below.



2. Replace the protective caps on the cable ends.
3. Replace the protective cap on the SFP module.

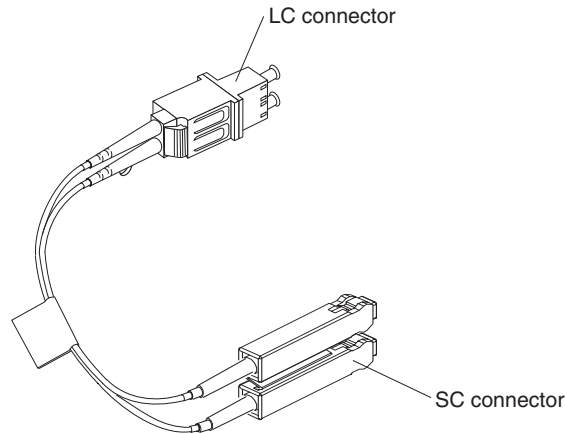
Using LC-SC Fibre Channel cable adapters

The LC-SC Fibre Channel Cable Adapter is a fiber-optic cable that is used to connect the LC connector into one of the following devices that require SC connectors:

- FAStT host adapter (Part number 00N6881)
- FAStT EXP500 expansion unit (Machine type 3560)
- 1 Gb Fibre Channel switch (Machine type 2109)
- Managed hub (Machine type 3534)

For more information about connecting to these devices, see the documentation that comes with the device.

The following figure shows an LC-SC Fibre Channel cable.



The following sections provide the procedures for properly connecting and removing an LC-SC Fibre Channel cable.

Connecting an LC-SC cable to a device

To connect an LC-SC cable to a device, complete the following steps.

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.

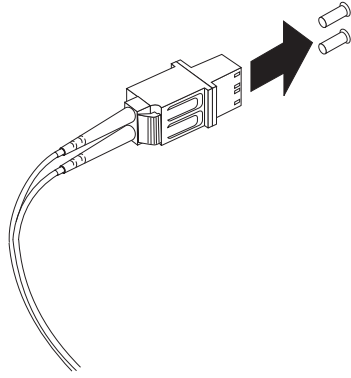


DANGER

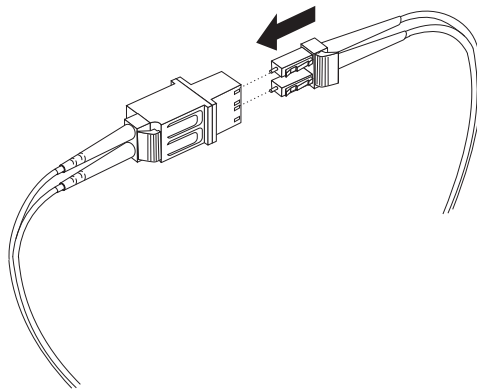
Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

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

1. Read the information in “Handling fiber-optic cables” on page 155.
2. Connect an LC-LC cable to an SFP module in the FAStT700 Storage Server mini hub. For instructions, see “Connecting an LC-LC cable to an SFP module” on page 156.
3. Remove the two protective caps from the LC connector end of the LC-SC cable, as shown in the following figure. Save the protective caps for future use.



4. Carefully insert the LC connector end of the cable into the LC connector end of the LC-SC cable adapter. Push in the connector until it clicks into place.



5. Connect the SC connector end of the LC-SC cable to one of the following devices:
 - Optical interface connector on an IBM FAStT FC-2 Host Bus Adapter (Part number 19K1246)
 - GBIC installed in a FAStT EXP500 expansion unit (Machine type 3560)
 - 1 Gb Fibre Channel switch (Machine type 2109)

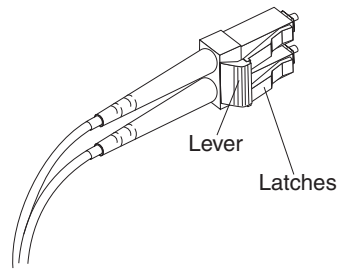
Note: Because the FAStT FC-2 Host Bus Adapter is shipped with an LC converter, a FAStT Host Adapter (00N6881) and Netfinity® Fibre Channel Adapter are needed (01K7297) to make the SC connection. For more information about connecting to these devices, see the documentation that comes with the device.

Removing an LC-LC cable from an LC-SC cable adapter

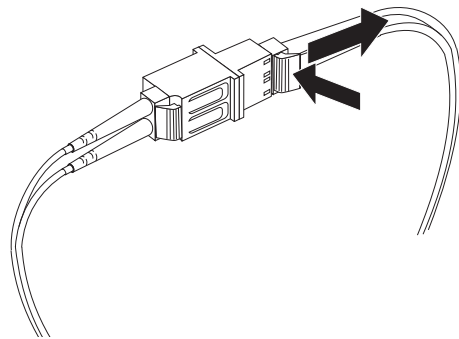
To remove an LC-LC cable from an LC-SC cable adapter, do the following:

Attention: To avoid damaging the LC-LC cable, make sure you press and hold the lever to release the latches before you remove the cable from an LC-SC cable adapter. Ensure that both levers are in the released position when removing the cable. When removing the cable from the SFP module, make sure you do not grasp the SFP module plastic tab.

1. On the end of the cable that connects into the LC connector end of the LC-SC cable adapter, press down and hold the lever to release the latches. The following figure shows the location of the lever and latches.



2. Carefully pull on the connector to remove it. Make sure you grasp the connector and not the cable when removing the LC-LC cable from the LC-SC cable adapter.



3. Replace the protective caps on the cable ends.

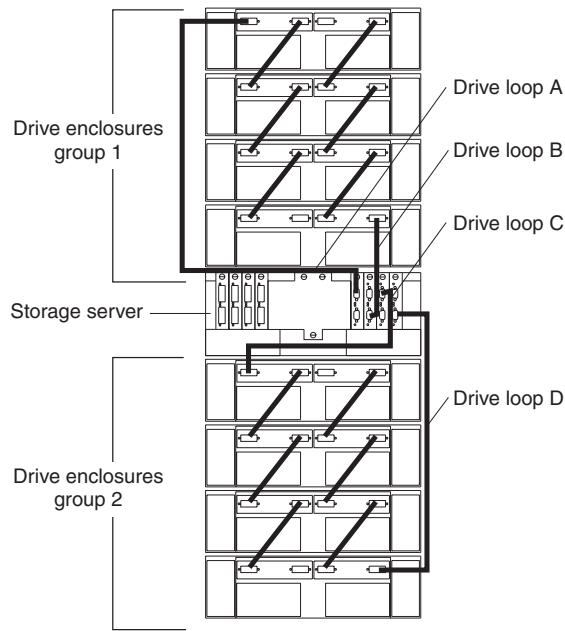
FAStT700 Storage Server and drive enclosure cabling overview

The FAStT700 Storage Server supports two redundant drive loops. A redundant drive loop consists of one or more drive enclosures connected to a controller using two sets of Fibre Channel cables. If one data path fails, the controller uses the other data path to maintain the connection to the drive group.

The figure below shows a storage subsystem containing one storage server and two redundant drive loops with four drive enclosures each. Each drive enclosures group uses redundant drive loops to connect to the FAStT700 Storage Server. Loop A and loop B make up one redundant pair of drive loops. Loop C and loop D make up a second redundant pair.

Attention: To prevent loss of drive enclosure redundancy, connect the drive enclosures as shown in the following figure.

Note: The illustrations in this document might differ slightly from your hardware.



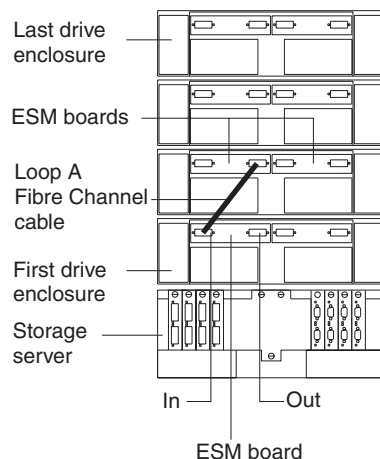
Configuring the drive loops

The procedure and illustrations in this section show an example of how to connect one drive enclosure group of four drive enclosures into a redundant drive loop. Instructions for how to connect a second redundant drive enclosure group of four drive enclosures into a redundant drive loop are also included in this procedure.

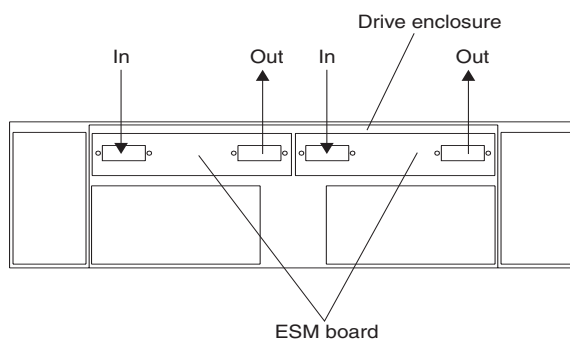
To complete this procedure, you will need two fiber-optic cables per drive enclosure. Handle and install fiber-optic cables properly to avoid degraded performance or loss of communications with devices. Do not overtighten the cable straps or bend the cables to a radius less than 38 mm (1.5 in.).

1. Connect the first two drive enclosures to drive loop A, as shown in the following figure.

Starting with the first drive enclosure, connect a fiber-optic cable from the In port on the left environmental services monitor (ESM) board to the Out port on the left ESM board in the second (next) drive enclosure.

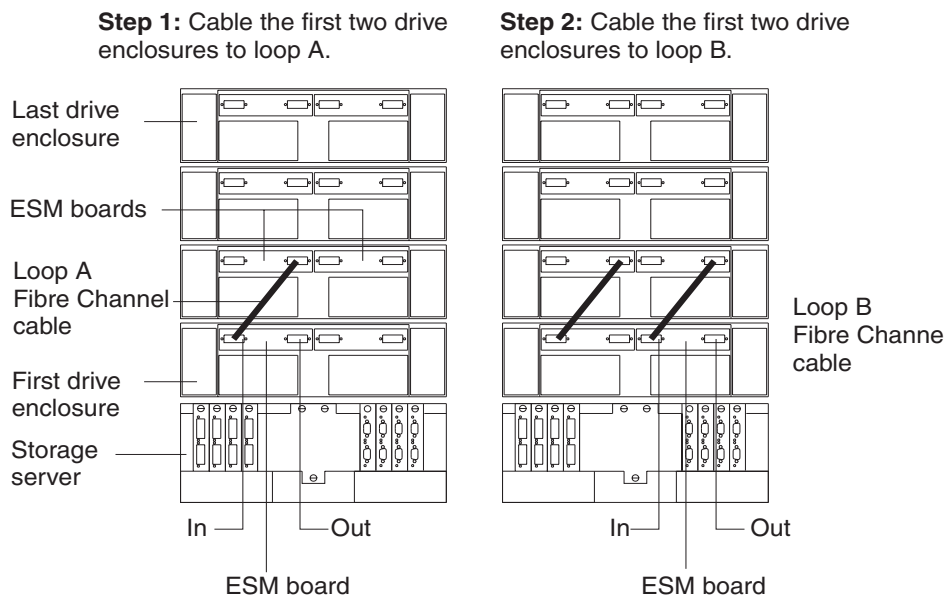


For the location of the ports on the drive enclosure ESM board, see the following figure.



2. Connect the same first two drive enclosures to drive loop B, as shown in the following figure.

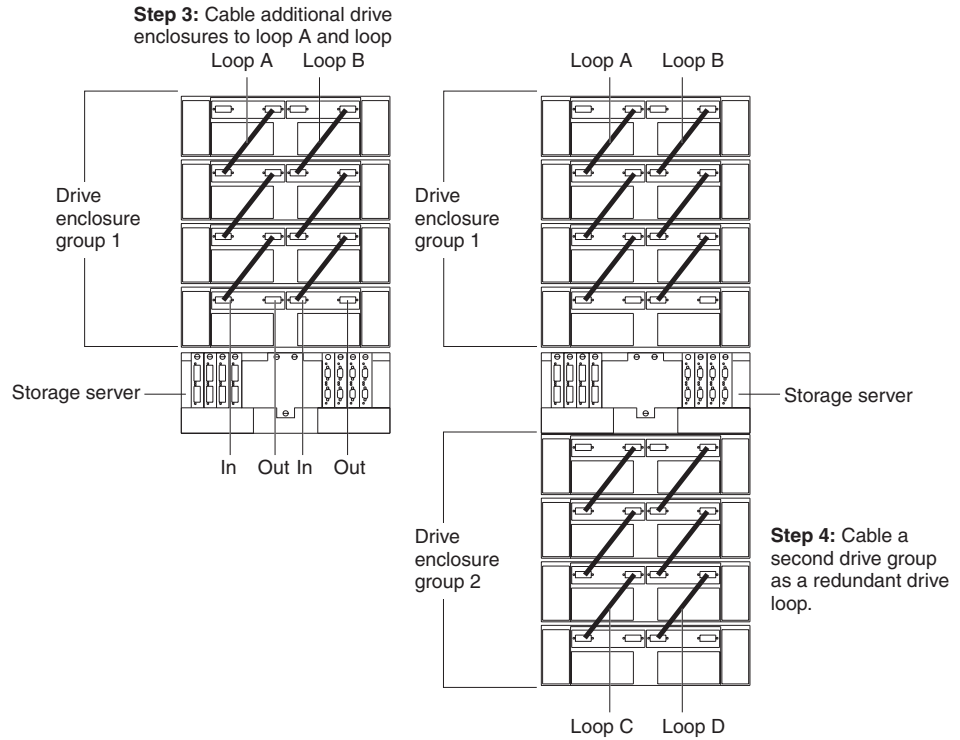
Starting with the first drive enclosure, connect a fiber-optic cable from the In port on the right ESM board to the Out port on the right ESM board in the second (next) drive enclosure.



If you want to connect more drive enclosures into drive loops A and B, continue with Step 3; otherwise, go to “Connecting a redundant drive loop to the FAStT700 Storage Server” on page 165.

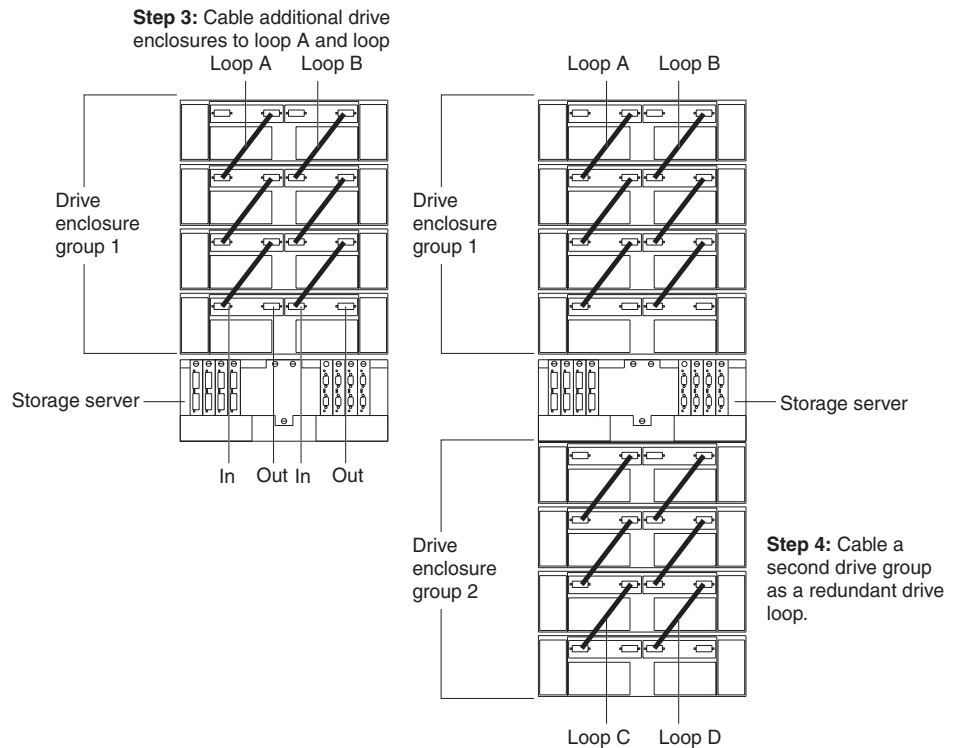
3. Connect additional drive enclosures to drive loops A and B, as shown below.

Starting with the second drive enclosure, connect each additional drive enclosure into drive loops A and B in the same manner. Leave the In port on the last drive enclosure in the loop and the Out port on the first drive enclosure unoccupied.



If you want to connect a second drive enclosure group, go to Step 4; otherwise, go to “Connecting a redundant drive loop to the FASTT700 Storage Server” on page 165.

4. Repeat Step 1 on page 162 through Step 3 on page 163 to connect a second redundant drive enclosure group. The following figure shows a second redundant drive enclosure group (loop C and loop D on drive enclosure group 2).



- Continue with “Connecting a redundant drive loop to the FAStT700 Storage Server”.

Connecting a redundant drive loop to the FAStT700 Storage Server

Use the following procedure to connect a redundant drive loop to the FAStT700 Storage Server. You will need two fiber-optic cables for each redundant pair of loops (for example, loop A and loop B) that you are connecting to the FAStT700 Storage Server.

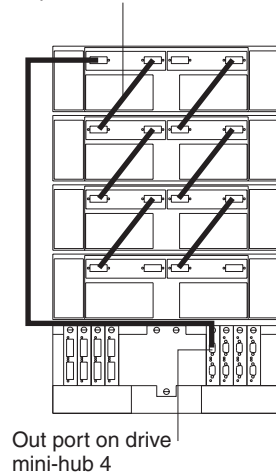
- Connect drive loop A to the FAStT700 Storage Server, as shown in the following figure.

Starting with the last drive enclosure in loop A, connect the In port on the left ESM board to the Out (upper) port on drive mini hub 4 on the FAStT700 Storage Server.

Leave the Out port on the left ESM board on the first drive enclosure and the In (lower) connector on drive mini hub 4 unoccupied.

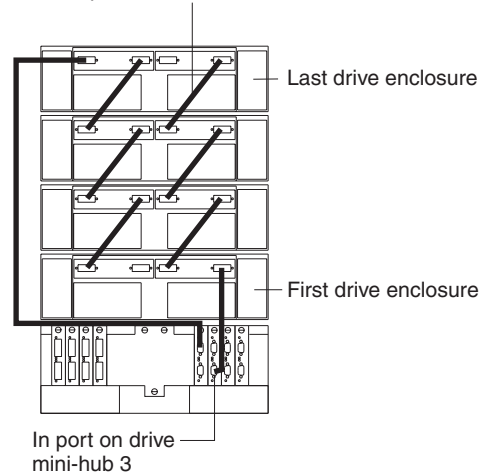
Step 1: Connect drive loop A to the storage server.

Loop A Fibre Channel cables



Step 1: Connect drive loop B to the storage server.

Loop B Fibre Channel cables



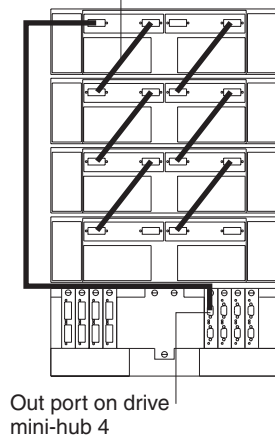
- Connect drive loop B to the FAStT700 Storage Server, as shown in the following figure.

Starting with the first drive enclosure in the loop, connect the Out port on the right ESM board to the In (lower) port on drive mini hub 3.

Leave the In port on the right ESM board on the last drive enclosure and the Out (upper) port on drive mini hub 3 unoccupied.

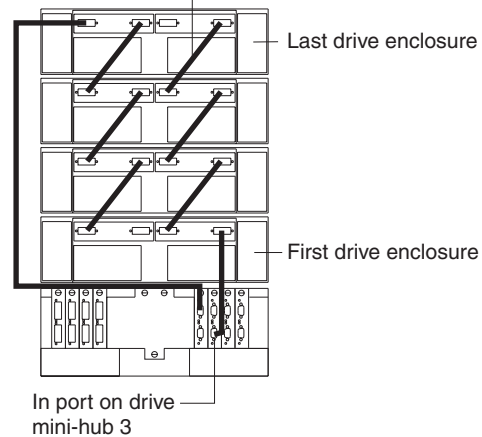
Step 1: Connect drive loop A to the storage server.

Loop A Fibre Channel cables



Step 1: Connect drive loop B to the storage server.

Loop B Fibre Channel cables



To connect a second redundant drive enclosure group to the FAStT700 Storage Server, continue with Step 3; otherwise, go to “Connecting hosts directly to the FAStT700 Storage Server” on page 167.

3. Connect drive loop C to the FAStT700 Storage Server, as shown below.

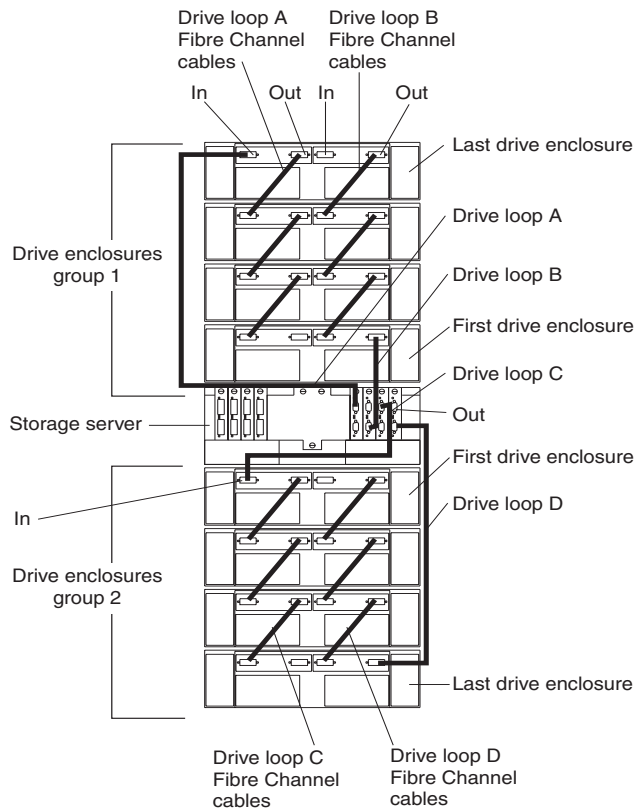
Starting with the first drive enclosure in drive enclosure group 2, connect the In port on the left ESM board to the Out (upper) port on drive mini hub 2.

Leave the Out port on the left ESM board on the last drive enclosure in drive enclosure group 2 and the In (lower) port on the drive mini hub 2 unoccupied.

4. Connect drive loop D to the FAStT700 Storage Server, as shown in the following figure.

Starting with the last drive enclosure in drive enclosure group 2, connect the Out port on the right ESM board to the In (lower) port on mini hub 1.

Leave the In port on the right ESM board on the first drive enclosure in drive enclosure group 2 and the Out (upper) port on drive mini hub 1 unoccupied.



Connecting hosts directly to the FAStT700 Storage Server

Use this procedure to connect up to four hosts, with two host adapters each, directly to the FAStT700 Storage Server. If you are connecting five or more hosts to the FAStT700 Storage Server, go to “Connecting hosts using external devices” on page 168.

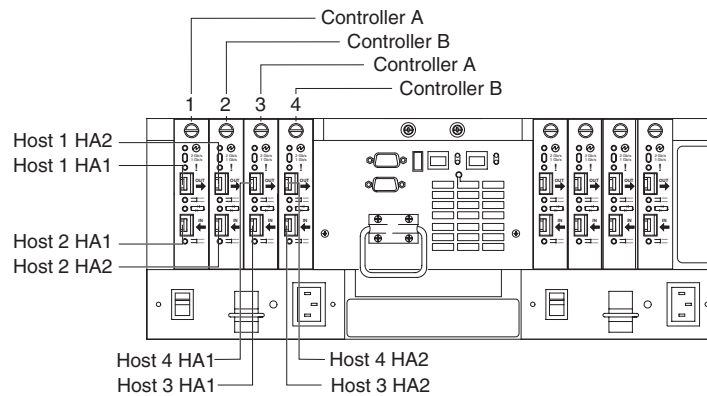
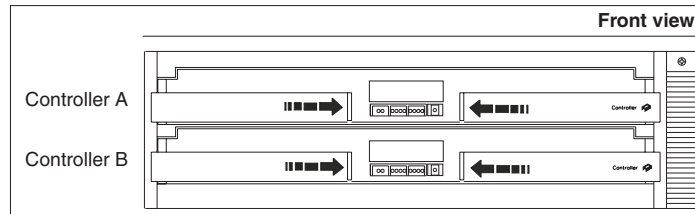
Before proceeding, make sure that you connect fiber-optic cables to all host adapters that you are connecting to the FAStT700 Storage Server.

Important: Host mini hub 1 and mini hub 3 correspond to Controller A (top) and mini hub 2 and mini hub 4 correspond to Controller B (bottom). To ensure redundancy, connect each host to both controllers. You can use either the upper or lower ports on either mini hub.

The example in the following procedure uses the upper ports for Hosts 1 and 4 and the lower ports for Hosts 2 and 3.

1. Connect the first host (Host 1) to the FAStT700 Storage Server, as shown below.
 Connect Host Adapter 1 (HA1) from Host 1 to a port on host mini hub 1. Connect HA2 from Host 1 to mini hub 2.
 To connect a second host, continue with Step 2; otherwise, go to “Setting the Link Rate Interface switch” on page 170.
2. Connect a second host (Host 2) to the FAStT700 Storage Server, as shown below.
 Attach HA1 from Host 2 to the unoccupied port on mini hub 1. Attach HA2 from Host 2 to the unoccupied port on mini hub 2.
 To connect a third host, continue with Step 3; otherwise, go to “Setting the Link Rate Interface switch” on page 170.

3. Connect a third host (Host 3) to the FAStT700 Storage Server, as shown below.
Attach HA1 from Host 3 to mini hub 3. Attach HA2 from Host 3 to mini hub 4.
To connect a fourth host, continue with Step 4; otherwise, go to “Setting the Link Rate Interface switch” on page 170.
4. Connect a fourth host (Host 4) to the FAStT700 Storage Server, as shown in the following figure.
Attach HA1 and HA2 from Host 4 to the two unoccupied ports on mini hub 3 and mini hub 4.



5. Go to “Setting the Link Rate Interface switch” on page 170.

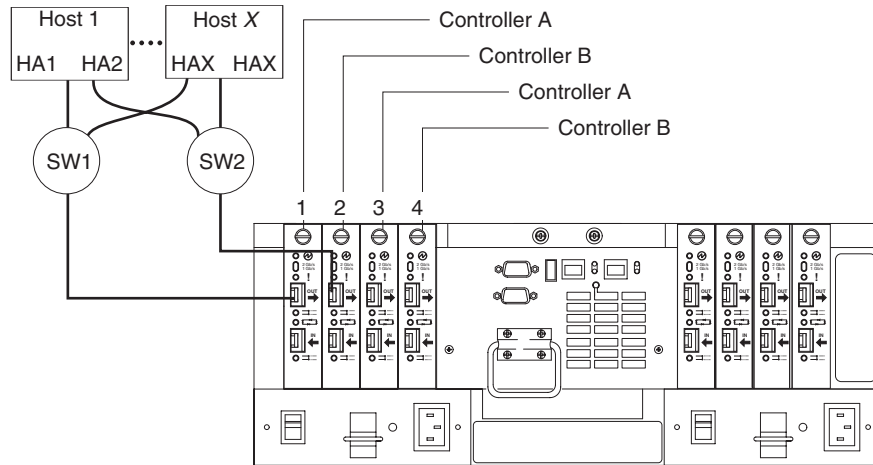
Connecting hosts using external devices

Use the information in this section to connect five or more hosts to the FAStT700 Storage Server. When you use external Fibre Channel switches, the FAStT700 Storage Server supports up to 64 hosts (128 host adapters, 64 host adapters per controller) and two host adapters for each host.

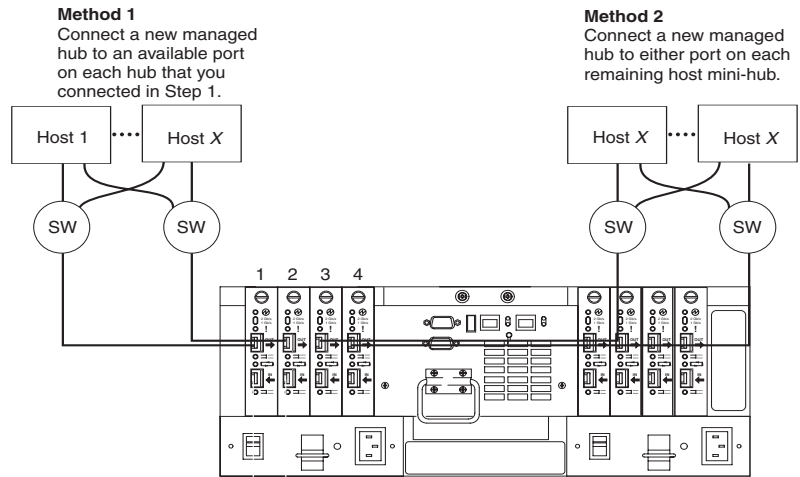
Important: Host mini hub 1 and host mini hub 3 correspond to Controller A (top). Mini hub 2 and mini hub 4 correspond to Controller B (bottom). To ensure redundancy, connect each host to both controllers. You can use either the upper or lower connectors on either mini hub.

You connect additional hosts to the FAStT700 Storage Server by adding host-side mini hubs and Fibre Channel switches, (one Fibre Channel switch for each mini hub).

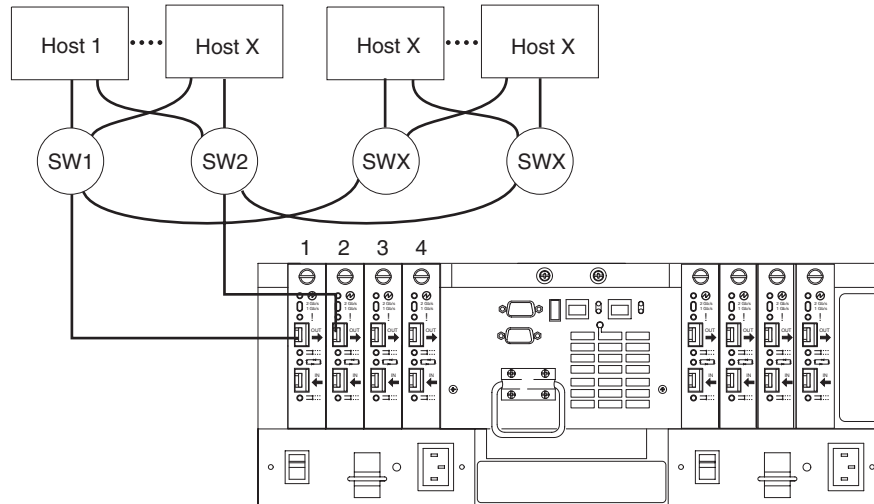
The following figure shows an example of dual path configuration using Fibre Channel switches. Host 1 contains two host bus adapters that are connected to host mini hubs. To configure a host with dual path redundancy, connect the first host bus adapter (HA1) to SW1 and connect the second host bus adapter (HA2) to SW2. Then, connect SW1 to host mini hub 1 and SW2 to host mini hub 2.



You can directly attach up to four Fibre Channel switches (one per mini hub) to a FAST700 Storage Server. The following figure shows an example of attaching four Fibre Channel switches.



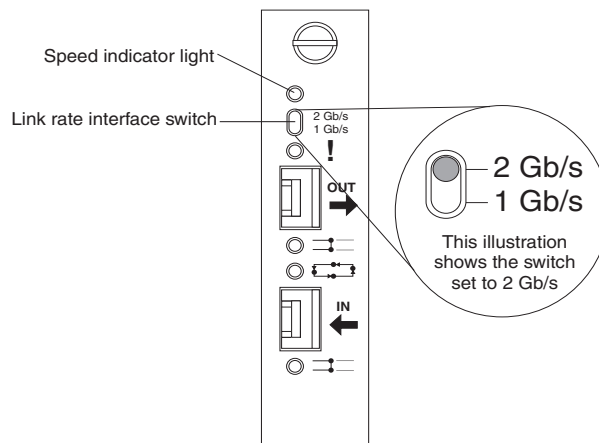
Most Fibre Channel switches support eight to sixteen hosts. If your configuration requires more hosts than four Fibre Channel switches can support, you must add cascading switches, as shown in the following figure.



Setting the Link Rate Interface switch

Each FASTT700 Storage Server mini hub has a Link Rate Interface switch that is used to select the host-side or drive-side mini hub data transfer rates. The switch settings are labeled 2 Gb per second and 1 Gb per second. Use a device with a point such as a small flat-blade screwdriver or ballpoint pen to set the host-side or drive-side mini hub Link Rate Interface switch. See the following figure.

The Speed indicator light is green when the data transfer rate of the Fibre Channel loop is 2 Gb per second. The Speed indicator light is off when the data transfer rate is 1 Gb per second. The following figure shows the location of the Link Rate switch and indicator light.



Setting data transfer rates on host-side mini hubs

To set the Link Rate Interface switch on the host-side mini hubs, complete the following steps.

Note: Host-side mini hub ports must be connected to devices that have the same data transfer rate.

1. Verify the data transfer rate of the devices on the loop or the Fibre Channel switch port.
2. Set the data transfer rate on the host bus adapter based on the data transfer rate of the devices on the loop or the Fibre Channel switch port.
3. Set the Link Rate Interface switch to match the data transfer rate of the host bus adapter.

Setting data transfer rates on drive-side mini hubs

On the drive-side mini hubs, set the Link Rate Interface switch to 2 Gb per second or 1 Gb per second based on the data transfer rate of the drive enclosures.

Note: All drive enclosures on the loop and drive-side mini hub ports must be connected to devices that have the same data transfer rate.

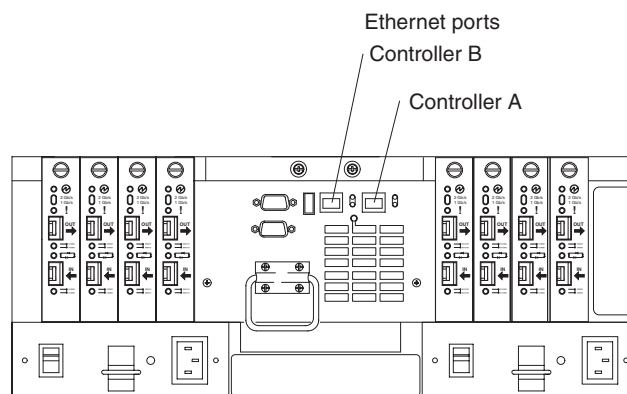
To set the data transfer rate on drive-side mini hubs, do the following:

1. Verify the data transfer rate of the drive enclosure on the loop.
2. Set the link rate interface switch to match the data rate of the drive enclosure.

Connecting Ethernet cables

To manage a storage subsystem using the direct (out-of-band) method, connect a pair of Ethernet cables from the management station to the Ethernet ports for Controller A or Controller B on the back of the FAStT700 Storage Server. For an illustration of direct (out-of-band) management, see “Installing hardware for direct (out-of-band) management” on page 147.

The following figure shows the location of the Ethernet ports.

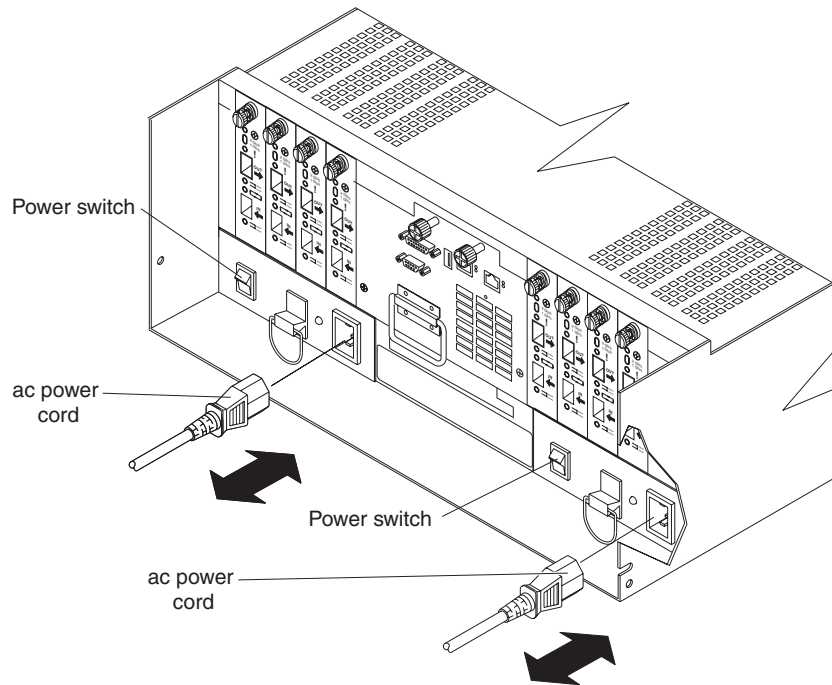


Connecting the power cords

To connect the power cords to the FAStT700 Storage Server and to the ac power source, complete the following steps.

1. Make sure both power switches on the FAStT700 Storage Server are off.
2. Plug both FAStT700 Storage Server power cords into the FAStT700 Storage Server, as shown in the following figure.
3. Plug both FAStT700 Storage Server power cords into the ac outlets.

To maintain power redundancy, plug each power cord into an independent power source, such as the ac distribution unit inside a rack cabinet or an external receptacle. For details about power requirements, see “Operating specifications” on page 205.



Turning on the power

Important: You must turn on the drive enclosures *before* you turn on the FAStT700 Storage Server. The controllers might not recognize the correct configuration if the hard disk drives are powered up after the FAStT700 Storage Server. For instructions on powering up the drive enclosures, refer to the drive enclosure documentation.

Note: Always wait at least 30 seconds between the time you turn off a power switch and the time you turn on the power again.

Use the following procedure to turn on the power for the FAStT700 Storage Server.

1. Verify that all communication and power cables are plugged into the back of the FAStT700 Storage Server and to a properly grounded ac electrical outlet.
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, Fibre Channel switches, and management stations) *before* the storage server.
 - b. You must turn on the drive enclosures *before* the FAStT700 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 drive enclosures, refer to the drive enclosure documentation.
 - c. Turn on the power to the storage server.

- d. Restart or turn on the power to the host.
3. Turn on the power to each device, use the following power-on sequence. To turn on power to the FAStT700 Storage Server, turn on the power-supply switches on the back of the FAStT700 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 indicator lights to check the overall status of the FAStT700 Storage Server and its components.

Turning off the power

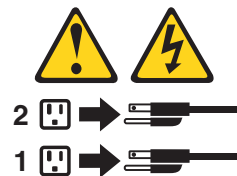
Attention: The FAStT700 Storage Server is designed to run continuously, 24 hours a day. Except in an emergency, never turn off the power even if any FAStT700 Storage Server fault indicator lights are lit. Use the proper troubleshooting or servicing procedure to correct the fault before turning off the power. This ensures that the FAStT700 Storage Server powers up correctly later.

Statement 5



CAUTION:

The power control button on the device and the power switch on 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 the following procedure to turn off power to the FAStT700 Storage Server.

1. Make sure that all amber fault indicator lights on the FAStT700 Storage Server are off. If any fault indicator lights are on, use the storage-management software to determine the status of the system components and correct any problems before turning off the power.
2. The operating system software might require you to perform other procedures before you turn off the power. 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. Prepare the FAStT700 Storage Server for shutdown, as follows:
 - a. Stop all I/O activity to the FAStT700 Storage Server and attached drive enclosures.

Note: If a parity check is in progress, it might take a long time for the drive indicator lights to stop blinking.
 - b. Use the operating-system software to disconnect the FAStT700 Storage Server logical drives from the host before the storage server is powered off.
 - c. Make sure that the fast write cache indicator light on each FAStT700 Storage Server front panel and all drive active indicator lights on each drive enclosure front panel are off (not blinking).
 - d. Disconnect the FAStT700 Storage Server and drive enclosures from the hosts.

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.

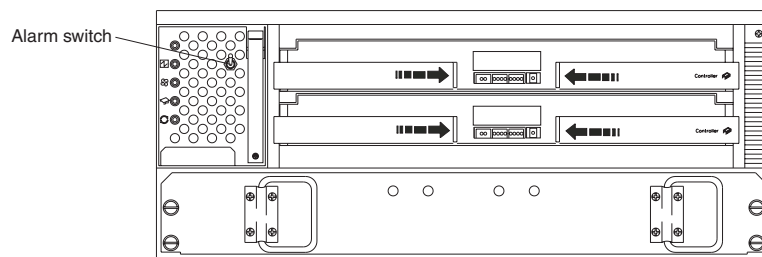
4. To turn off the power to each device, use the following shutdown sequence.

Note: You do not need to perform this step if you are servicing only the FAST700 Storage Server.

- 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 drive enclosures. 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, or Ethernet switches).

Turning on the FAST700 Storage Server alarm

The FAST700 Storage Server has an audible alarm. This alarm is controlled by a switch that is located on the storage server fan. You can enable this alarm by removing the bezel and setting the switch in the up position, as shown in the following figure.



Installing the FAST Storage Manager software

You can now install the FAST Storage Manager software that is provided on an installation CD that comes with the FAST700 Storage Server. Install the software using the procedures in the FAST Storage Manager 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.

Replacement procedures

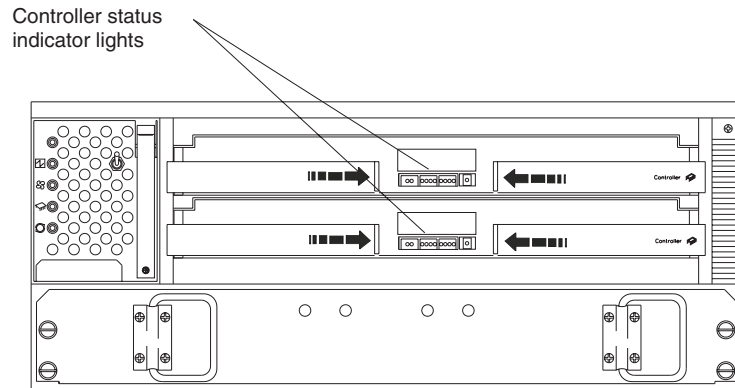
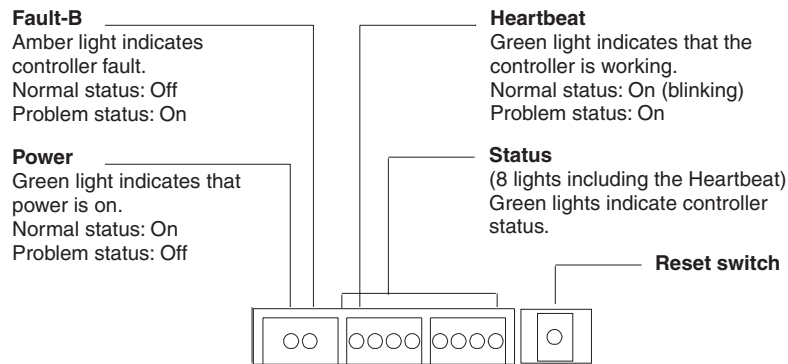
The FAST700 Storage Server consists of two RAID controllers, a cooling system, mini hubs, SFP modules, and a power system. This chapter includes detailed instructions on replacing these components. Read "Handling static-sensitive devices" on page 145 before replacing any components.

FAST700 Storage Server controller

The FAST700 Storage Server supports redundant array of independent disks (RAID) technology. The FAST700 Storage Server contains two RAID controllers.

Each controller comes in a removable, portable unit, called a controller CRU. The controller CRUs slide into one of two controller slots on the front of the FAStT700 Storage Server and attach to hosts through Fibre Channel connections. Two handles lock the controller in place. Each controller slot has a controller slot designation that identifies the physical location of the controller in the chassis: controller slot A (top) or controller slot B (bottom). Each controller CRU has ten indicator lights: one power, one fault, and eight status indicator lights, as shown in the following figure.

Note: If you are removing both controllers (controller A and controller B) from the FAStT700 Storage Server, identify the controllers A and B with the white tape dots that are included in the rack mounting assembly kit. The controllers must be installed back to their original location.



Servicing notes

Consider the following when servicing the controllers in the FAStT700 Storage Server:

- The FAStT700 Storage Server supports two controller CRUs, which attach to hosts through Fibre Channel connections.
- You can hot swap or replace a failed controller while the FAStT700 Storage Server is in operation as long as the failed controller is one of a redundant pair (two controllers attached to the same host) and it has a “passive” or “offline” status in the storage-management software.
- If cache mirroring is enabled in redundant controllers and one controller fails, the second controller assumes processing functions without data loss. However, some or all data might be lost if cache mirroring is disabled and a failure occurs before data is written from cache memory to disk.
- If you replace the controller CRU and still experience problems, the FAStT700 Storage Server might have defective components or connections. Check the storage-management software for indications of other component failures.
- When a controller CRU fails, the fault light on the affected controller is lit. For more information about indicator lights, see “Checking the indicator lights” on page 135.
- Firmware between the two controllers is automatically synchronized when you replace a controller.

Replacing a failed controller

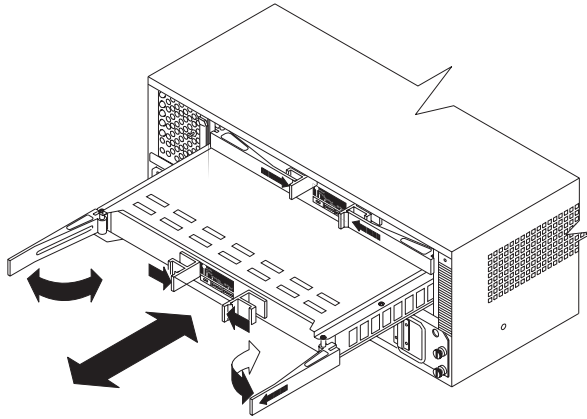
When instructed by the storage-management software, replace a controller CRU using the following procedure.

Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 145.

1. Remove the FAStT700 Storage Server bezel (see “Removing the front bezel to access the controls” on page 195).

Attention: Removing a controller that is operating normally (not failed) can result in data loss. Only remove a controller that:

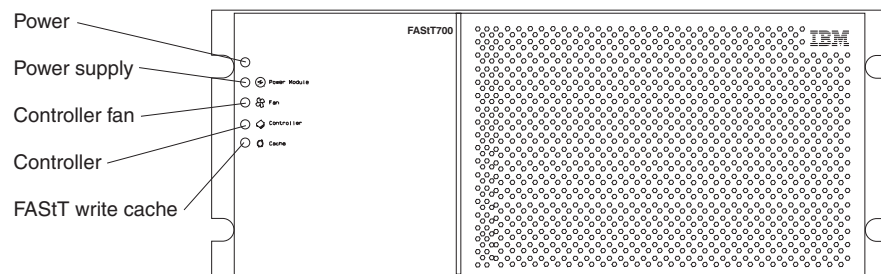
- Has a fault indicator light that is lit
 - Is marked as “Failed” (offline) through the storage-management software
2. Using the following figure as a guide, remove the controller that has failed.
 - a. Squeeze the two center tabs and pull both controller handles outward.
 - b. Using the handles, pull out on the controller to remove it.



Attention: When you replace a failed 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.

3. Unpack and check the new controller.

Using the proper handling precautions, remove the new controller from the packing material. Check the shipping invoice and the controller to make sure that it has the same memory size as the controller that you just removed.
4. Using the above figure as a guide, install the new controller as follows:
 - a. Squeeze the two center tabs and open the controller the handles.
 - b. Using the handles, slide the controller into the slot until the back edge of both handles hooks onto the frame.
 - c. Close the handles and snap into place.
5. Using the following figure as a guide, check the controller indicator lights.



- If the green power indicator is on and the amber fault indicator is off, go to Step 8 on page 178.
 - If the green power indicator remains off or the fault indicator is on after a few seconds, make sure that the controller CRU is locked into place. If the fault indicator remains on, go to Step 6..
6. Use the storage-management software to check the status of both controllers. If applicable, perform the recovery procedures required by the software. If this corrects the fault and the FAST700 Storage Server is operating without error, go to Step 8 on page 178 If not, go to Step 7.
 7. Reinsert the controller CRU. Then, if there are no error messages or controller faults, go to Step 8 on page 178 If there is still a problem, call for service.

8. Replace the FAStT700 Storage Server bezel.

Battery

The battery CRU contains rechargeable batteries and a battery-charger board. The battery CRU plugs into the front of the FAStT700 Storage Server, where it provides backup power to the controllers' cache memory. During a power outage, a properly charged battery CRU maintains electrical current to the controllers for up to five days with 1 GB cache memory installed. All data stored in memory is preserved as long as the batteries can sustain power to the cache memory. However, the battery does not provide power to the rest of the system during a power outage. Therefore, the system is not able to write data to drives without a backup power source.

Servicing notes

Consider the following when servicing the battery in the FAStT700 Storage Server:

- The battery has a three-year life expectancy. Replace the battery every three years or whenever it fails to hold a charge. Using the FAStT700 Storage Server in a hot environment (above 35° C or 95° F) lowers the life expectancy of the battery. Under these conditions, you might need to replace the battery more often.
- The service label on the battery provides a blank line for recording the date on which the battery was last serviced. Check this label to determine when to replace the battery. For information about using the software to track battery age, refer to the IBM FAStT Storage Manager documentation and online help.
- When a battery fails, the fault light on the battery is lit. For more information about indicator lights, see "Checking the indicator lights" on page 135.
- If you replace the battery and still experience battery problems (for example, loss of battery power to the controllers or batteries not charging properly), the FAStT700 Storage Server might have defective components or connections. Check the storage-management software for indications of other component failures.

Replacing a failed battery

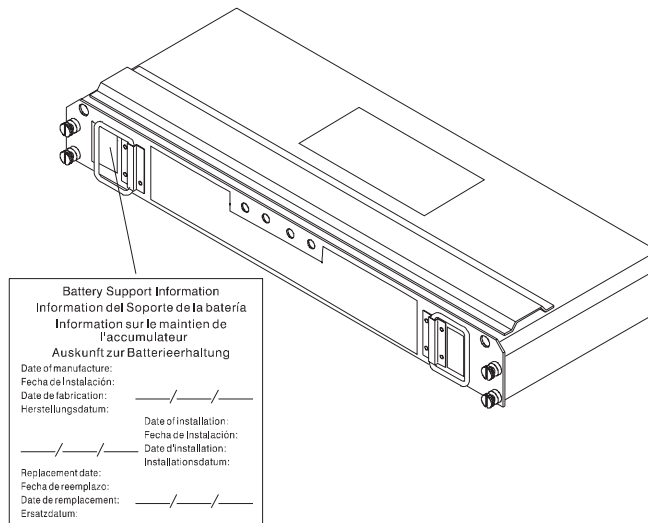
When instructed by the storage-management software, replace the battery.

Attention: Because the battery CRU is a sealed unit, you must replace the entire CRU (not just the batteries) in order to keep the battery backup system in working order. Opening the battery CRU voids your warranty.

1. Use the storage-management software to check that there is no data in cache and that all caching has stopped. Data in cache is unprotected if a power outage occurs while the battery CRU is out of operation.

Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see "Handling static-sensitive devices" on page 145.

2. Prepare the new battery. Unpack the battery CRU. Save the packing material for shipping the used battery CRU to a disposal facility. Find the "Battery Support Information" label on the front of the new battery CRU, as shown in the following figure.



3. Fill in the following information:
 - Date of Installation - Record today's date on the blank line
 - Replacement Date - Record the expiration date (three years from today's date) on the blank line
4. Remove the FAST700 Storage Server bezel.

Attention: Be careful when removing the battery. The battery weighs approximately 6.4 kg (14 lbs).

Statement 8

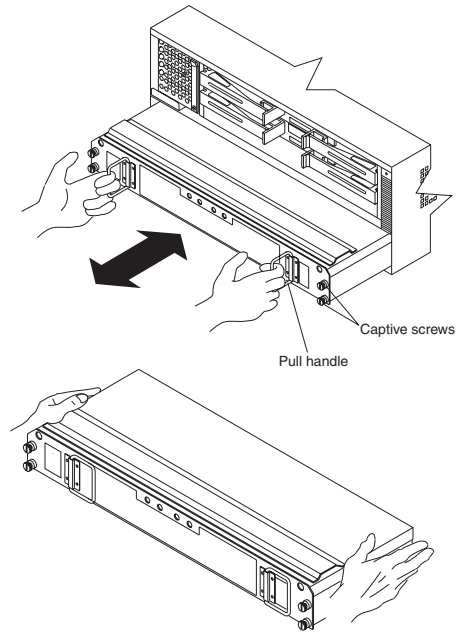


CAUTION:
 Never remove the cover on a power supply or any part that has the following label attached.

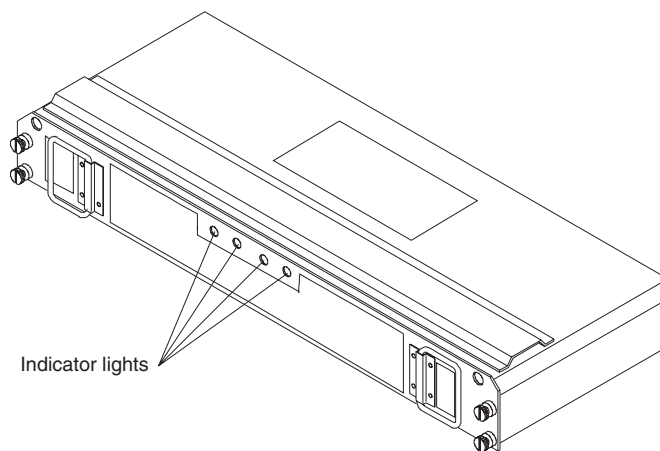


Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

5. Using the following figure as a guide, remove the battery.
 - a. Loosen the four captive screws on the battery. If necessary, use a flat blade screwdriver to loosen the screws.
 - b. Using the pull handles, slide out the battery about 5 cm (2 in.).
 - c. Using both hands, grasp the sides of the battery and pull out.

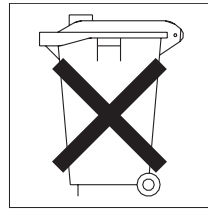


6. Install the new battery.
 - a. Using both hands, slide the battery about 5 cm (2 in.) into the slot.
 - b. Using the pull handles, slowly push the battery completely into the slot.
 - c. Tighten the four captive screws.
7. Replace the FAStT700 Storage Server bezel.
8. Run the system for at least 24 hours to properly charge the batteries. The battery might take up to 15 minutes to complete its self-test and up to 24 hours to fully charge, especially after a power loss of more than a few minutes. When properly charged, both full-charge indicator lights on the front of the battery are lit.
9. Check the battery indicator lights, as shown in the following figure.



Note: If the Full Charge-A and the Full Charge-B indicator lights are blinking, the battery is in the process of charging.

10. After your battery is replaced, reset the battery installation date using the storage-management software. The software continues to issue battery-related errors if the installation date is not reset.



CONTAINS
SEALED LEAD
BATTERY.
BATTERY
MUST BE
RECYCLED.

Pb

Attention: 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.

11. Dispose of the used battery CRU according to local and federal regulations, which might include hazardous material handling procedures.

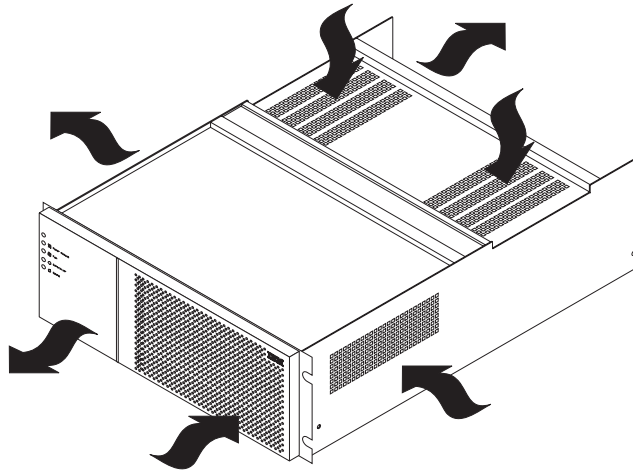
Storage server fan

The storage server fan is a single, removable unit containing two cooling fans and temperature monitoring circuitry. The storage server fan plugs directly into a slot on the front of the FASSt700 Storage Server, to the left of the controllers. Five indicator lights provide overall system status information. The dual fans in the storage server fan provide a redundant cooling system to both controller CRUs. If one fan fails, the other continues to operate, providing sufficient air circulation to prevent the controllers from overheating until you can replace the entire storage server fan.

To prevent cooling problems, the FASSt700 Storage Server must have proper air circulation throughout the chassis. Cooling problems include any malfunctions or obstructions that impede air flow and cause one or more components in the FASSt700 Storage Server to overheat. Make sure that the ambient air temperature around the FASSt700 Storage Server is within the environmental requirements. To boost air circulation, the FASSt700 Storage Server chassis has air vents along its top and sides. These vents serve as air intake and exhaust passages. Always keep vents clean and free of obstructions.

The following figure shows the FASSt700 Storage Server air flow. Make sure your installation site allows adequate ventilation to the FASSt700 Storage Server during operation

Note: Allow at least 60 cm (2 ft) of clearance in front of and behind the FASSt700 Storage Server for proper ventilation.



Servicing notes

Consider the following when servicing the storage server fan:

- Both fans failing simultaneously in the storage server is unlikely. Such a failure will cause either one or both controllers to overheat. Under these circumstances, the amber controller light on the front panel might light. If this occurs, shut down the FAST700 Storage Server immediately and let the unit cool to room temperature and then replace the storage server fan.
- You can hot swap, or replace, the storage server fan, as long as you complete the exchange within 15 minutes. The time limit applies to the total time that the fan is out of the chassis. The time begins when you remove the failed storage server fan and ends when you install the new one. This does not include the time it takes to perform the entire procedure (for example, checking the indicator lights).
- When a storage server fan fails, the fault light on the storage server fan is lit. For more information about indicator lights, see “Checking the indicator lights” on page 135.
- If you replace the storage server fan and still experience problems, the FAST700 Storage Server might have defective components or connections. Check the storage-management software for indications of other component failures.

Replacing a failed storage server fan

When instructed by the storage-management software, replace a storage server fan.

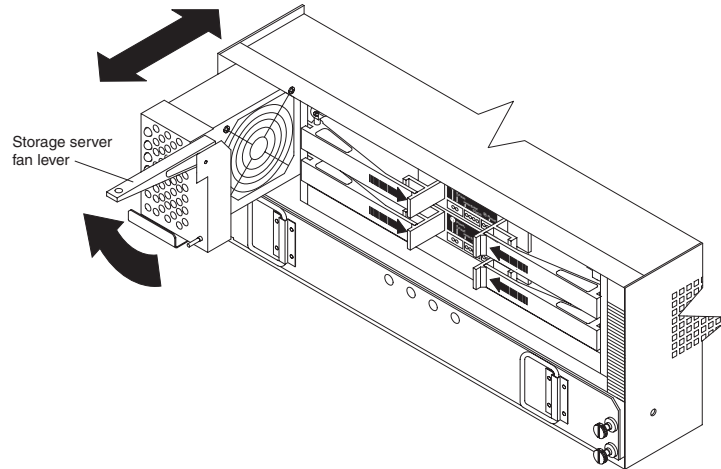
Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 145.

1. Unpack the new storage server fan.
2. Remove the FAST700 Storage Server bezel.

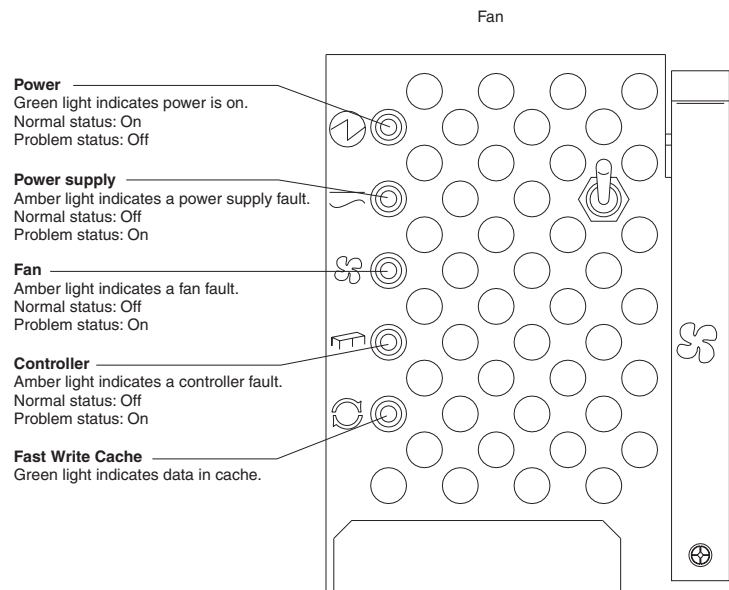
Attention: : To prevent damage to the FAST700 Storage Server components, do not operate the FAST700 Storage Server without adequate ventilation to the controllers. If it will take longer than 15 minutes to replace the storage server fan, you must shut down the FAST700 Storage Server to prevent it from overheating. The time limit applies to the total time that the fan is out of the chassis. For more information, see “Turning off the power” on page 198.

3. Remove the failed storage server fan, as shown in the following figure.
 - a. Lift up the lever on the storage server fan.

- b. Pull firmly on the bottom lip to remove the fan.



4. Install the new storage server fan.
 - a. Slide the new storage server fan all the way into the slot.
 - b. Press down on the lever and snap the lever into place.
5. Using the following figure as a guide, check the storage server indicator lights on the fan.



- When the storage server fan is operating properly, the green power indicator is lit and the amber fan indicator is not off.
- If the amber fan indicator is lit or the green power indicator remains off, make sure that the storage server fan is seated securely in the slot and that the lever is snapped into place. Check the controller fan or the fan and communications module status.
- If the storage server fan indicator remains on, it might indicate a problem with the new storage server fan or the fan and communications module (both components share the same indicator light). Replace the storage server fan with a spare, if available. Otherwise, turn off the FAST700 Storage Server to prevent it from overheating until you can replace the fan.

6. Replace the FAStT700 Storage Server bezel.

Fan and communications module

The fan and communications module is a single, removable unit containing two cooling fans and two Ethernet ports. This module plugs into a slot at the center back of the FAStT700 Storage Server, just above the power supplies. It has a locking lever and a pull handle for securing and removing the fan and communications module. The module contains dual fans that provide a redundant cooling system to both power supplies. If one fan within the module fails, the other continues to operate. A single fan provides sufficient air circulation to prevent the power supplies from overheating until you can replace the entire fan and communications module.

Servicing notes

Consider the following when servicing the fan and communications module:

- The fan and communications module contains two Ethernet RS-232 connections used for direct network-management.
- You can hot swap the fan and communications module as long as you complete the exchange within 15 minutes from when you remove the failed unit until you install the new one.
- It is unlikely that both fans in the fan and communications module will fail simultaneously. Such a failure will cause one or both power supplies to overheat. In these circumstances, the amber power supply indicator light on the bezel lights and the overheated power supply automatically shuts down (the green power indicator light turns off). Once the ambient air temperature cools below 70° C (158° F), the power supply automatically turns on. Replace the failed fan and communications module then check the power supply indicator lights (fault indicator light on the front and power indicator light on the back). If the power supply fault indicator light remains on, replace the power supply. For more information about indicator lights, see “Checking the indicator lights” on page 135.
- If you replace the fan and communications module and still experience problems, the FAStT700 Storage Server might have defective components or connections. Check the storage-management software for indications of other component failures.

Replacing a failed fan and communications module

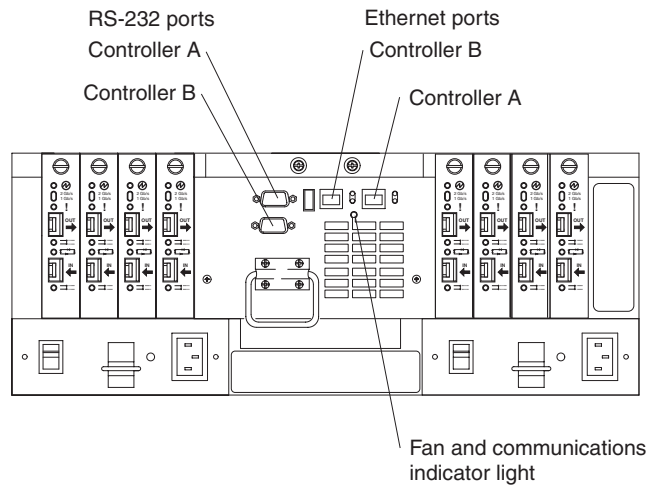
When instructed by the storage-management or diagnostic software, replace a fan and communications module.

Attention: To prevent damage to the FAStT700 Storage Server circuitry, do not operate the FAStT700 Storage Server without adequate ventilation to the controllers. If it will take longer than 15 minutes to replace the storage server fan, you must shut down the FAStT700 Storage Server to prevent it from overheating. The time limit applies only to the total time that the fan is out of the chassis. The time begins when you remove the failed module and ends when you install the new one. This does not include the time it takes you to perform this entire procedure (for example, checking the lights).

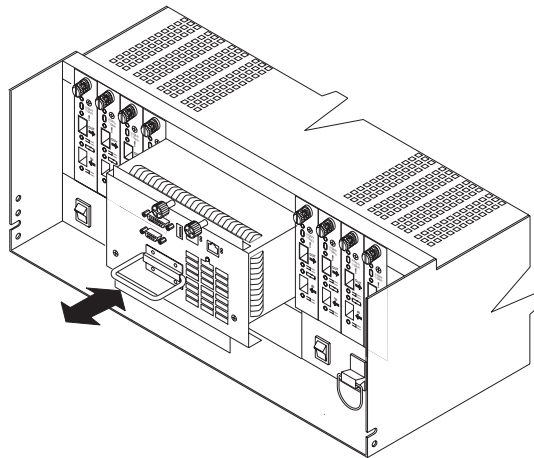
Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 145.

1. Unpack the new fan and communications module.

2. Disconnect all Ethernet interface cables from the failed fan and communications module. The locations of the ports are shown in the following figure.



3. Using the following figure as a guide, remove the failed fan and communications CRU from the FAStT700 Storage Server.



- a. Using a flat-blade screwdriver, loosen the two captive screws on the fan and communications module.
 - b. Use the pull handle to slide the module out of the slot a few inches.
 - c. Grasp the sides of the module with both hands and remove it from the FAStT700 Storage Server.
4. Install the new fan and communications module. Push the new fan and communications module all the way into its chassis slot. Use a flat-blade screwdriver to tighten the three captive screws on the new module, securing it into place.
 5. Check the fan and communications indicator light.
 - If the amber fault indicator light is on, make sure that the fan and communications module is inserted all the way into the chassis and secured in place.
 - If the fault indicator light remains on, one or both fans inside the fan and communications module might be malfunctioning. Replace the failed fan and communications module with a spare, if available. Otherwise, shut down the

controller unit until you can replace the failed fan and communications module with a new one.

6. Reconnect the interface cables that you disconnected in Step 2 on page 185, to the new fan and communications module.

Power supply

The FAStT700 Storage Server power system consists of two power supplies. The power supplies slide into either of the two slots on the back of the FAStT700 Storage Server. The power supplies provide power to the internal components by converting incoming ac voltage to dc voltage. The power supplies are interchangeable and redundant. Each power supply uses one power cord. You can plug both power cords into a common power source or plug each cord into a separate circuit for power redundancy. One power supply can maintain electrical power to the FAStT700 Storage Server if the other power supply is turned off or malfunctions.

Servicing notes

Consider the following when servicing the power supplies:

- Each power supply has a built-in sensor that detects the following conditions:
 - Overvoltage
 - Overcurrent
 - Overtemperature

If any of these conditions occur, one or both power supplies enter shutdown mode. All power remains off until one of the following occurs:

- You cycle the power switches (turn off the power switches, wait at least 30 seconds, then turn on the power switches). For more information, see “Overtemperature condition and power supply shutdown” on page 199.
- The power supplies automatically resume operation when the ambient air temperature cools to below 70° C (158° F). When the power supplies automatically resume operation, the controller also resumes operation.

After you manually cycle the power off then on, or when the power supplies automatically resume operation, an automatic restart resets the controllers, attempts to spin up the drives (which has no effect on the drives if they are already running), and returns the FAStT700 Storage Server to normal operation without operator intervention.

- You can hot swap (replace) a power supply because the two power supplies provide redundancy.
- Both power supplies have built-in temperature sensors designed to prevent the power supplies from overheating. If a temperature sensor detects an ambient air temperature greater than 70° C (158° F), the “overheated” power supply automatically shuts down. The second power supply remains on as long as its temperature remains below 70° C (158° F). If the second power supply overheats, it turns off all power to the FAStT700 Storage Server.

Note: There is a serious problem if the air temperature inside the cabinet is hot enough to cause the power supplies to shut down.

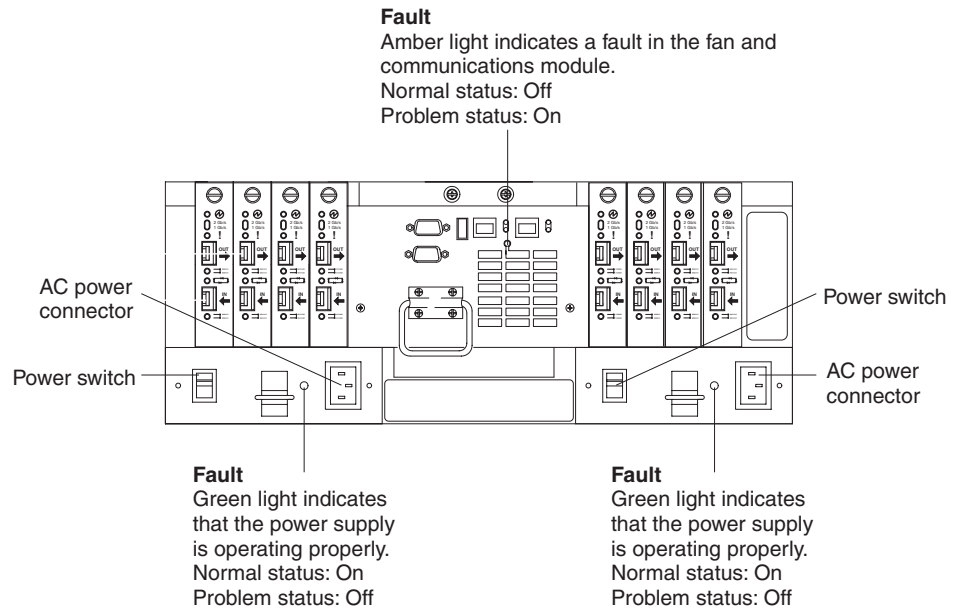
- The FAStT700 Storage Server is capable of power-up recovery without operator intervention. Once the air temperature cools to below 70° C (158° F), the power supplies automatically restart. An automatic restart resets the controllers, attempts to spin up the drives, which has no effect on the drives if they are already running, and returns the FAStT700 Storage Server to normal operation.

- When a power supply fails, the green power indicator light on the power supply goes off and the amber power supply fault light on the storage server fan on the front of the FAStT700 Storage Server lights. For more information, see “Checking the indicator lights” on page 135.
- If you replace the power supply CRU and still experience problems, the FAStT700 Storage Server might have defective components or connections. Check the storage-management software for indications of other component failures.

Replacing a failed power supply

When instructed by the storage-management software, replace a power supply.

1. Check the power supply indicator light on the back of the FAStT700 Storage Server, as shown in the following figure. Be sure that the green power light on the failed power supply is off.

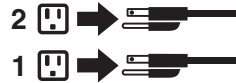


Statement 5



CAUTION:

The power control button on the device and the power switch on 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.



2. Turn off the power switch and unplug the power cord from the failed power supply.

Statement 8



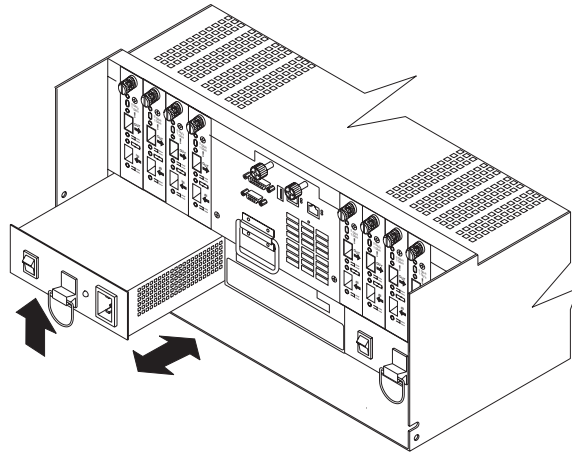
CAUTION:

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.

3. Using the following figure as a guide, remove the failed power supply. Lift up and pull out on the pull handle to release the power supply; then, slide the unit out.



Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 145.

4. Unpack the new power supply.
5. Install the new power supply, as shown in the above figure. Using the pull handle, push the power supply into the slot until it locks into place.
6. Plug in the power cord and turn on the power.
7. Check the new power supply and other FAStT700 Storage Server indicator lights for faults. For more information, see “Checking the indicator lights” on page 135.

SFP Modules

SFP module are used to connect mini hub ports to attached nodes. An SFP module slides into a mini hub port on the back of the FAStT700 Storage Server and then a host or drive-interface cable connects into the SFP module. For more information, see “Mini hubs” on page 192.

Servicing notes

Consider the following when servicing SFP modules:

- The SFP module housing has an integral guide key designed to prevent you from inserting the SFP module improperly.
- Use minimal pressure when inserting the SFP module into a mini hub port. Forcing the SFP module into a port could cause damage to the SFP module or the port.
- SFP modules are hot pluggable. You can insert or remove the SFP module while the storage server is powered on.
- The operational loop performance is not affected when you install or remove an SFP module.
- You must insert the SFP module into a mini hub port before you connect the fiber-optic cable.
- You must remove the fiber-optic cable from the SFP module before you remove the SFP module from the mini hub.
- Four indicator lights on a mini hub provide status information. If an SFP module fails, the interface fault and the bypass indicator lights on the mini hub light and

the loop good indicator light goes off. For more information about indicator lights, see “Checking the indicator lights” on page 135.

- If you replace the SFP module and still experience problems, the FAStT700 Storage Server might have defective components or connections. Check the storage-management software for indications of other component failures.

Replacing a failed SFP module

When instructed by the storage-management software, replace an SFP module in the mini hub.

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.

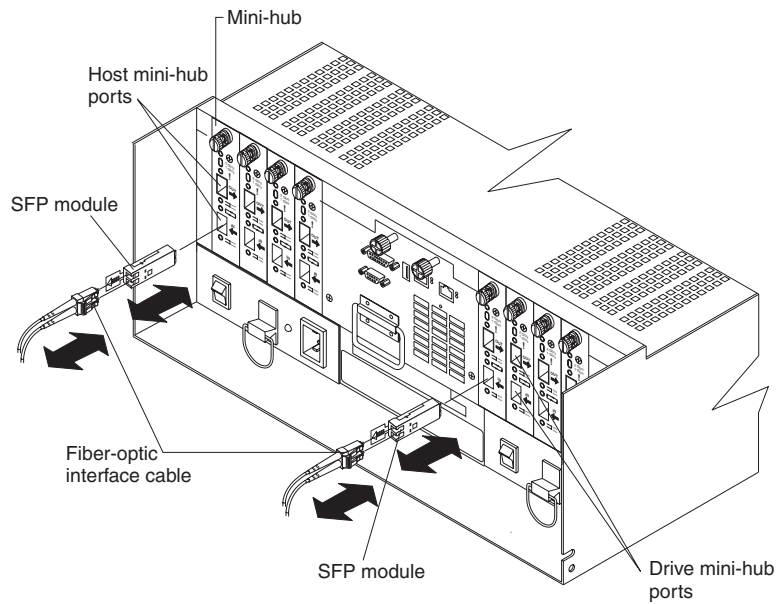
Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Attention: To prevent possible data loss, do not remove cables from an SFP module that has not failed.

Note: You must remove the fiber-optic cable from the SFP module before you can remove the SFP module from the mini hub port.

For proper handling of fiber-optic cables, see “Handling fiber-optic cables” on page 155.

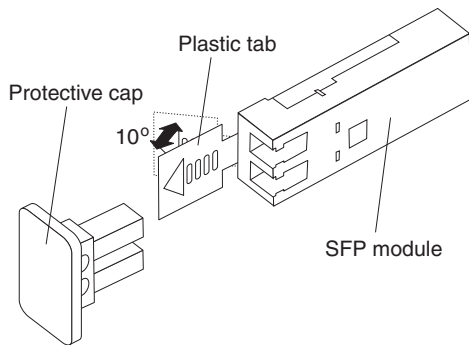
1. Remove the fiber-optic cable from the SFP module that has failed; then, replace the protective caps on the cables and replace the protective cap on the SFP. For more information, see “Removing an LC-LC Fibre Channel cable” on page 157 and the following figure.



2. To remove the SFP module from the mini hub, do the following:

Attention: To avoid damage to the cable or SFP module, make sure you unplug the LC-LC Fibre Channel cable *before* you remove the SFP module.

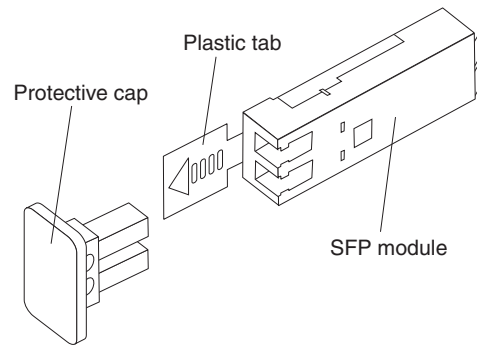
- a. The SFP module has a plastic tab that controls the latch that locks the SFP module into the mini hub. Grasp the plastic tab and pull the plastic tab outward 10 degrees to unlock the SFP module latch, as shown in the following figure.



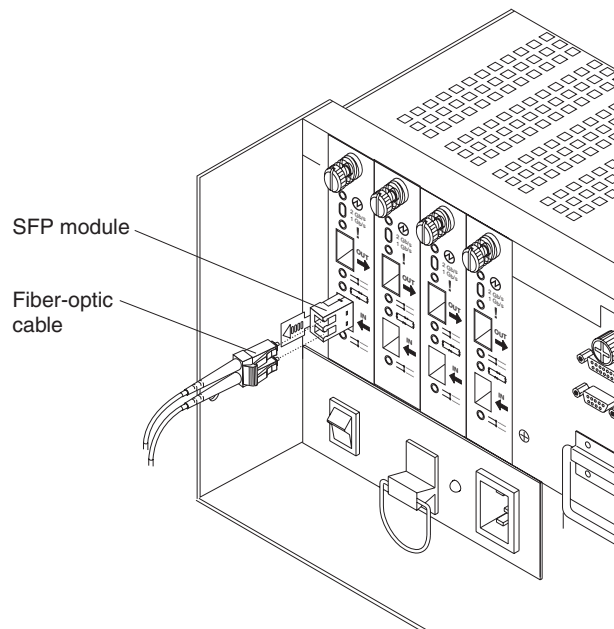
- b. Pull the failed SFP module from the mini hub.
- c. Insert the protective cap on the SFP module.
- d. Place the SFP module into a static-protective package.

Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see "Handling static-sensitive devices" on page 145.

3. Unpack the new SFP module.
4. Remove the protective cap from the SFP module, as shown in the following figure.



5. Insert the SFP module into the mini hub port until it clicks into place.



6. Reconnect the fiber-optic cables that you removed in Step 1 on page 190.
7. Check the indicator lights on the mini hub.

When the mini hub is operating properly, the green loop good light is lit and the fault light is off. If the mini hub is connected to a Fibre Channel loop, the amber port bypass light is off. If a problem is indicated, use the storage-management software to check the FAST700 Storage Server status.

Mini hubs

The mini hubs are located on the back of the FAST700 Storage Server. A mini hub is a single, removable unit that provides the Fibre Channel interface between a FAST700 Storage Server and hosts or drives. The back of the FAST700 Storage Server can accommodate eight mini hubs: up to four host-side and up to four drive-side mini hubs. Each mini hub has two ports. An SFP module is installed in a mini hub port. Then a fiber-optic interface cable is connected into the SFP module. For more information, see "SFP Modules" on page 189.

Servicing notes

Consider the following when servicing mini hubs:

- You can hot swap (replace) a failed mini hub while the FAStT700 Storage Server is in operation.
- Four indicator lights provide status information. If a mini hub fails, the interface fault and the bypass indicator lights on the mini hub are lit and the loop good indicator light is off. For more information about indicator lights, see “Checking the indicator lights” on page 135.
- If you replace the mini hub and the SFP modules in them and still experience problems, the FAStT700 Storage Server might have defective components or connections. Check the storage-management software for indications of other component failures.

For more information, see “Interface ports” on page 144.

Replacing a failed mini hub

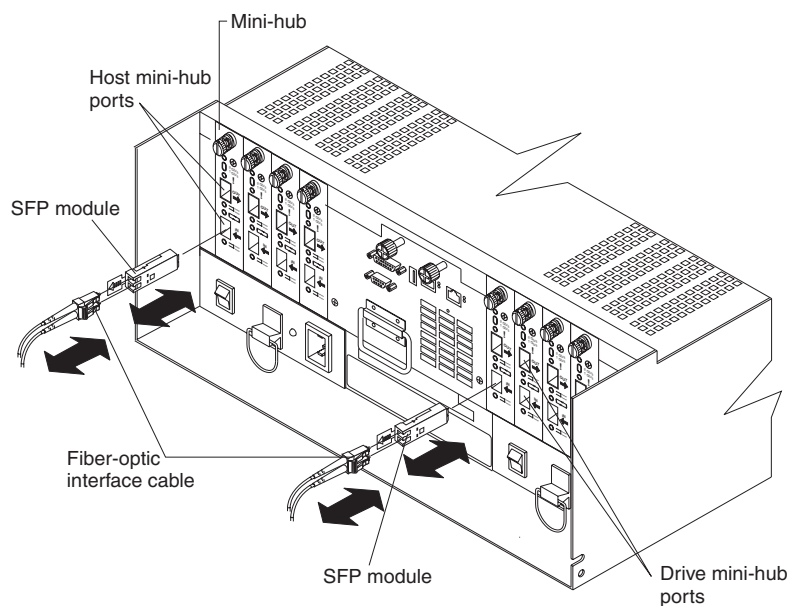
When instructed by the storage-management software, replace a mini hub. Use this procedure to replace either a failed host-side or drive-side mini hub.

Attention: To prevent possible data loss, do not pull cables from a mini hub that has not failed.

Note: You *must* remove the fiber-optic cable from the SFP module before you can remove the SFP module from the mini hub port.

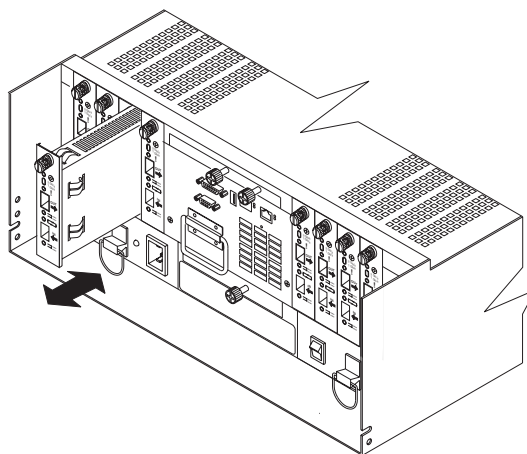
1. On the mini hub that has failed, remove the fiber-optic cables from the SFP modules, as shown in the following figure.

For proper handling of fiber-optic cables, see “Handling fiber-optic cables” on page 155.



2. Replace the protective caps on the cables.
3. Remove the SFP modules from the mini hub as follows:
 - a. Unlock the SFP module latch by pulling the plastic tab outward 10 degrees.
 - b. Slide the SFP module out of the mini hub port.
 - c. Replace the protective cap on the SFP module.
 - d. Place the SFP module into a static-protective package.

4. Loosen the captive screw on the mini hub; then, grasp the screw and pull the mini hub from the chassis. The following figure shows the location of the mini hubs and ports.



Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 145.

5. Unpack the new mini hub and slide it into the appropriate slot; then, tighten the captive screw.
6. Replace the SFP modules that you removed in Step 2 on page 191.
 - a. Remove the SFP module from the static-protective package.
 - b. Remove the protective cap from the SFP module.
 - c. Slide the SFP module into the mini hub port.
7. Replace the fiber-optic cables that you removed in Step 1 on page 193.
8. Check the indicator lights on the mini hub.

When the mini hub is operating properly, the green loop good light is lit and the fault light is off. If the mini hub is connected to a Fibre Channel loop, the amber port bypass light is off. If a problem is indicated, use the storage-management software to check the FAST700 Storage Server status.

Additional service information

Perform the tasks shown in Table 26 to maintain the FAST700 Storage Server after it is installed.

Table 26. Tasks overview.

Task	Description	See
Accessing the controls	To access the controller CRUs, battery, storage server fan, and indicator lights, remove the FAST700 Storage Server bezel.	“Removing the front bezel to access the controls” on page 195
Turning on or off the power	The FAST700 Storage Server usually runs continuously. However, you might need to turn off and on the power to move the FAST700 Storage Server or to perform maintenance procedures.	“Turning on the power” on page 196 and “Turning off the power” on page 198

Table 26. Tasks overview.

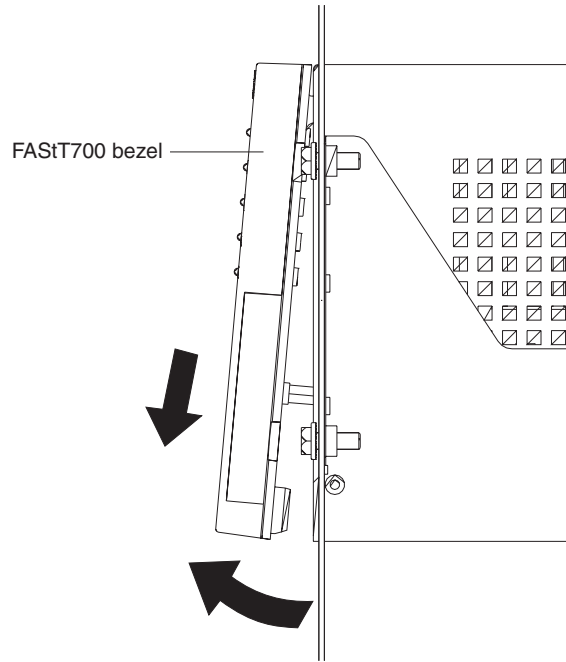
Task	Description	See
Monitoring FASSt700 Storage Server status through software	Run the storage-management software continuously. This software checks the storage subsystem for failures and displays messages indicating the types of failures and the recovery procedures.	“Monitoring status through software” on page 199
Checking fault indicator lights for component failures	Component failures are indicated by lights on the front and back of the FASSt700 Storage Server and are monitored by the storage-management software. Note: The indicator lights identify problems with the FASSt700 Storage Server components, but you might need more information to thoroughly diagnose and repair the unit. Therefore, it is important to use the storage-management software to continuously monitor the status of the FASSt700 Storage Server.	“Checking the indicator lights” on page 135
Restoring power after a power supply shutdown	When the FASSt700 Storage Server shuts down because of a power supply overtemperature condition, take special care restarting it.	“Overtemperature condition and power supply shutdown” on page 199
Checking the battery service date	Periodically check the battery service date information. Replace the battery whenever it fails to hold a charge or every three years. Note: Using the FASSt700 Storage Server in a hot environment (above 35° C or 95° F), lowers the battery life expectancy. Under these conditions, you might need to replace the battery more often.	“Checking the battery service date” on page 201
Preparing to move the FASSt700 Storage Server	You might need to move the FASSt700 Storage Server to a new location or remove the chassis from its cabinet.	“Preparing to move the FASSt700 Storage Server” on page 202

Removing the front bezel to access the controls

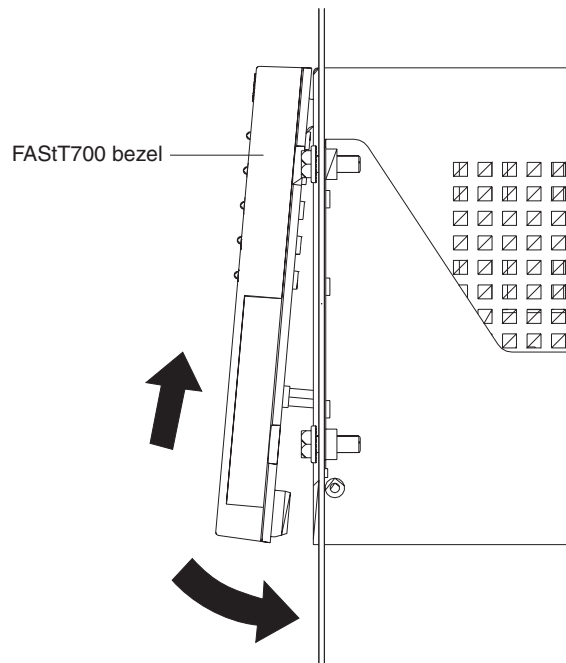
To access the controllers, battery, storage server fan, and indicator lights, you must remove the FASSt700 Storage Server bezel.

Attention: Pulling the cover out too far can damage the plastic hooks at the top. To avoid damaging the hooks, place the FASSt700 Storage Server on a flat surface. Be sure the front of the FASSt700 Storage Server extends beyond the edge approximately 5 cm (2 in.).

1. Carefully pull the bottom of the bezel out to release the pins; then slide the bezel down, as shown in the following figure.



2. To replace the bezel, slip the top edge of the bezel under the lip on the chassis, then push the bottom of the bezel until the pins snap into the mounting holes, as shown in the following figure.



Turning on the power

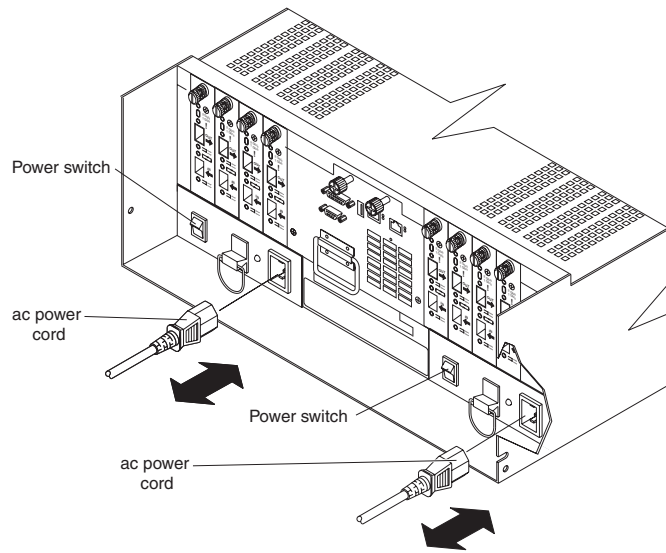
Important: You must turn on the drive enclosures before the FAST700 Storage Server.

The controllers might not recognize the correct configuration if the drives are powered up after the FAST700 Storage Server. For instructions on powering up the drive enclosures, refer to the drive enclosure documentation.

Note: Always wait at least 30 seconds between the time you turn off a power switch and the time you turn on the power again.

Use the following procedure to turn on power to the FASt700 Storage Server. If you are restoring power to the FASt700 Storage Server after an emergency shutdown or power outage, go to “Overtemperature condition and power supply shutdown” on page 199.

Turn on both power switches on the back of the FASt700 Storage Server (see the following figure). You must turn on both switches to take advantage of the redundant power supplies. Then, go to “Checking the indicator lights” on page 135.



1. Verify that all communication and power cables are plugged into the back of the FASt700 Storage Server and to a properly grounded ac electrical outlet.
Attention: If you are restarting the FASt700 Storage Server 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 drive enclosures *before* the FASt700 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 drive enclosures, refer to the drive enclosure documentation.
 - c. Turn on the power to the storage server.
 - d. 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 FASt700 Storage Server, turn on the power-supply switches on the back of the FASt700 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 indicator lights to check the overall status of the FASt700 Storage Server and its components.

Turning off the power

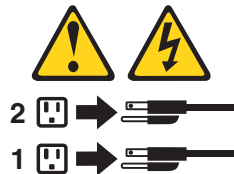
Attention: The FAStT700 Storage Server is designed to run continuously, 24 hours a day. Except in an emergency, never turn off the power even if any FAStT700 Storage Server fault indicator lights are lit. Use the proper troubleshooting or servicing procedure to correct the fault before turning off the power. This ensures that the FAStT700 Storage Server powers up correctly later. For more information, see “Checking the indicator lights” on page 135.

Statement 5



CAUTION:

The power control button on the device and the power switch on 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 the following procedure to turn off power to the FAStT700 Storage Server.

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. Prepare the FAStT700 Storage Server for shutdown, as follows:
 - a. Stop all I/O activity to the FAStT700 Storage Server and attached drive enclosures. Disconnect the FAStT700 Storage Server and drive enclosures from the hosts. Make sure that the fast write cache indicator light on each FAStT700 Storage Server front panel and all drive active indicator lights on each drive enclosure front panel are off (not blinking).

Note: If a parity check is in progress, it might take a long time for the drive indicator lights to stop blinking.

- b. Make sure that all amber fault indicator lights on the FAStT700 Storage Server are off. If any fault indicator lights are on, correct the problem before turning off the power. For more information, see “Monitoring status through software” on page 199 and “Checking the indicator lights” on page 135.
- c. If applicable, use the operating-system software to disconnect the FAStT700 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.

Note: You do not need to perform this step if you are servicing only the FAStT700 Storage Server.

- 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 drive enclosures. 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).

Monitoring status through software

To monitor FAStT700 Storage Server status, always run the storage-management software and check it frequently. Be sure to enable the management alerts that you need. The storage-management software provides the best way to diagnose and repair FAStT700 Storage Server failures. This software can help you:

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

Although the FAStT700 Storage Server has fault indicators, these lights are summary indicators and might not identify the specific component that has failed or needs replacing, or which type of recovery procedure you must perform. In some cases (such as loss of redundancy in FAStT700 Storage Server components), the fault light does not come on. Only the storage-management software can detect the failure.

Recovering from a FAStT700 Storage Server failure might require you to perform procedures other than replacing the component. The storage-management software gives these procedures.

Note: Always follow the software recovery procedures to prevent data loss.

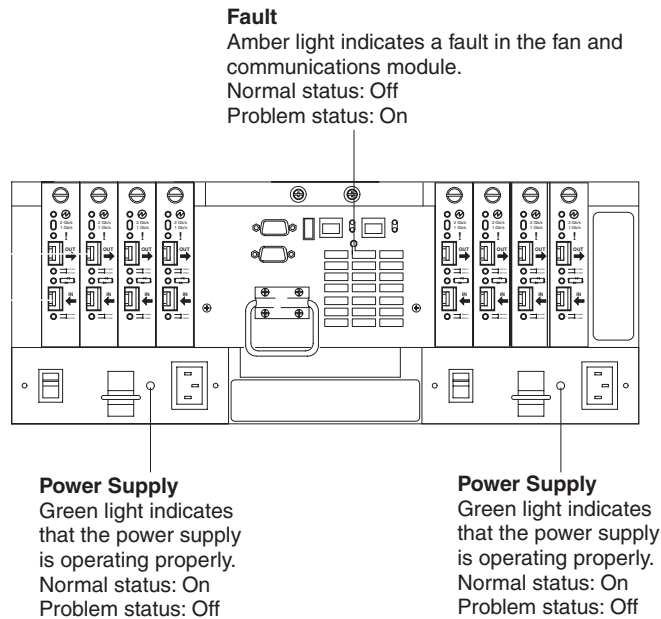
For more information about the storage-management software, refer to the appropriate publications:

- *IBM FAStT Storage Manager Installation and Support Guide for Microsoft Windows NT and Windows 2000*
- *IBM FAStT Storage Manager Installation and Support Guide for Novell NetWare*
- *IBM FAStT Storage Manager Installation and Support Guide for Red Hat Linux*
- *IBM FAStT Storage Manager Installation and Support Guide for HP-UX and Sun Solaris*
- *IBM FAStT Storage Manager Concepts Guide*
- The following IBM FAStT Storage Manager online helps are also available:
 - Enterprise Management Online Help
 - Subsystem Management Online Help

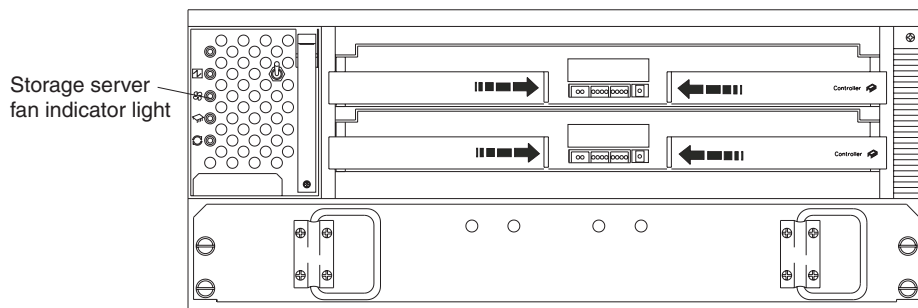
Overtemperature condition and power supply shutdown

If the fan and communications module fails or is unable to maintain an internal temperature below 70° C (158° F), one or both of the power supplies in the FAStT700

Storage Server might shut down (see the following figure). If both power supplies shut down, the FAStT700 Storage Server is not operational.



The storage-management software causes the fan and communications module fault indicator to light before the temperature has risen sufficiently to shut down the power supplies. The light comes on when the FAStT700 Storage Server temperature exceeds 45° C (113° F). The FAStT700 Storage Server shuts down if the temperature rises to 70° C (158° F). See the following figure for the location of the storage server fan fault indicator. If both power supplies shut down, the fault indicator cannot light.



Turning on the power after an overtemperature shutdown

If your FAStT700 Storage Server shuts down unexpectedly, use the storage-management software to determine if the FAStT700 Storage Server is overheated. If an overtemperature shutdown is indicated, use the following procedure to regain normal system operation.

1. Turn off the power switches and cool the FAStT700 Storage Server.
2. When the room temperature is below the upper operating temperature of 35° C (95° F), turn on the power switches.
3. Check the FAStT700 Storage Server for faults or damage. Use the storage-management software to check the overall status of the FAStT700 Storage Server and its components. Correct any problems indicated.

Turning on the power after an emergency shutdown

Use this procedure to regain normal system operation after a power failure or emergency shutdown.

1. Check all components and cables for damage. If there is no visible damage, continue with Step 2; otherwise, service the system.
2. Make sure the power cords are plugged in.
3. Make sure that the circuit breaker, drive enclosures, and storage server power switches are in the off position.
4. Turn on the circuit breakers in the cabinet, and turn on the power switches on all drive enclosures attached to the FAStT700 Storage Server.

Important: You must turn on the drive enclosures before the FAStT700 Storage Server. The controllers might not recognize the correct configuration if the attached drives are powered up after the FAStT700 Storage Server. For instructions on powering up the drive enclosures, refer to the drive enclosure documentation.

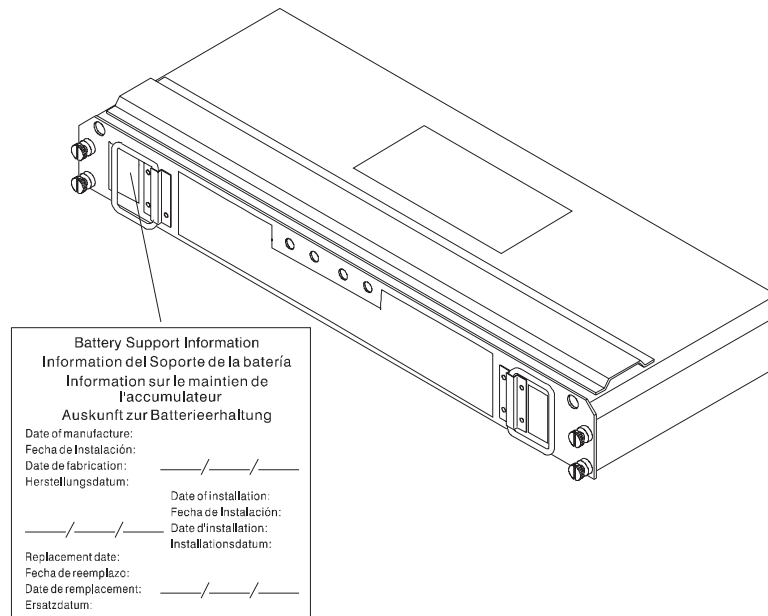
5. Turn on both power switches on the back of the FAStT700 Storage Server.
6. Check the status of the FAStT700 Storage Server and other devices. Make sure all fault indicator lights are off on the front and back of the FAStT700 Storage Server. For more information, see “Checking the indicator lights” on page 135.
7. When all the devices are powered up, check the overall system status using the storage-management software.

Checking the battery service date

Note: Replace the battery whenever it fails to hold a charge or every three years. Using the FAStT700 Storage Server in a hot environment (above 35° C or 95° F) lowers the battery life expectancy.

To check the battery service date, do the following:

1. Remove the FAStT700 Storage Server bezel (see “Removing the front bezel to access the controls” on page 195).
2. Check the Battery Support Information label, as shown in the following figure.



The Battery Support Information label on the front of the battery has three dates:

- **Date of Manufacture** - Date the battery was built at the factory
 - **Date of Installation** - Date the battery was installed in the FASSt700 Storage Server
 - **Replacement Date** - Date to replace the battery (see the note at the beginning of this section)
3. Do one the following:
- If it is time to replace the battery, install a new battery using the procedure described in “Replacing a failed battery” on page 178.
 - If it is not time to replace the battery, replace the FASSt700 Storage Server bezel.

Preparing to move the FASSt700 Storage Server

Remove each component CRU before moving the FASSt700 Storage Server to a new location or before removing the chassis from its cabinet. This helps safeguard the equipment and ensures a smoother transition to the new environment.

If you are moving the FASSt700 Storage Server a short distance, and you have sufficient assistance or equipment, you might be able to move the FASSt700 Storage Server without removing each component CRU. If you do not have sufficient assistance or equipment, use the procedure in “Removing and installing the components” to safely move the equipment to its new location.

If you are moving the FASSt700 Storage Server a significant distance, be sure to pack it in its original shipping container.

Removing and installing the components

Use the following procedure to remove all component CRUs before moving or relocating the FASSt700 Storage Server. Replace the CRUs after you complete the procedure.

1. Prepare the FASSt700 Storage Server for shutdown, as follows:

- a. Stop all I/O activity to the FAStT700 Storage Server and attached drive enclosures.
- b. Disconnect the controller and drive enclosures from the hosts.
- c. Make sure that the fast write cache indicator light on the front bezel is off (not blinking).
- d. Make sure that all applicable drive active indicator lights on each drive enclosure front panel are off (not blinking).

Note: If a parity check is in progress, it can take a long time for the drive indicator lights to stop blinking.

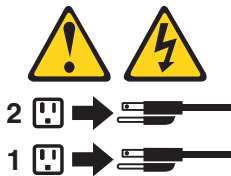
2. Remove the FAStT700 Storage Server bezel (see “Removing the front bezel to access the controls” on page 195).
3. Make sure that all amber fault indicator lights on the front and back of the FAStT700 Storage Server are off. If any fault indicator lights are on, correct the problem before turning off the power. For more information, see “Checking the indicator lights” on page 135.

Statement 5



CAUTION:

The power control button on the device and the power switch on 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.



4. Turn off both power switches and unplug the power cords from the FAStT700 Storage Server (see “Turning off the power” on page 198).
5. If you are shutting down the system, turn off the main circuit breakers or power switches.
6. Disconnect the interface cables and label the host Fibre Channel cables.

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 of less than 38 mm (1.5 in.).

7. Disconnect and label all remaining cables from the FAStT700 Storage Server, so that you can correctly reconnect them later.

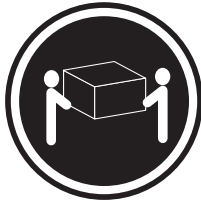
Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling static-sensitive devices, see “Handling static-sensitive devices” on page 145.

8. Remove all CRUs from the FAStT700 Storage Server.
9. Remove the two screws from the inside rear of the FAStT700 Storage Server; then, remove the two screws from the inside front of the FAStT700 Storage Server. Save

the screws for later. For detailed information, see *Rack Mounting Instructions* that come with the storage server.

Attention: Do not remove the black hex head screws. These secure the rails that support your FASSt700 Storage Server.

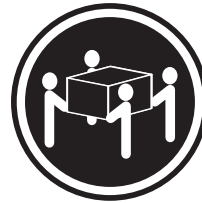
Statement 4



≥ 18 kg (39.7 lb)



≥ 32 kg (70.5 lb)



≥ 55 kg (121.2 lb)

CAUTION:

Use safe practices when lifting.

10. Slide the FASSt700 Storage Server out of the rack and set it on a level, dry surface.
11. Do one of the following:
 - If you are shipping the FASSt700 Storage Server to another location, replace all CRUs in the FASSt700 Storage Server. Carefully pack the unit in its original shipping container. You are finished with this procedure.
 - If you are moving the FASSt700 Storage Server to another cabinet, remove the support rails and power cords from the old cabinet and install them in the new one.
12. Replace the FASSt700 Storage Server and components, go to “Removing and installing the components” on page 202 and use the proper precautions as follows:
 - a. Slide the FASSt700 Storage Server into the rack.
 - b. Insert and tighten two of the screws that you removed in Step 9 on page 203, on the inside front of the FASSt700 Storage Server.
 - c. Insert and tighten the remaining two screws that you removed in Step 9 on page 203, on the inside rear of the FASSt700 Storage Server.
 - d. Replace all CRUs in the FASSt700 Storage Server.
 - e. Connect the interface cables and host Fibre Channel cables that you labeled in Step 7 on page 203.
 - f. Connect the remaining cables to the FASSt700 Storage Server.
 - g. Turn on the drive enclosures, main circuit breakers, or power switches.
 - h. Plug in the power cords to the FASSt700 Storage Server; then, turn on both power switches.
 - i. Make sure that all amber fault indicator lights on the FASSt700 Storage Server are off. If any fault indicator lights are on, correct the problem.
 - j. Replace the FASSt700 Storage Server bezel.

Operating specifications

The following table summarizes the operating specifications of the FAStT700 Storage Server.

Table 27. IBM FAStT700 Fibre Channel Storage Server operating specifications.

<p>Size (with front panel and without mounting rails)</p> <ul style="list-style-type: none"> • Depth: 63.5 cm (25 in.) • Height: 17.45 cm (6.87 in.) • Width: 48.2 cm (18.97 in.) <p>Weight</p> <p>Typical FAStT700 Storage Server fully configured: 43.99 kg (97 lbs)</p> <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: 257 V ac — Input kilovolt-amperes (kVA) approximately: 0.214 kVA 	<p>Environment</p> <ul style="list-style-type: none"> • Air temperature: <ul style="list-style-type: none"> — Altitude: 0 to 914 m (3000 ft): 10° to 35° C (50° to 95° F) — Altitude: 914 m (3000 ft) to 2133 m (7000 ft): 10° to 32° C (50° to 90° F) • Humidity: 10% to 80% 	<p>Acoustical noise emissions values: For typical system configurations:</p> <ul style="list-style-type: none"> • Sound power (idling and operating): 6.5 bels • Sound pressure (idling and operating): 65 dBA <p>These levels are measured in controlled acoustical environments according to 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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Symptom-to-FRU index

The Symptom-to-FRU index lists symptoms and the possible causes. The most likely cause is listed first.

The problem determination (PD) maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

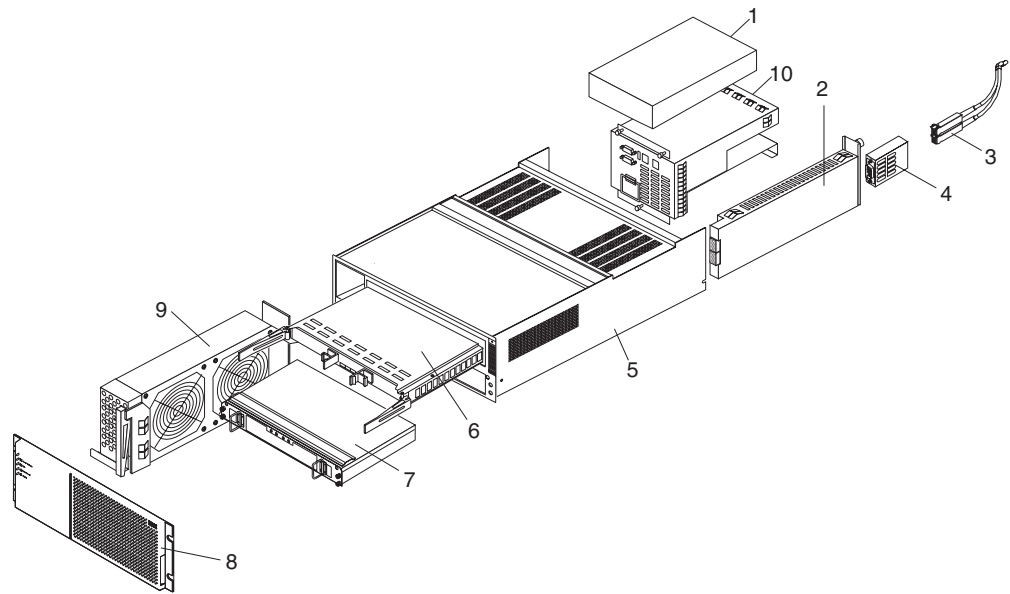
Table 28. Symptom-to-FRU index for FAStT700 RAID controller.

Problem	FRU/Action
Controller LED (front cover) is on.	<ol style="list-style-type: none"> 1. Reseat Controller CRU. 2. Place Controller online using SM7 GUI. 3. If in passive mode, check Fibre path/GBIC. 4. Controller CRU
Software issued a controller error message.	<ol style="list-style-type: none"> 1. Check Controller Fan 2. Controller CRU

Table 28. Symptom-to-FRU index for FAStT700 RAID controller.

Problem	FRU/Action
Software errors occur when attempting to access controllers or drives.	<ol style="list-style-type: none"> 1. Check appropriate software and documentation to make sure the system is set up correctly and the proper command was executed. 2. Power to the Controller 3. Interface cables 4. ID settings 5. Controller 6. Drive 7. Controller backpanel
Fan LED (front cover) is on.	<ol style="list-style-type: none"> 1. Power supply fan CRU 2. Controller fan CRU
Controller and Fan fault LEDs (front cover) are on.	<ol style="list-style-type: none"> 1. Check both Fan and Controller CRUs for fault LED and replace faulty CRU.
Fault-A or Fault-B LED (battery CRU) is on.	<ol style="list-style-type: none"> 1. Battery CRU
Full Charge-A or Full Charge-B LED (battery CRU) is off.	<ol style="list-style-type: none"> 1. Power-on Controller and allow batteries to charge for 24 hours until the Full Charge LEDs are on. 2. Battery CRU 3. Both power supplies
No power to controller (all power LEDs off).	<ol style="list-style-type: none"> 1. Check power switches and power cords. 2. Power supplies
Power Supply LED is off.	<ol style="list-style-type: none"> 1. Check and reseal power supply. 2. Check for overheating. Wait ten minutes for the power supply CRU to cool down. 3. Power supply CRU
Power Supply CRUs LED are on, but all other CRU LEDs are off.	<ol style="list-style-type: none"> 1. DC power harness

Parts listing



Index	Fibre Channel RAID Controller (Type 3552)	FRU
1	175W-Watt Power Supply	01K6743
2	GBIC Card Assembly	19K1270
3	Optical Cable - 1 Meter	19K1265
3	Optical Cable - 5 Meters	19K1266
3	Optical Cable - 25 Meters	19K1267
4	Short Wave GBIC	19K1280
4	Long Wave GBIC	19K1281
5	Frame Assembly with Midplane	19K1277
6	Fibre Channel Host Adapter (optional)	19K1273
7	Battery Backup Assembly	37L0099
8	Bezel Assembly	19K1285
9	Front Fan Assembly (Controller CRU Fan)	37L0094
10	Rear Fan Assembly	37L0102
	512 MB 100 Mhz DIMM	19K1283
	Battery Cable	03K9285
	Blank Cannister	37L0100
	Line Cord Jumper, High Voltage	36L8886
	Power Cable	37L0101
	Miscellaneous Hardware Kit	37L0092
	RAID Card	37L0098
	Rail Kit	37L0085

Chapter 9. FAStT200, Type 3542 and FAStT200 HA, Type 3542

Note: The problem determination (PD) maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

The FAStT200 type 3542 and FAStT200 HA type 3542 are compatible with the following IBM products:

- IBM FAStT Host Adapter (FRU 09N7292)
- IBM FAStT EXP500 enclosure
- Type 3534 Managed Hub
- Type 2109 Fibre Channel Switch

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 215 and “Checking the LEDs” on page 215.

To diagnose a cluster system, use the cluster problem determination procedure. See the *Fibre Channel Problem Determination Guide*.

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.

General information

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 chapter, the use of hub or external hub refers to a managed hub.)

Note: Throughout this chapter, 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.

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:
 - 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.

Features

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”.

Table 29. Features at a glance.

General <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>	RAID controllers <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>

Additional service information

Operating specifications

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

Table 30. 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: <ul style="list-style-type: none"> 10° to 35° C (50° to 95° F) Altitude: 0 to 914 m (3000 ft) — Storage server on: <ul style="list-style-type: none"> 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 values: For 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 to 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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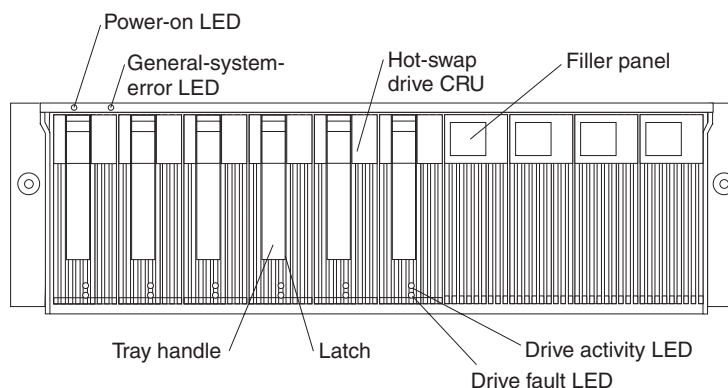
Storage server components

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 figure shows the components and controls on the front of the server.



Power-on LED

When on, this green light indicates that the unit has adequate 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 215

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

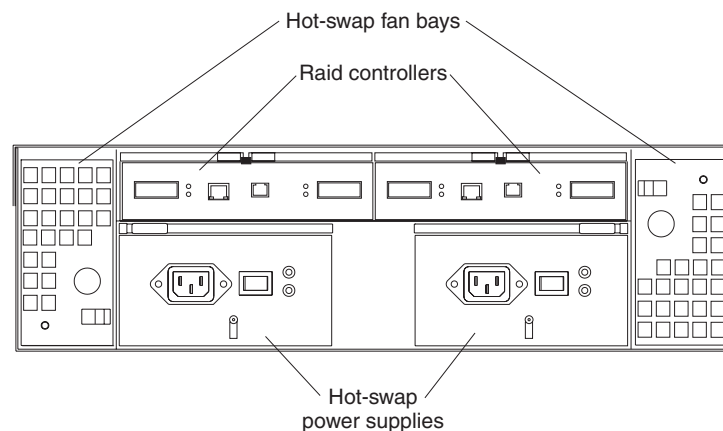
You can use this multipurpose handle to insert and remove a drive CRU in the bay.

For information on installing and replacing drive CRUs, see “Working with hot-swap drives” on page 233. For more information about the LEDs, see “Checking the LEDs” on page 215.

Back view

The following figure shows the components at the back of the 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 231.

Hot-swap fans

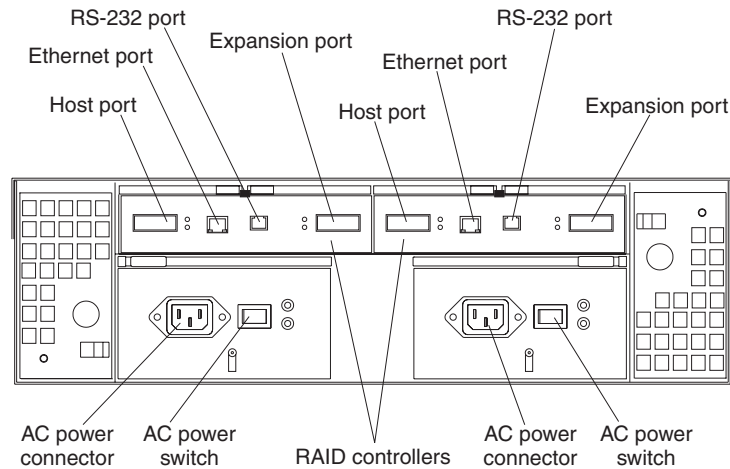
The storage server has two interchangeable hot-swap and redundant fan CRUs. Each fan CRU contains two fans. If one fan CRU fails, the second fan CRU continues to operate. Both fan CRUs must be installed to maintain proper cooling within your storage server, even if one fan CRU is not operational.

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 figure 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.

Diagnosics

To diagnose Fibre Channel problems, use FAStT MSJ (see the *Fibre Channel Problem Determination Guide*).

To diagnose the Type 3542 storage system, use the following diagnostic tools:

- Storage-management software
- Checking LEDs

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 whether the drives are responding to I/O transmissions from the host.

Storage server LEDs (front)

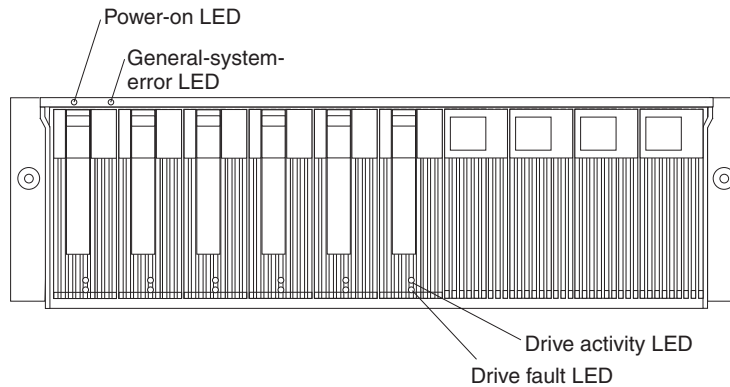


Table 31. Storage server LEDs (front).

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.
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.
<p>¹ Always use the storage-management software to identify the failure.</p> <p>² Not all component failures turn on this LED. For more information, see “Monitoring status through software” on page 215.</p>		

Storage server LEDs (rear)

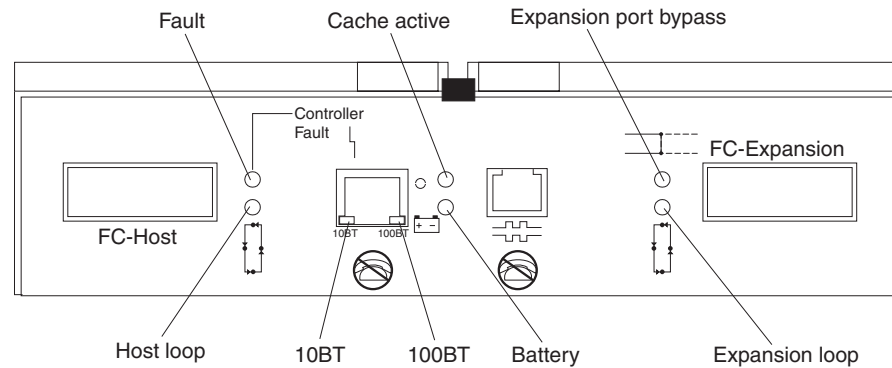


Table 32. RAID Controller LEDs .







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.
	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.

Table 32. RAID Controller LEDs .

Icon	LED	Color	Operating states ¹
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: The 10BT LED is off, 100BT LED is on. • If there is no Ethernet connection: Both LEDs are off.
No icon	100BT		

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

Fan and power supply LEDs

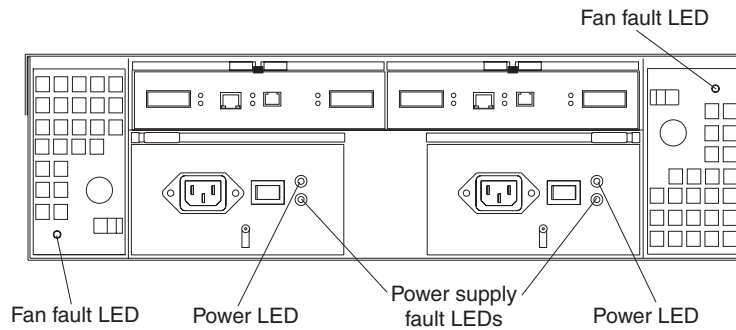


Table 33. Fan LEDs .

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

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

Table 34. 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.

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

Installation Procedures

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

Storage subsystem configuration

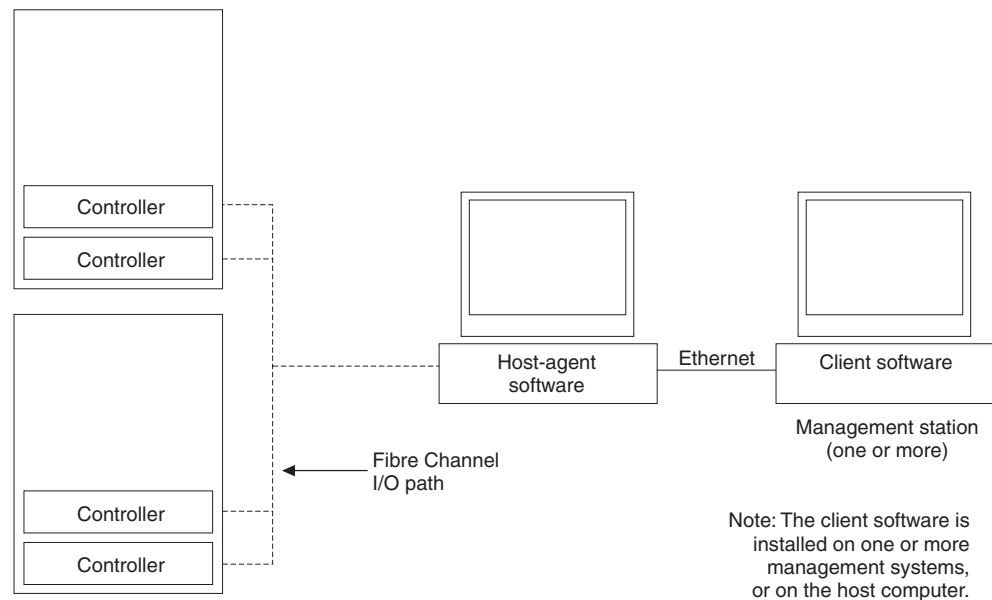
You must set up your storage subsystem configuration before you can install the storage server in a rack. Use the information in the following sections to install the storage subsystem configuration.

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.

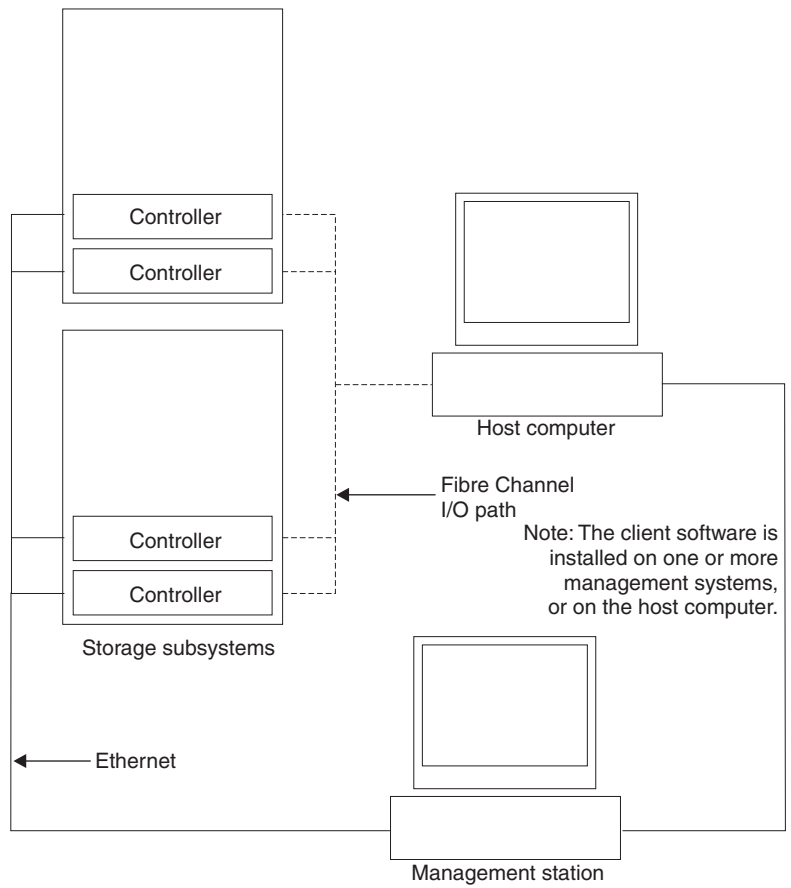
Host-agent management method

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 figure shows the host-agent management method.



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 figure shows the direct management method.



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 226.

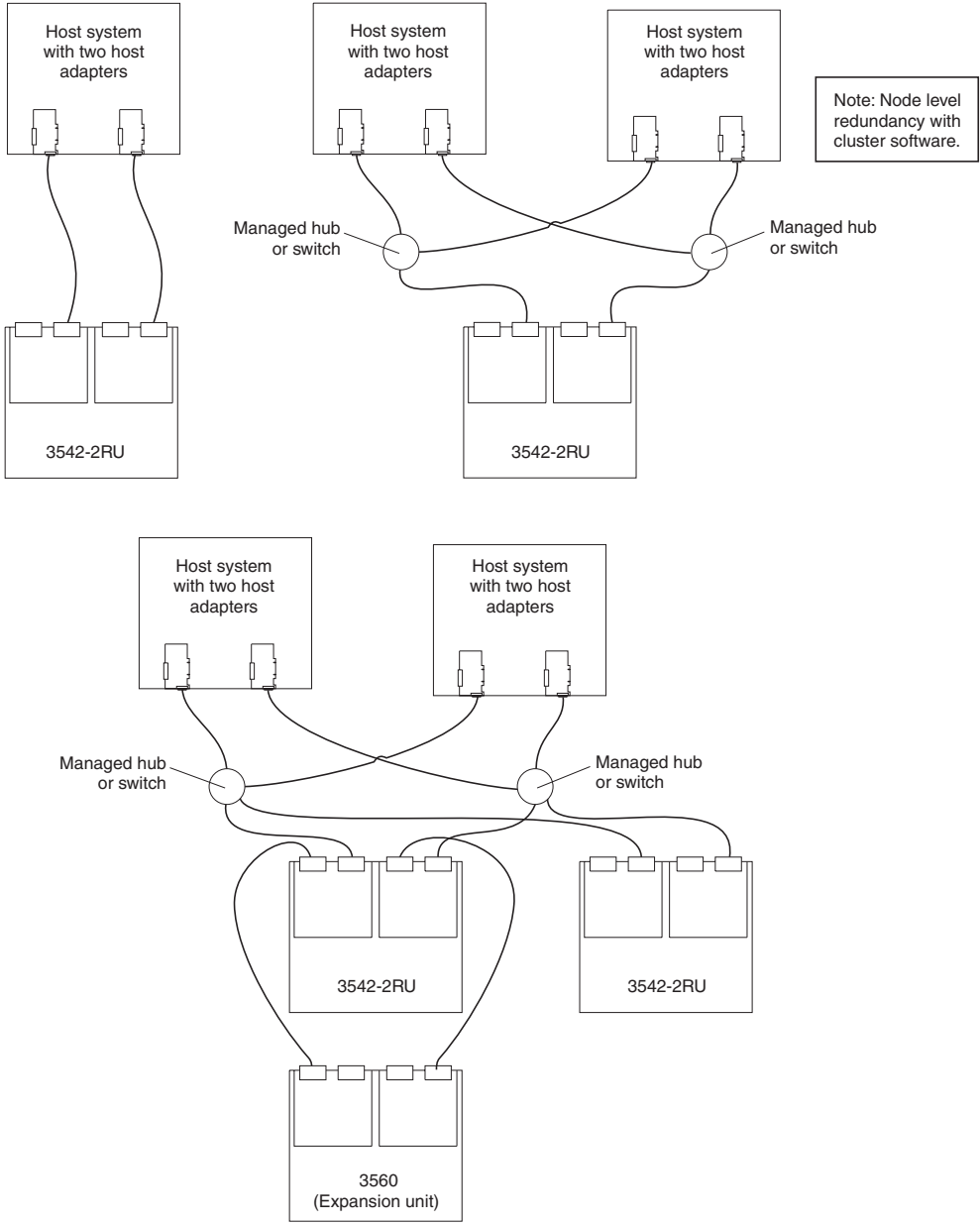
Note: The Model 3542-1RU storage server supports a single Fibre Channel host and drive loop.

Fibre Channel loop configurations

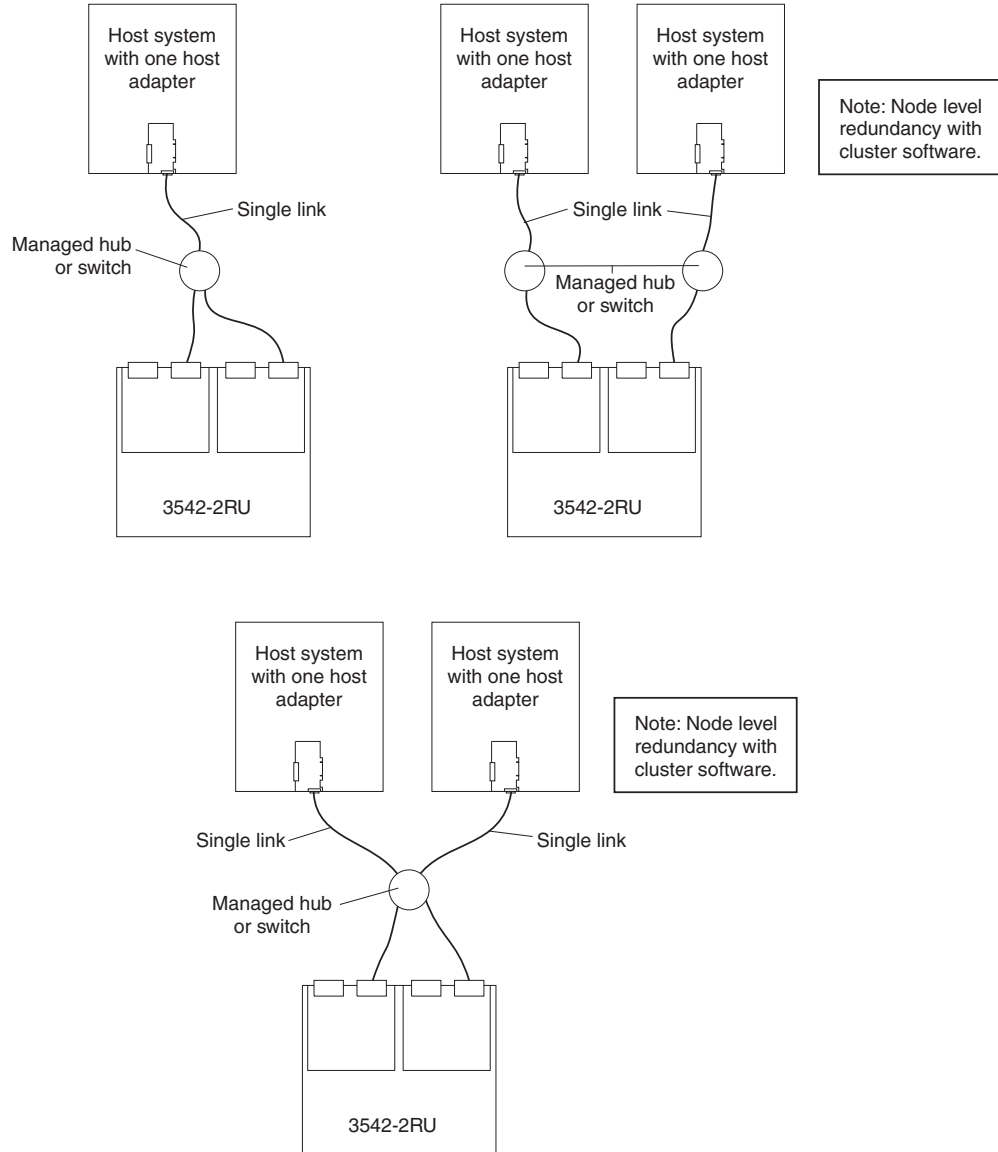
You must determine how the host systems will connect to the storage server. You can connect one host system directly to the storage server or connect multiple hosts to the storage server through managed hubs and switches. The figures in the following sections show common host system configurations.

Redundant host and drive loops: The following figure shows examples of redundant host and drive loop Fibre Channel configurations.

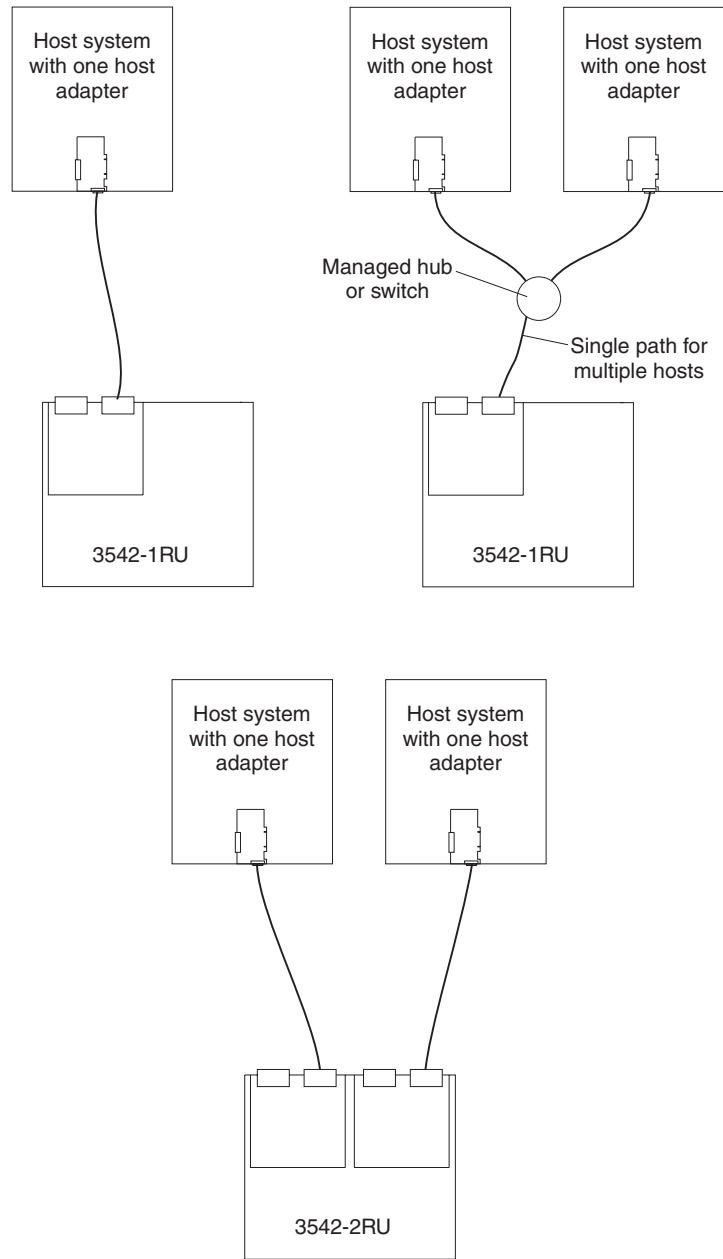
Note: These configurations have host and drive path failover protection and are recommended for high availability.



Partially-redundant host and redundant drive loops: The following figure 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.



Non-redundant host and drive loops: The following figure 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.



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 257.

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 211.
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 *IBM 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 258.
6. After you install the storage server in the rack, go to “Cabling the storage server”.

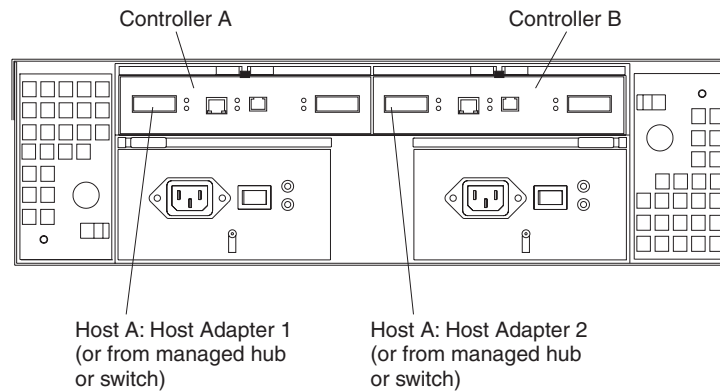
Cabling the storage server

This section 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 228 for the initial startup of the storage server.

Connecting hosts to the RAID controllers

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

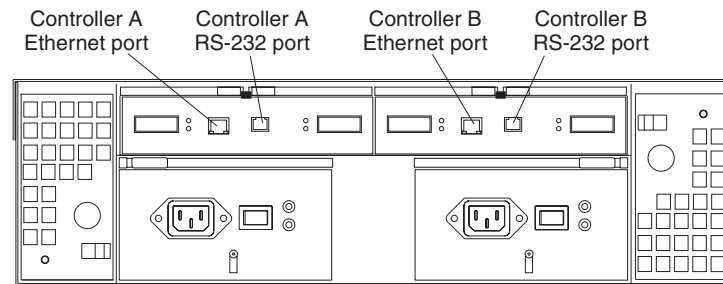
1. Install a GBIC in the host port on the RAID controller.
2. Connect the host-system cables to the RAID controller or to managed hubs and switches. The following figure shows the location on the RAID controllers where the host-system cables connect.



For examples of redundant, partially-redundant, and non-redundant host and drive loop configurations, see “Fibre Channel loop configurations” on page 220.

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 figure 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

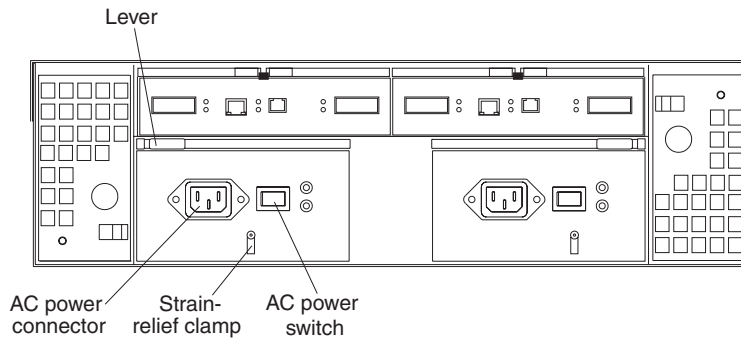
Install the storage-management software using the procedures in the software Installation and Support Guide for your operating system. Use that book and the online help to configure the logical drives, partitions and so on for the RAID controllers. Use your operating system documentation to make the 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 215.

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 figure 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 228 for the initial startup of the storage server.

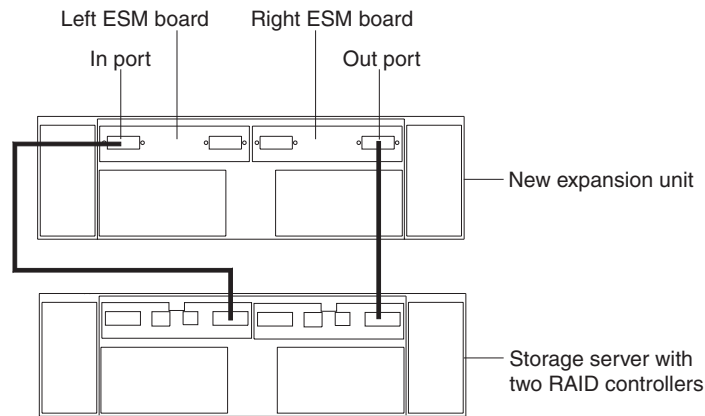
Connecting additional expansion units

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 figure 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.

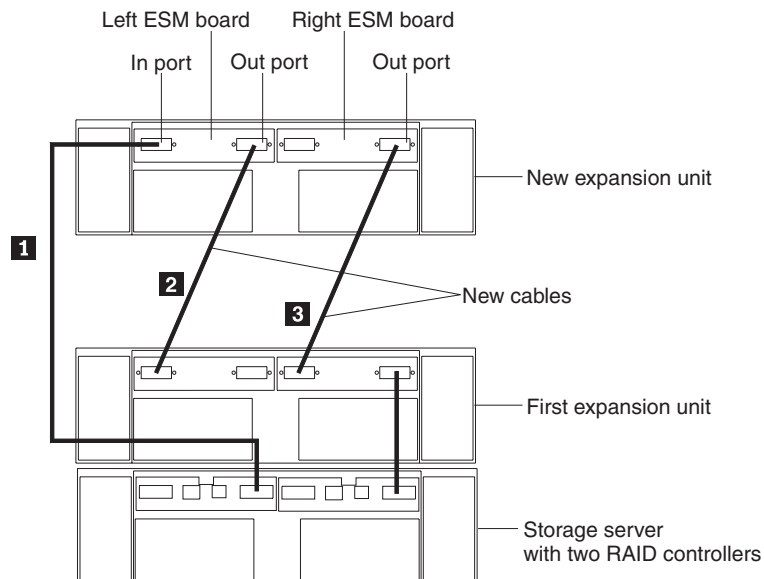


After you complete all connections, the storage server locates the new drives.

- 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 figure to connect a second expansion unit to the storage server after previously adding the first expansion unit.

- Disconnect cable **1** from its current connection and connect it to the In port on the left ESM board on the new expansion unit.
- 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.
- 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 unit.
- 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.

- 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 section 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 231.

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 234.

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 215).

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 215.

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 “Diagnostics” on page 215.

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:

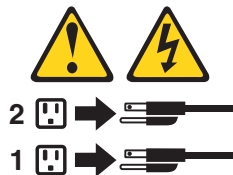
- Instructions in a hardware or software procedure require you to turn off the power.
- A service technician tells you to turn off the power.
- A power outage or emergency situation occurs (see “Performing an emergency shutdown” on page 230).

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 228.

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 229) 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 231 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 231 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 “Diagnostics” on page 215).

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 228 to determine the proper power-on sequence for your system.
4. Complete step 3 on page 228 and step 4 on page 228 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 228 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 229 and 4 on page 228 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.

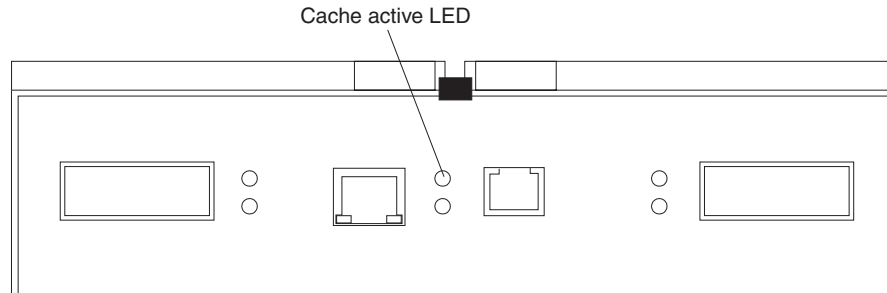
See the storage-management software documentation for information on setting cache memory options.

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 figure 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, you 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.

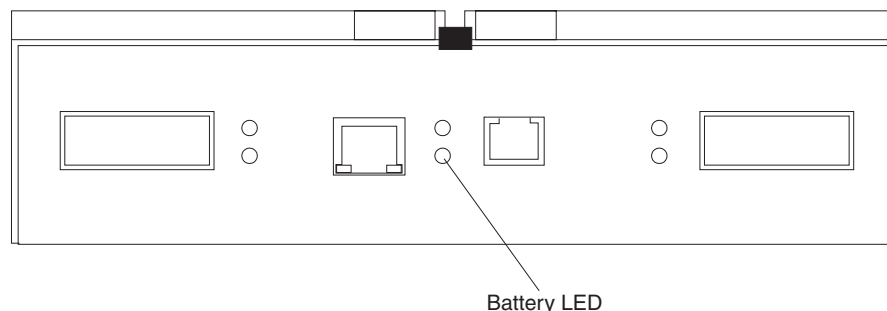
Each RAID controller has a green Battery LED on the back that indicates the battery status, as follows:

- 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 figure shows the location of the Battery LED on the front of the RAID controller.



Installing and replacing options

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.

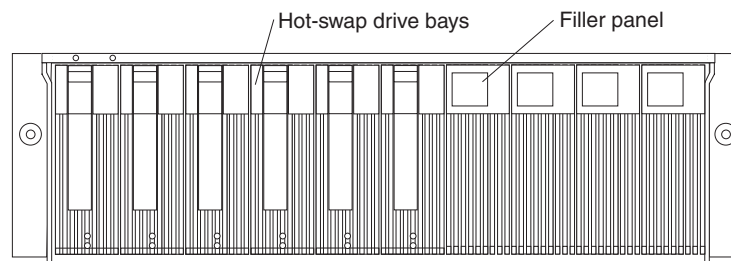
To reduce the possibility of electrostatic discharge (ESD) when you handle options and storage server components, observe the following precautions:

- 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 figure shows the location of the hot-swap drive bays that are accessible from the front of the storage server. In this figure, 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 that indicate the status for that particular drive. For information about the drive LED operating states and descriptions, see “Storage server LEDs (front)” on page 216.

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 air flow 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, you should perform the following:

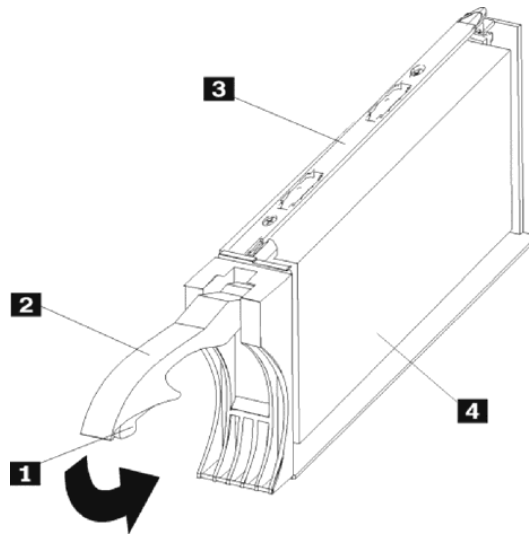
- Read the safety and handling guidelines provided in “Electrical safety” on page 393 and “Handling electrostatic discharge-sensitive devices” on page 394.
- Ensure that the current system configuration is working properly.
- Back up all important data before you make changes to storage devices, such 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.

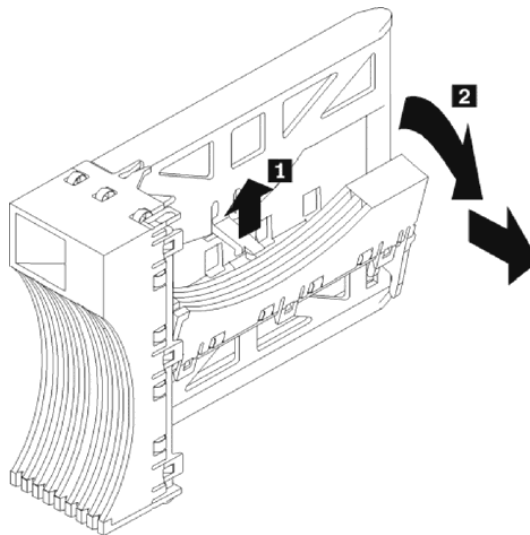
Note: If you are replacing a drive, see “Replacing hot-swap drives” on page 236.

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 215 and “Symptom-to-FRU index” on page 264.
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:

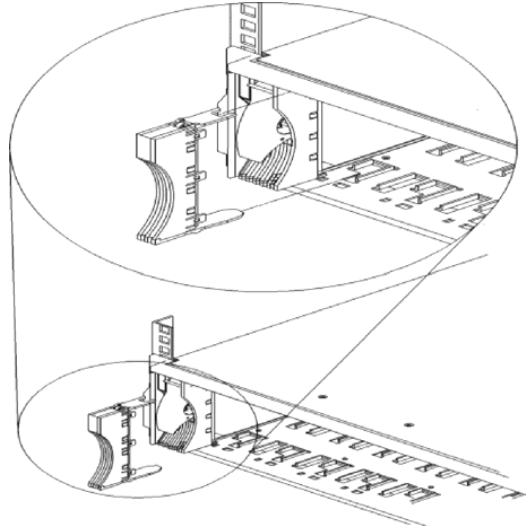
Note: The hard disk drive comes with a tray already attached. Do not attempt to detach the drive **4** from the tray **3**.



- 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 236.
- 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 figure.



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



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.

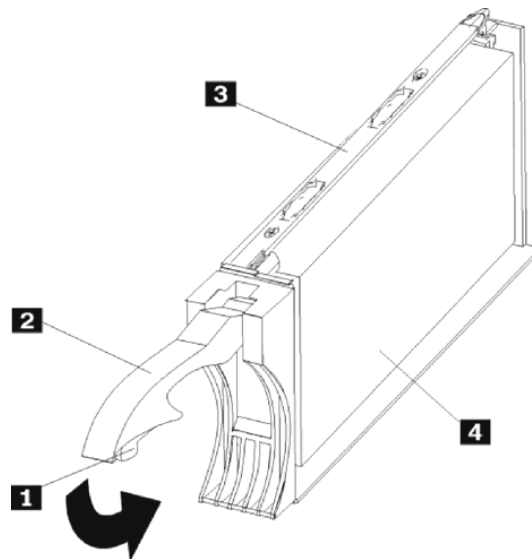
Use the following procedure to replace host-swap drives.

1. Check the hardware and software documentation that is provided with the system to see whether 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 234).
- 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 whether 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”.

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 240.

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 237, 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 whether 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 233.

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 236 to remove the drives that you want to replace. Use the procedures in “Installing hot-swap drives” on page 234 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 on page 239. 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 238).

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 237, 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 233.

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 236 to remove the failed drive. Use the procedures in “Installing hot-swap drives” on page 234 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.

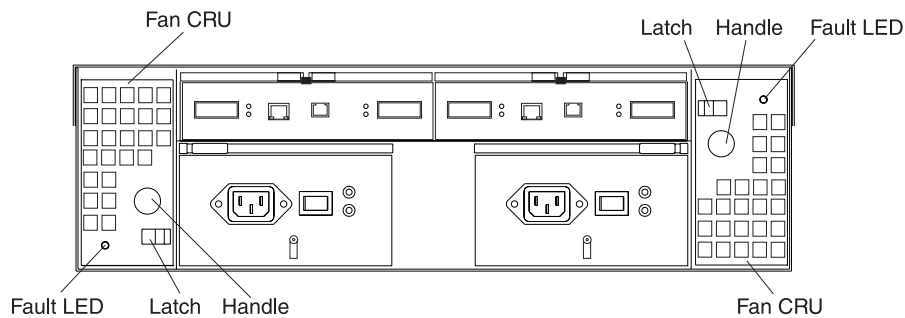
9. When reconstruction is finished on the new drive, repeat step 5. through step 8. for each additional drive that you want to install.
10. Use the storage-management software to configure the additional space on the new drives.

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 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 231.

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

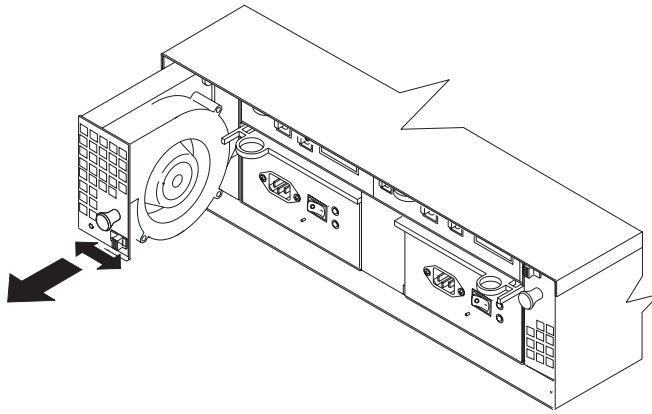
Use the latches and handles to remove or install the fan CRUs.

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 “Diagnostics” on page 215.

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:

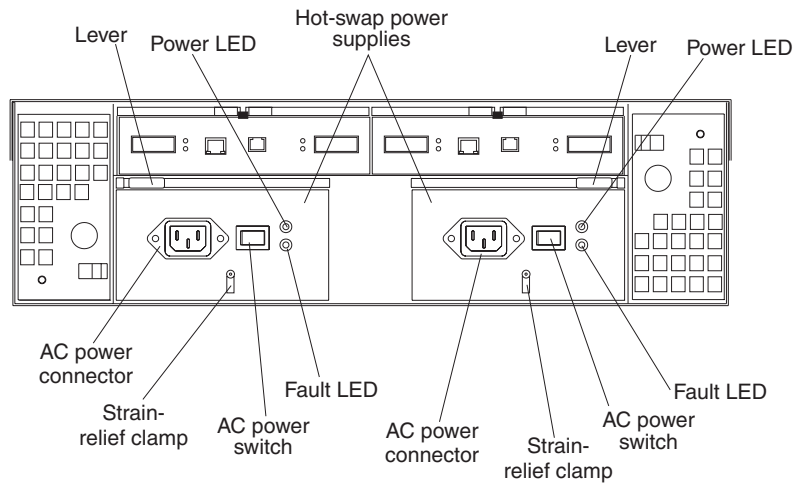
- Over-voltage
- Over-current
- Overheated power supply

If any of these conditions occurs, one or both power supplies 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 emergency shutdown” on page 231 and “Restoring power after an overtemperature shutdown” on page 231.

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 figure.



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.



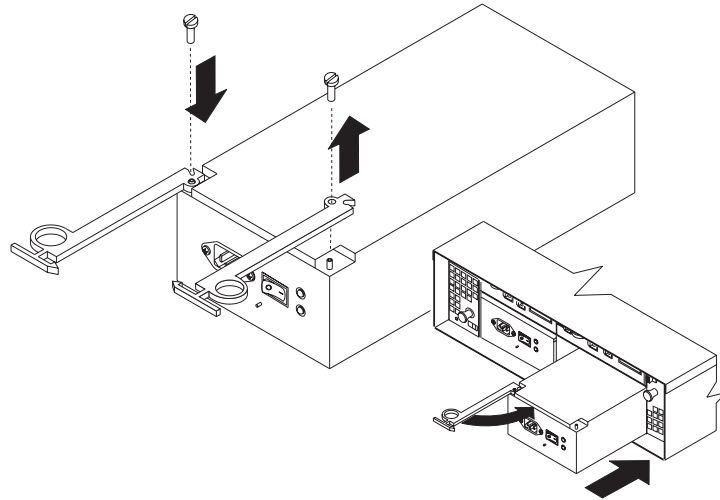
Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

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 215.

Working with hot-swap RAID controllers

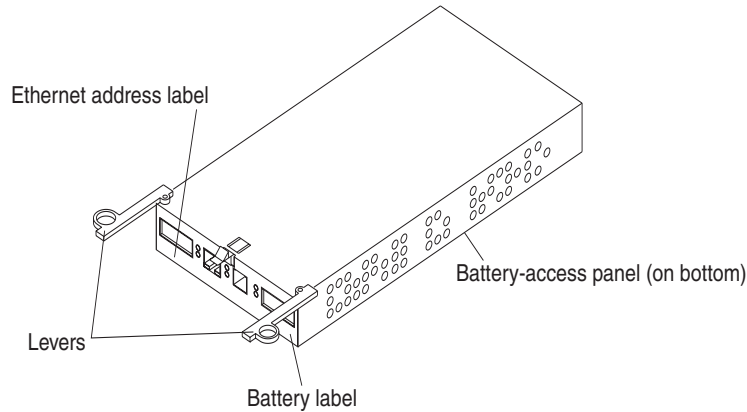
Attention: To prevent overheating, replace the RAID controller or blank filler within 30 minutes of removal. If the RAID controller or filler is removed for more than 30 minutes, you might get a nominal overheating warning indication.

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 that is printed on a label on the front. There is also a label giving the installation and expiration date of the battery. The following figure shows the location of these items.



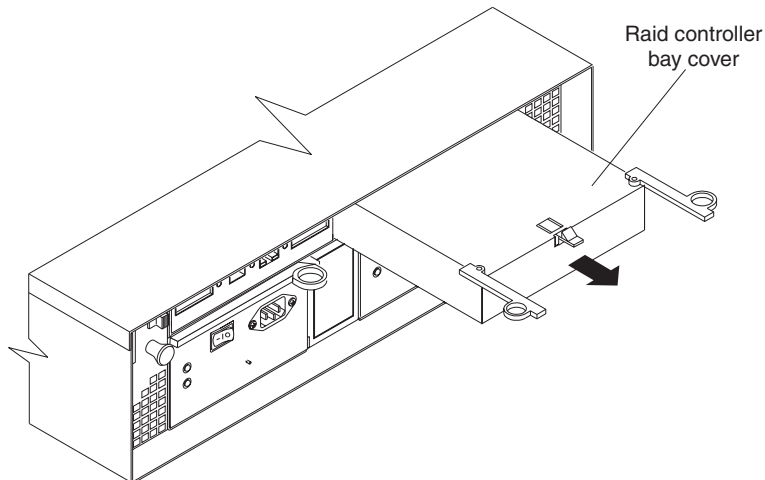
For information about the RAID controller cache memory and rechargeable battery, see “Cache memory and RAID controller battery” on page 231.

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 FAStT200 Redundant RAID Controller option.

Note: The FAStT200 Redundant RAID Controller option comes with a RAID controller cache battery installed.

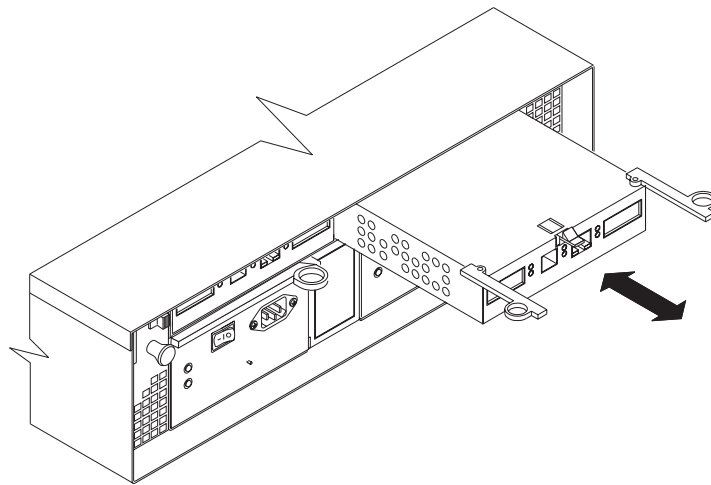
1. To remove the RAID controller bay cover, use the following figure and procedure:



- 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 233.

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 figure.



- 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” on page 256.
7. Connect the Fibre Channel cables, using the instructions in “Working with GBICs and fiber-optic cables” on page 255. For information about connecting the storage server to other devices, see “Fibre Channel loop configurations” on page 220 and “Cabling the storage server” on page 224.
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.

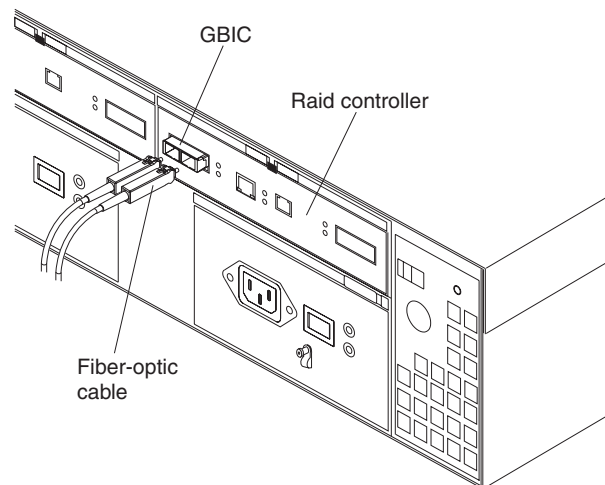
Replacing a RAID controller

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.

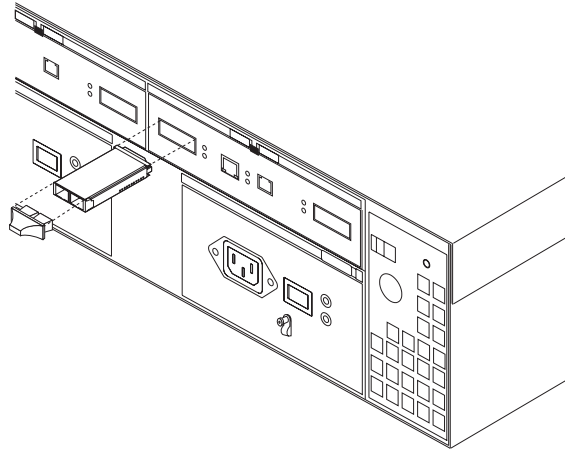
To replace a RAID controller, do the following:

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 229.
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 figure.

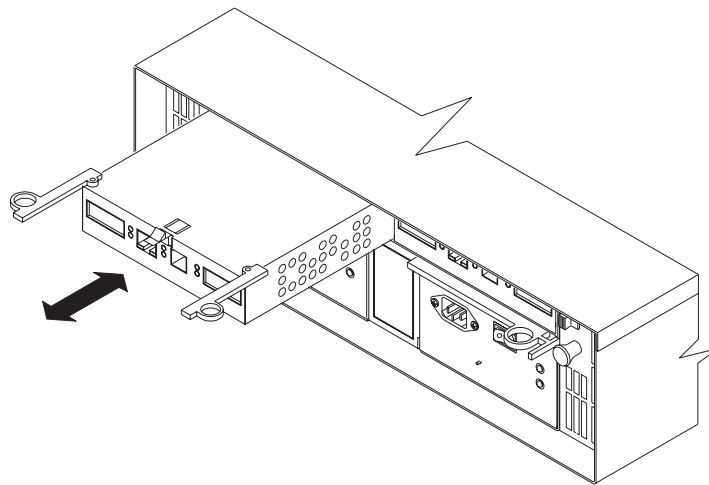


After removing the Fibre Channel cables, insert the protective caps.

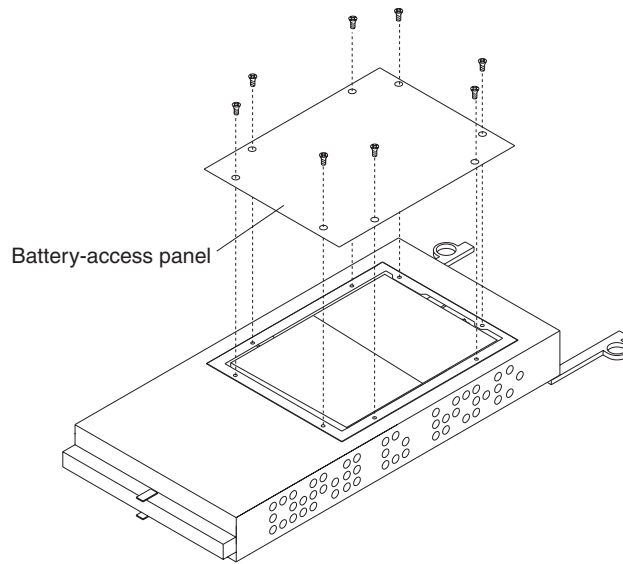
5. Use the following procedure to remove the GBICs from the RAID controller that has failed.
 - a. Move the metal latch on the GBIC to the unlocked (center) position.



- 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.

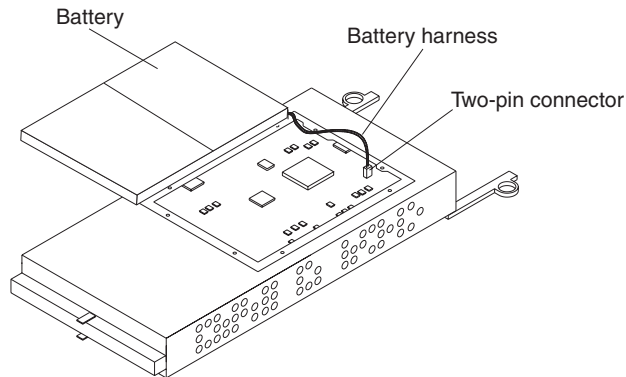


- b. Grasp the pull-rings; then, pull on the levers and remove the RAID controller.
7. To remove the cache battery, use a Phillips head screwdriver to remove the eight screws from the battery access panel on the bottom of the RAID controller that you just removed, as shown in the following figure.



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 figure.



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 233.

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 256.
17. Connect the Fibre Channel cables to their original locations, according to the instructions in “Installing fiber-optic cables” on page 257.
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 228.
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 233.

2. Unpack the new battery.

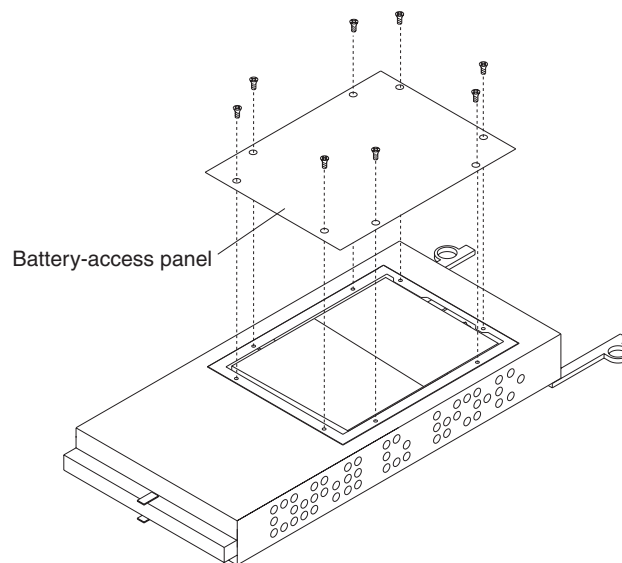
Set the new battery on a dry, level surface. Save all packing materials in case you need to return the battery.

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.

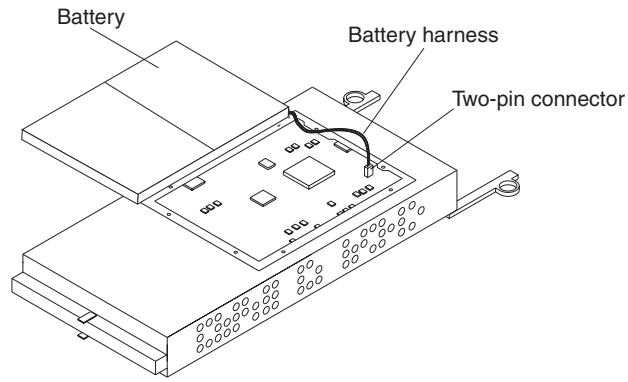
Attention: To prevent data loss if you have a single-controller configuration, you must shutdown your system before you can replace the RAID controller battery. For the proper shutdown sequence, see “Turning off the storage server” on page 229.

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 255.
8. Remove the RAID controller as described in “Replacing a RAID controller” on page 249.
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 figure.

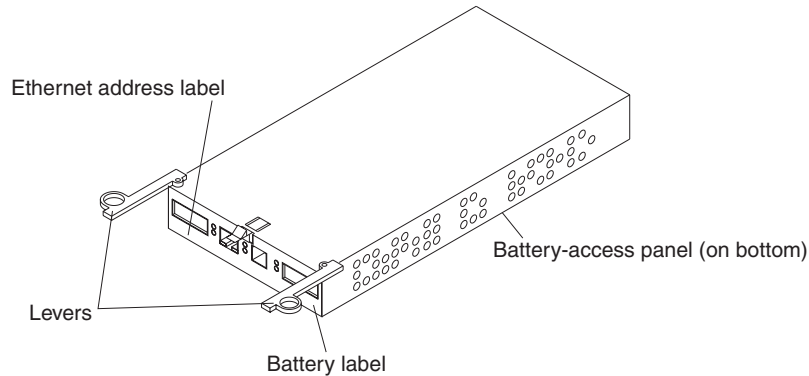


10. Lift the old battery out of the RAID controller CRU.

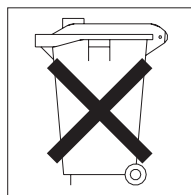
Note: If you cannot lift out the battery, turn over the RAID controller and hold it upside-down so that the battery is close above a flat surface and let it fall out. Do not let the battery pull on the battery harness.



11. Connect the battery harness on the new battery to the two-pin connector on the controller board.
12. Position the battery inside the RAID controller, and replace the battery-access panel.
13. 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 figure.



14. 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
15. Dispose of the used battery CRU according to local and federal regulations, which might include hazardous material handling procedures.



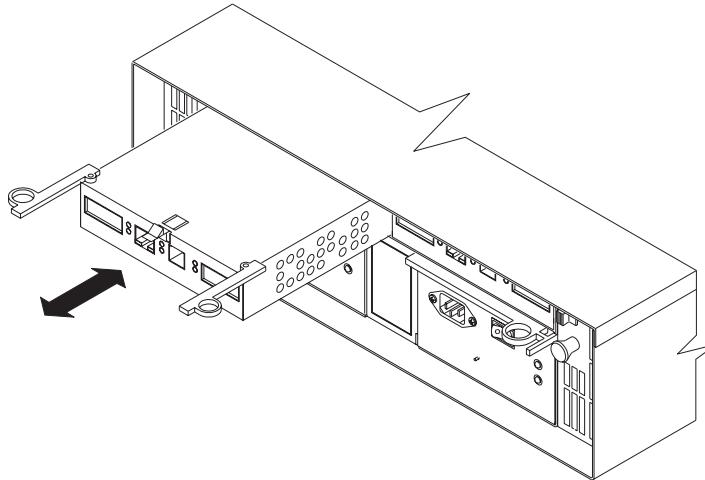
CONTAINS
SEALED LEAD
BATTERY.
BATTERY
MUST BE
RECYCLED.

Pb

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. Install the RAID controller, as shown in the following figure.



- a. Slide the RAID controller all the way into the empty slot.
 - b. Close both levers until the latch locks into place.
17. Install the GBICs and then connect the Fibre Channel cables to their original locations.
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 228.
19. 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.
20. 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.

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. The GBICs are laser products.

Statement 3



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.

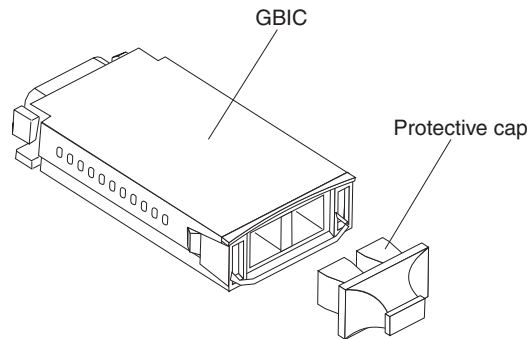
Installing GBICs

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.

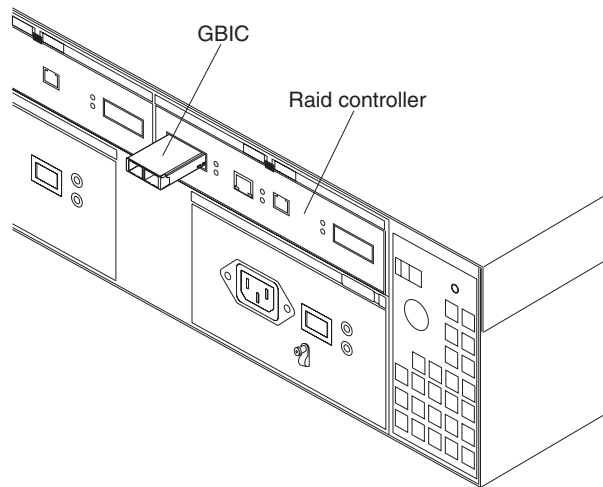
To install a GBIC, do the following:

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



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 figure.



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).

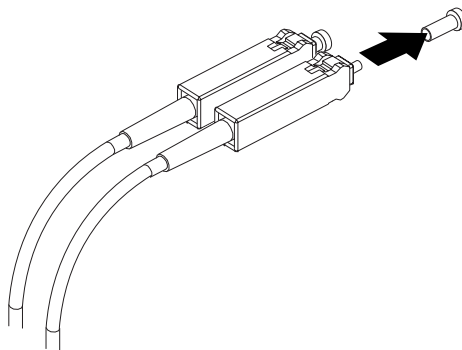
Installing fiber-optic cables

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

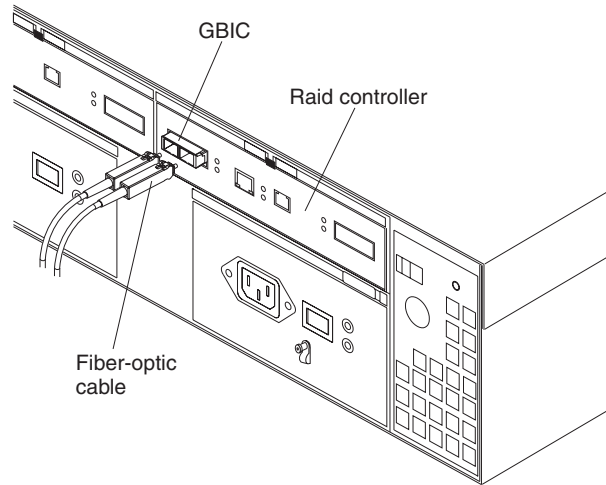
- Do not route the cable along a folding cable-management arm.
- When attaching fiber-optic cables to a device on slide rails, leave enough slack in the cable so that it does not bend to a radius smaller than 76 mm (3 in.) when extended or become pinched when retracted.
- Route the cable away from places 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 figure.



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

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 32 on page 217.

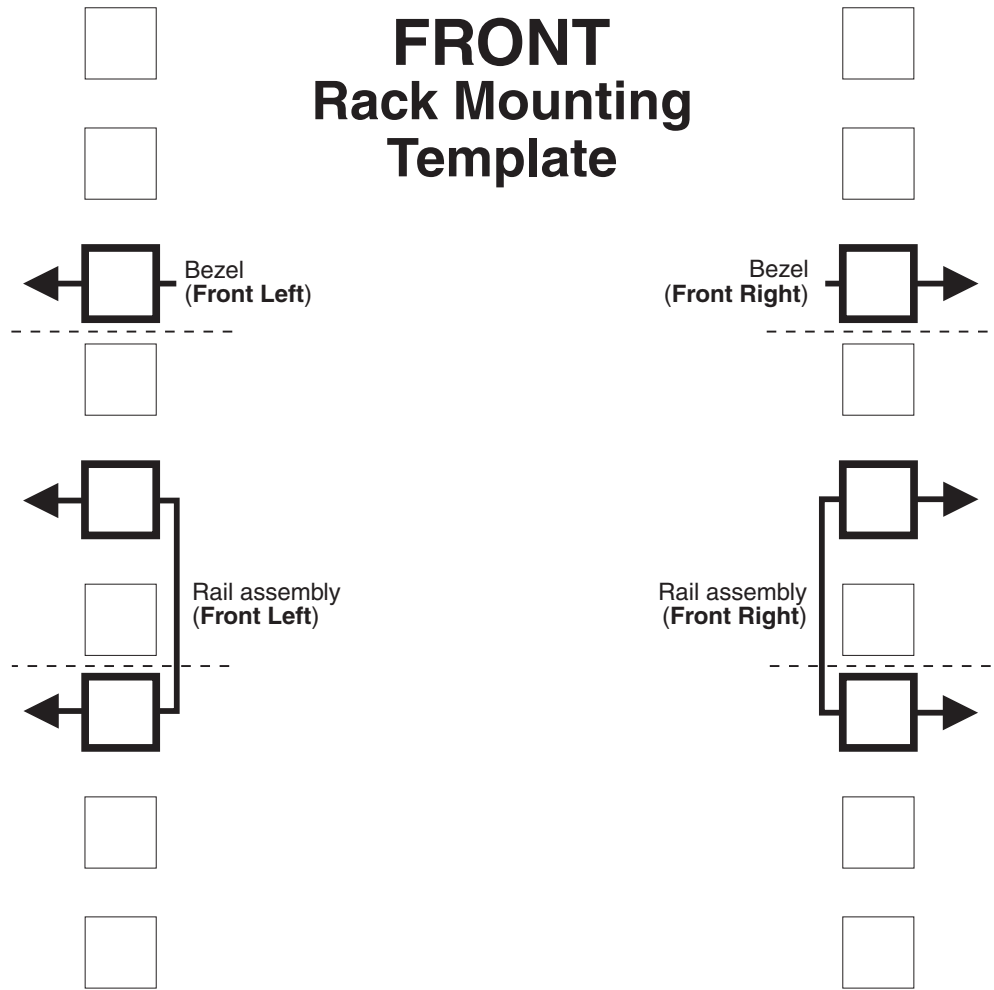
To remove the fiber-optic cables and GBICs, do the following:

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.

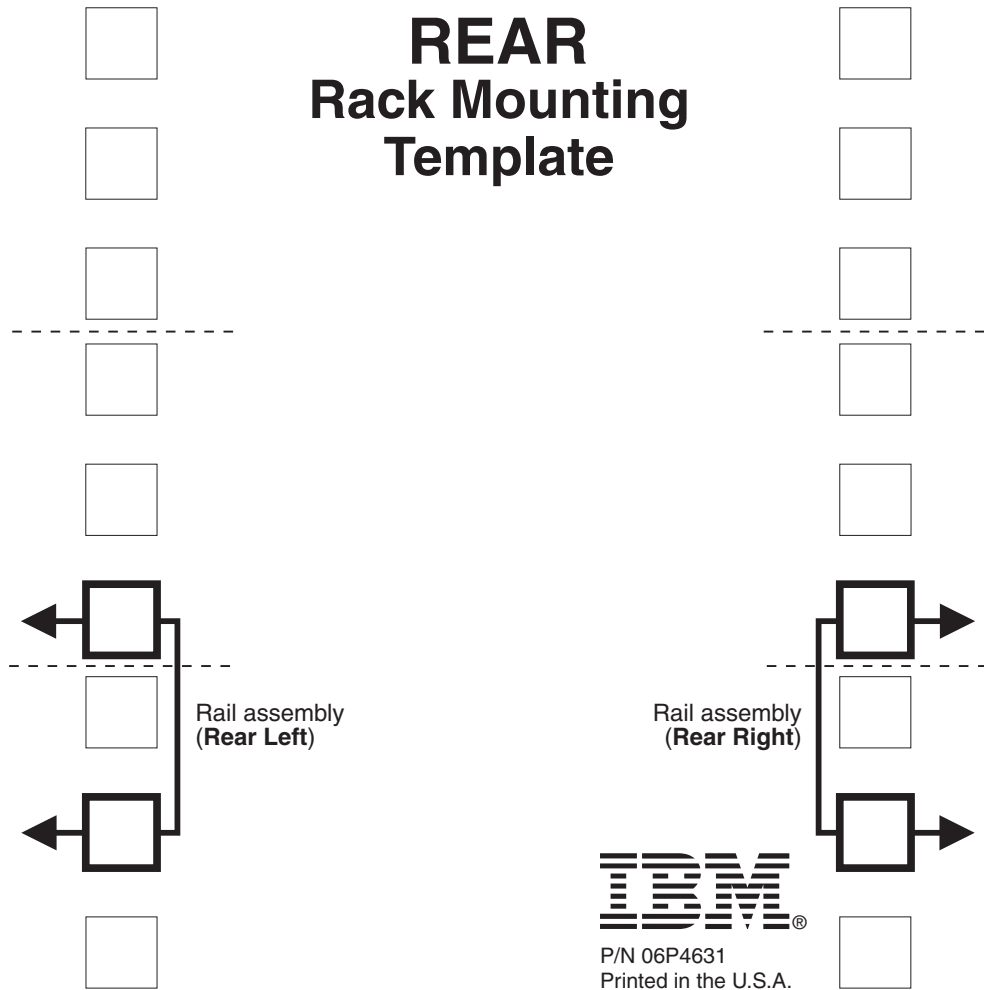
Rack mounting template and instructions

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

FRONT Rack Mounting Template



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)

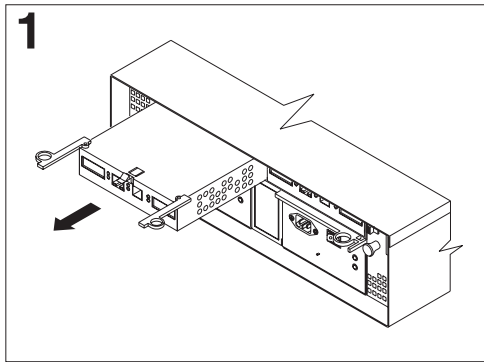


≥55 kg (121.2 lbs)

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.

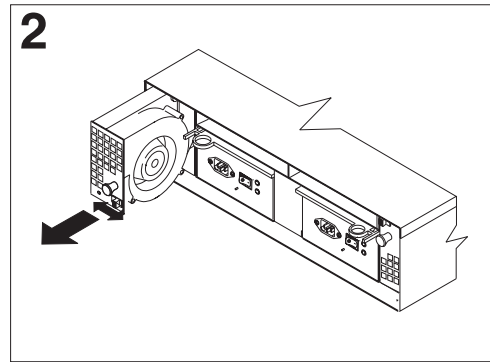
- Cage nuts (10)
- Clip nuts (10)
- M6 screws (10)
- Side rails (2)

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.



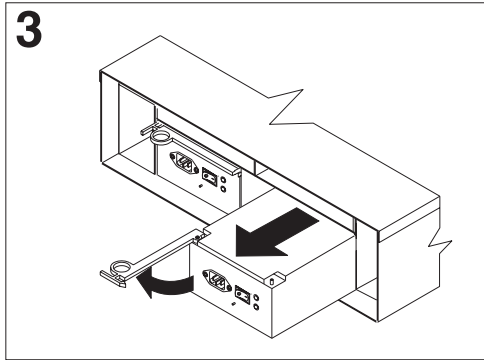
To remove a RAID controller, push down on the latch centered above the controller; then, grasp the pull-rings on the levers and pull them to remove the RAID controller and set it aside for later installation.

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



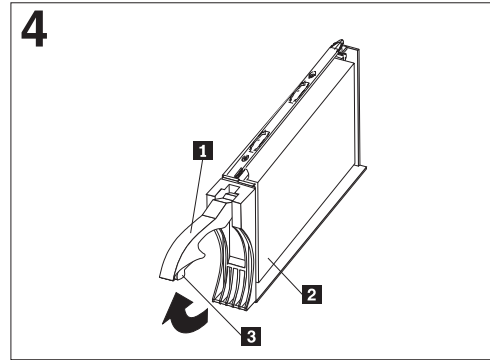
To remove a hot-swap fan, slide the latch on the fan to unlock it; then, pull the handle and remove the fan from the storage server.

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.

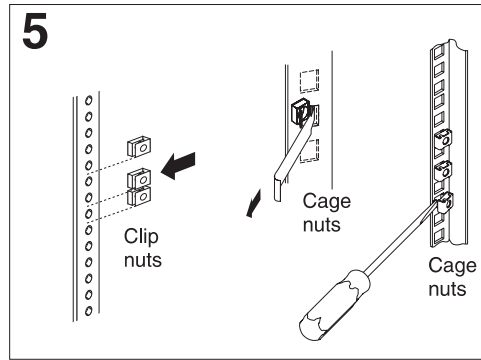
Repeat this step for the other power supply; then, set both power supplies aside for later installation.



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.

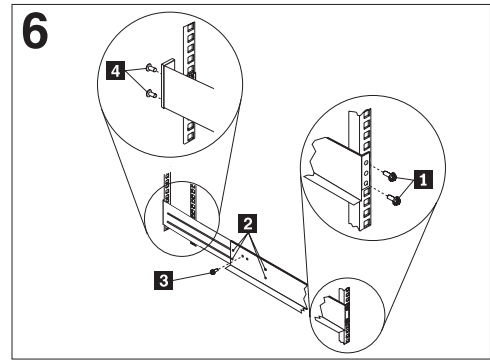
Note: Before you remove any hard disk drives, make sure that you mark their location so that you can reinstall them in the same location.

Repeat this step for all hard disk drives.



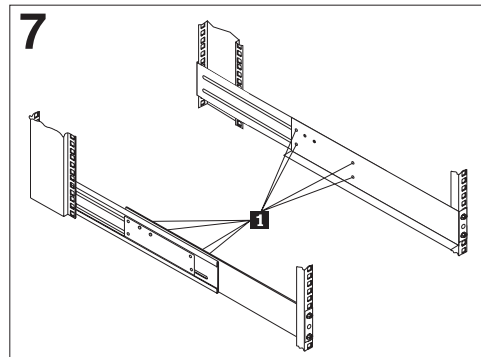
Use the attached template and stickers to mark the appropriate holes on your rack; then, install clip nuts or cage nuts as required for your rack cabinet.

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

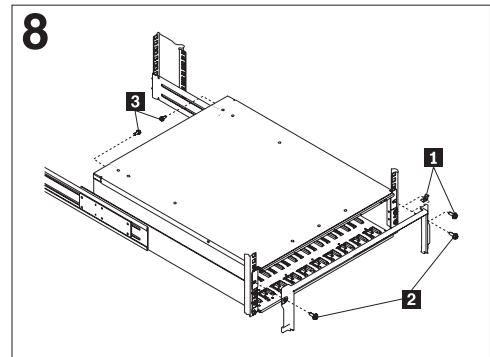


On the rail marked **R**, remove the 6-32 in. screw **3** and loosen the four screws **2**; then, hold the front of the rail against the outside of the right rack-mounting-flange and loosely install two M6 screws **1**.

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.

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.

Refer to the problem determination maps (PD maps) in the *Fibre Channel Problem Determination Guide* for more detailed procedures for problem isolation.

Table 35. Symptom-to-FRU index for FAST200, Type 3542 and FAST200 HA, Type 3542 controller.

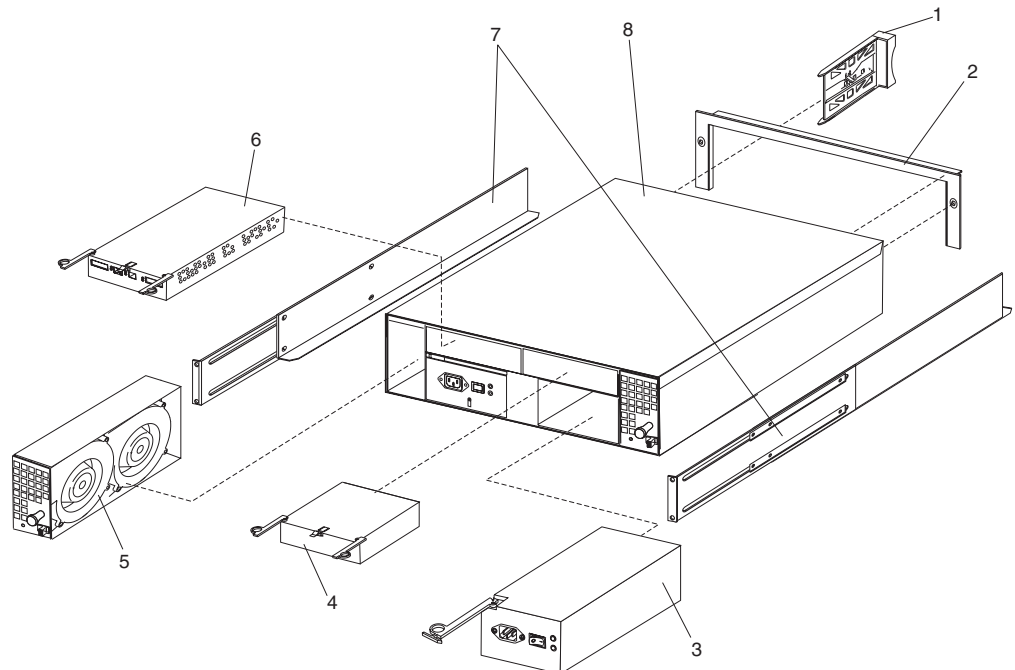
Problem Indicator	Action/FRU
Amber LED on - Drive CRU	1. Replace the drive that has failed.
Amber LED on - Fan CRU	1. Replace the fan that has failed.
Amber LED on - RAID controller Fault LED	1. If the RAID controller Fault LED is lit, replace the RAID controller.
Amber LED on - Expansion port Bypass 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

Table 35. Symptom-to-FRU index for FAStT200, Type 3542 and FAStT200 HA, Type 3542 controller.

One or more green LEDs off - Host Loop	<ol style="list-style-type: none"> 1. Check if host managed hub or switch is on. Replace 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.

Parts Listing



This parts listing supports the following 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

Table 36. 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

Table 36. Power cords.

IBM power cord part number	Used in these countries and regions
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 10. IBM EXP15 and EXP200 enclosures

Note: The problem determination (PD) maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

The IBM Netfinity EXP15 and EXP200 enclosures are compatible with:

- Type 3526 Fibre Channel RAID controller

This chapter contains the information for the EXP15 and EXP200 enclosures. Information that is common to both enclosures is given first. Information that is specific to each enclosure is given second.

Features of IBM EXP15 type 3520 and EXP200 type 3530

Modularized Components

- High-capacity hard disk drives
- Environmental Services Monitor (ESM) board
- Power supplies
- Cooling fans

Technology

- Disk array technology
 - EXP15 type 3520 supports disk array technology
 - EXP200 type 3530 supports disk array technology (Ultra2 disk drives only)
- SCSI host interface
 - EXP15 type 3520 supports LVD or SE host interface
 - EXP200 type 3530 supports Ultra2 or Ultra host interface
- Redundant data storage, cooling system, and power system
- Hot-swap technology for hard disk drives, power supplies, and fans
- Automatic recovery after power failure without user intervention
- EXP200 type 3530 supports clustering

User Interface

- Built-in Power, Activity, and Fault indicators
- Identification labeling on Customer Replaceable Units, (CRUs), rear indicator lights, switches and connectors

Hard Disk Drives

- Supports up to 10 hard disk drives
- Supports 2 channels per expansion unit
- Supports 5 hard disk drives per channel

ESM Board

- ID numbers
 - Switch controlled for hard disk drive channel numbers: 1 and 2

- Switch On - Hard Disk Drive SCSI IDs: 0, 1, 2, 3, and 4 for both Channel 1 and Channel 2
- Switch Off (default) - Hard Disk Drive SCSI IDs: 0, 1, 2, 3, 4, 8, 9, 10, 11, and 12 for Channel 1 or Channel 2
- Technology and Interfaces
 - Model:
 - EXP15 type 3520: SCSI, LVD, or single-ended
 - EXP200 type 3530: Ultra2 or Ultra
 - SCSI bus interface: Two 68-pin VHDCI connectors for incoming and outgoing SCSI bus cables

Diagnosics and test information (for EXP15 and EXP200)

Important

The service procedures are designed to help you isolate problems. They are written with the assumption that you have model-specific training on all computers, or that you are familiar with the computers, functions, terminology, and service-related information provided in this manual and the appropriate IBM PC/Netfinity Server Hardware Maintenance Manual.

The following is a list of problems and references for diagnosing the IBM EXP15 Storage Expansion Unit - Type 3520 and IBM EXP200 Storage Expansion Unit - Type 3530.

Problem	Reference
Hard Disk Drive Numbering	See "EXP15 drive numbering" on page 277 or "EXP200 drive numbering" on page 287.
Error Codes/Error Messages	Refer to the Symptom-to-FRU Index for the server that the Storage Expansion Unit you are servicing is connected to.
Expansion Unit Options Switches	See "Expansion unit option switches" on page 275.
Fan Controls and Indications	See "EXP15 fan controls and indicators" on page 279 or "EXP200 fan controls and indicators" on page 290.
Performing a Shutdown	See "Performing a shutdown" on page 271.
Power Supply Controls and Indicators	See "EXP15 power supply controls and indicators" on page 280 or "EXP200 power supply controls and indicators" on page 292.
Rear Controls and Indications	See "ESM board controls and indicators" on page 274.
Turning the Power On	See "Turning the power on" on page 271.

Additional service information (for EXP15 and EXP200)

This section provides service information that is common to both the EXP15 and EXP200 enclosures.

- "Performing a shutdown" on page 271
- "Turning the power on" on page 271
- "Specifications" on page 271

Performing a shutdown

Note: If the Expansion Unit loses power unexpectedly, it might be due to a hardware failure in the power system or midplane (see “Symptom-to-FRU index for EXP15 and EXP200” on page 273).

To perform a shutdown:

1. Make sure that all I/O activity has stopped. If applicable, logically disconnect from the host controller.
2. Make sure that all amber Fault LEDs are off. If any Fault LEDs are lit (drives, power supplies, or fans), correct the problem before you turn off the power.
3. Turn off *both* power supply switches on the back of the expansion unit.

Turning the power on

Use this procedure to power-on the EXP15 and EXP200 Storage Expansion unit.

• Initial start-up:

1. Verify that all communication and power cables are plugged into the back of the expansion unit.
 - a. All hard disk drives are locked securely in place.
 - b. **For EXP15:** The option ID switch on the expansion unit is set correctly.
For EXP200: Option switches 1 through 5 and the tray number switch on the expansion unit are set correctly.
 - c. The host controller and other SCSI bus devices are ready for the initial power-up.
 - d. Power-on the expansion unit before powering on the server.
2. Turn on the power to each device, based on this power-up sequence.
3. Turn on *both* power supply switches on the back of the expansion unit.
4. Only the green LEDs on the front and back should be on. If one or more of the amber Fault LEDs are on, refer to “Symptom-to-FRU index for EXP15 and EXP200” on page 273.

• Re-starting:

If you are re-starting after a normal shutdown, wait at least ten seconds before you attempt to turn on *either* power supply switch.

Specifications

Table 37. Specifications for EXP15 type 3520 and EXP200 type 3530.

Specification	EXP15 type 3520	EXP200 type 3530
Size (with front panel)	Depth: 57.9 cm (22.8 in.)	Depth: 56.3 cm (22.2 in.)
	Height: 13.2 cm (5.2 in.)	Height: 12.8 cm (5 in.)
	Width: 48.2 mm (18.97 in.)	Width: 44.7 mm (17.6 in.)
Weight	Typical expansion unit as shipped: 39 kg (86 lb)	Typical expansion unit as shipped: 22.5 kg (49.5 lb)

Table 37. Specifications for EXP15 type 3520 and EXP200 type 3530.

Specification	EXP15 type 3520	EXP200 type 3530
Electrical Input:	Sign-wave input (50 to 60 Hz)	
	<ul style="list-style-type: none"> • Low range: Minimum: 90 V ac / Maximum: 127 V ac • High range: Minimum: 198 V ac / Maximum: 257 V ac 	
Environment	Input Kilovolt-amperes (kVA) approximately	
	<ul style="list-style-type: none"> • Minimum configuration: 0.06 kVA • Maximum configuration: 0.39 kVA 	
Heat Output	Air Flow: Air flow is from front to back	
	Air temperature:	
	<ul style="list-style-type: none"> • Expansion unit on: 10° to 35° C (50° to 95° F) Altitude: 0 to 914 m (3000 ft.) • Expansion unit on: 10° to 32° C (50° to 90° F) Altitude: 914 m (3000 ft.) to 2133 m (7000 ft.) 	
Acoustical Noise Emissions Values	Humidity: 10% to 80%	
	<p>Approximate heat output in British Thermal Units (BTU) per hour:</p> <ul style="list-style-type: none"> • Minimum configuration: 205.2 BTU (60 watts) • Maximum configuration: 1333.8 BTU (390 watts) 	
Acoustical Noise Emissions Values	For open bay (0 hard disk drives installed) and typical system configurations (8 hard disk drives installed).	
	<ul style="list-style-type: none"> • Sound Power (idling): — 6.2 bels (open bay) — 6.4 bels (typical) • Sound Power (operating): — 6.2 bels (open bay) — 6.5 bels (typical) • Sound Pressure (idling): — 47 dBA (open bay) — 49 dBA (typical) • Sound Pressure (operating): — 47 dBA (open bay) — 50 dBA (typical) 	<ul style="list-style-type: none"> • Sound Power (idling): — 6.3 bels (open bay) — 6.5 bels (typical) • Sound Power (operating): — 6.3 bels (open bay) — 6.6 bels (typical) • Sound Pressure (idling): — 47 dBA (open bay) — 49 dBA (typical) • Sound Pressure (operating): — 47 dBA (open bay) — 50 dBA (typical)
	<p>These levels are measured in controlled acoustical environments according to 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>	

Symptom-to-FRU index for EXP15 and EXP200

Note: The PD maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

Use this chart to find solutions to problems that have definite symptoms.

Table 38. Symptom-to-FRU index for EXP15 and EXP200 Storage Expansion units.

Problem Indicator	FRU/Action
EXP200 only: Amber LED On (Front Panel)	1. General Machine Fault Check for amber LED on expansion unit
EXP15 only: Amber and Green LEDs flashing (Drive)	1. Host issued a drive rebuild command
EXP15 only: Amber and Green LEDs Off (Power supply)	1. Reseat hard disk drive 2. Hard disk drive
Amber LED On (Drive)	1. Hard Disk Drive
Amber LED On (Fan)	1. Fan
Amber LED On (ESM board)	1. ESM board 2. Check for fan fault LED 3. Unit is overheating. Check temperature.
Amber LED On, Green LED Off (Power supply)	1. Turn Power Switch On 2. Power cord 3. Reseat Power Supply 4. Power Supply
Amber and Green LEDs On (Power supply)	1. Power Supply
All Green LEDs Off (Power supply)	1. Check AC voltage cabinet AC voltage line inputs 2. Power Supplies 3. Midplane board
Intermittent power loss to expansion unit	1. Check AC voltage line inputs and cabinet power components 2. Power Supplies 3. Midplane board
One or more Green LEDs Off (All)	1. Turn Power Switch On 2. Power cord 3. Reseat Power Supply 4. Power Supply
One or more Green LEDs Off (Drive)	1. No activity to the drive 2. This can be normal activity
One or more Green LEDs Off (All Hard Disk Drives or those on one Bus)	1. Use SCSI RAID Manager to check drive status 2. SCSI Cables 3. ESM Board 4. Midplane board

Table 38. Symptom-to-FRU index for EXP15 and EXP200 Storage Expansion units.

Problem Indicator	FRU/Action
EXP15 type 3520: Unable to access drives on one or both SCSI buses	<ol style="list-style-type: none"> 1. Check SCSI cables and connections 2. Option switch 2 must be set to off 3. ESM board
EXP200 type 3530: Unable to access drives on one or both SCSI buses	<ol style="list-style-type: none"> 1. Check SCSI cables and connections 2. Check the drive SCSI ID setting 3. ESM board 4. Ensure that option switches 1 and 5 are set to the appropriate position (change the switch position only when the expansion unit is powered off).
Intermittent Power Loss	<ol style="list-style-type: none"> 1. AC power or plug 2. Power supply 3. Midplane
Random errors	<ol style="list-style-type: none"> 1. Midplane board 2. (For EXP15 only) Make sure option switches 1 and 2 are set to Off

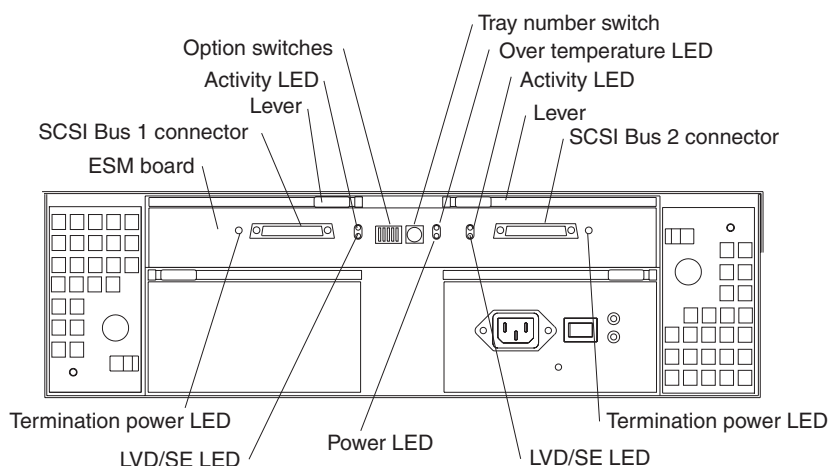
Note: If you cannot find the problem using this Symptom-to-FRU Index, test the entire system. See the server documentation for more detailed information on testing and diagnostic tools.

Locations and installation procedures for EXP15 and EXP200

This section provides locations and installation procedures that are common to both the EXP15 and EXP200 enclosures.

- “ESM board controls and indicators”
- “Expansion unit option switches” on page 275
- “ESM board replacement” on page 276

ESM board controls and indicators



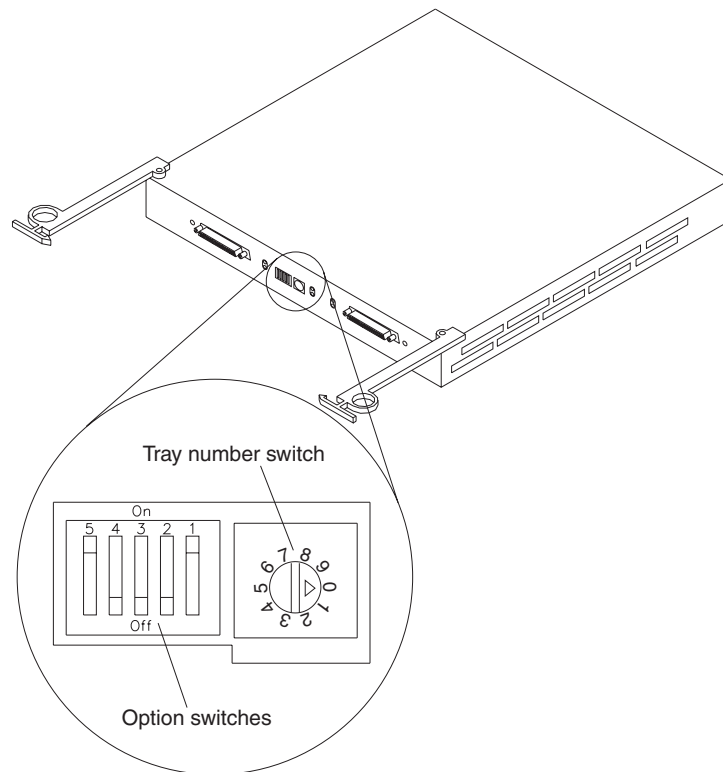
Note: SCSI Bus Connectors are 68-pin VHDCI connectors used for attaching SCSI cables.

Note: The figure above shows an EXP200 enclosure. (The position of controls and indicators is identical for both EXP15 and EXP200 enclosures.)

Table 39. ESM Board LED indications for EXP15 and EXP200 Storage Expansion units.

LED	Description
Termination Power (green)	LED is On if Term Power is present, indicating that the other end of the cable is connected to a power-on controller.
LVD/SE (green)	LED is On if the host bus is in LVD mode (default is SE mode.)
Power (green)	LED is On when there is power to the ESM board.
Over Temp (amber)	This LED is On if the expansion unit overheats.
Active (green)	This LED flashes when there is activity on the external SCSI bus.

Expansion unit option switches



The EXP15 expansion unit has three types of ID numbers. The EXP200 expansion unit has two types of ID numbers:

Drive SCSI IDs

Identifies each drive in the expansion unit

Tray ID Identifies each expansion unit

SAF-TE chip SCSI ID (EXP15 only)

System Management SCSI Accessed Fault Tolerant Enclosure processor

Switch settings are as follows:

- Option Switches
 - Switch 1 off (default)
 - Bus 1 and 2 as Single Bus 1, accessing all ten drives, (IDs 0-4 and 8-12).

- Switch 1 on
 - Bus 1 and Bus 2 accessing 5 drives each.
 - Bus 1 accessing IDs 0-4
 - Bus 2 accessing IDs 0-4

Note: For EXP15, Option Switches 2-5 must be set to the Off (down) position. Errors might occur if these switches are set to the On position.

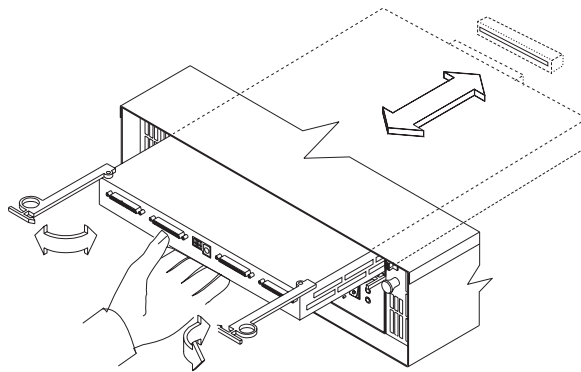
- Switch 5 off (default) (**EXP200 only**)
 - Rack Mode
- Switch 5 on (**EXP200 only**)
 - Tower Mode

When Option Switch 5 is in the On position, two changes occur. First, the SCSI ID ordering is reversed, providing IDs in ascending order from top to bottom. Second, the general system error indicator on the front panel is swapped with the power-on LED, placing the green power-on LED above the general-system error indicator.

- Switches 2 through 4 are reserved and must remain off.

- Tray Number Switch
Identifies each expansion unit 0-9.
- SAF-TE chip SCSI ID (**EXP15 only**)
Internal SCSI ID numbers 14 and 15

ESM board replacement



To remove the ESM board:

1. Shut down the expansion unit. For shutdown information, see “Performing a shutdown” on page 271.
2. Grasp each pull-ring and squeeze the latches to release.
3. Pull open both levers at the same time and remove ESM board.

Note: When inserting the ESM board:

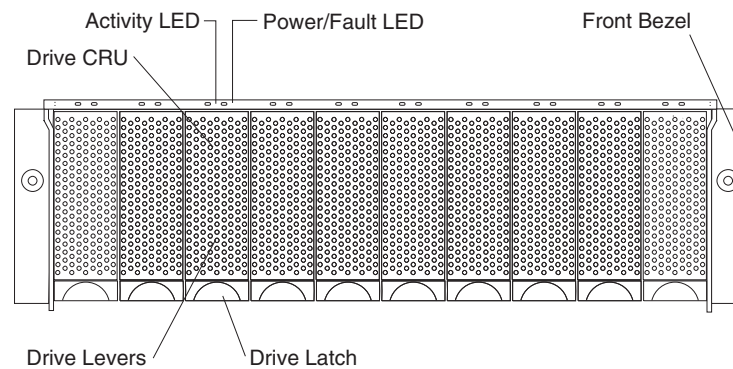
1. Make sure both levers are straight out, as shown above.
2. Using your hand, gently push on the center of the ESM board to insert it into the controller.
3. When inserting the ESM board, make sure both levers swing inward at the same time.
4. Close and lock both levers at the same time.

Locations and installation procedures for EXP15

This section provides locations and installation procedures that are specifically for the EXP15 enclosure.

- “EXP15 front controls and indicators”
- “EXP15 drive numbering”
- “EXP15 replacing drives (hot-swap)” on page 278
- “EXP15 fan controls and indicators” on page 279
- “EXP15 replacing fans (hot-swap)” on page 280
- “EXP15 power supply controls and indicators” on page 280
- “EXP15 replacing power supplies (hot-swap)” on page 281
- “EXP15 removal from rack” on page 281
- “EXP15 replacing rails” on page 283

EXP15 front controls and indicators

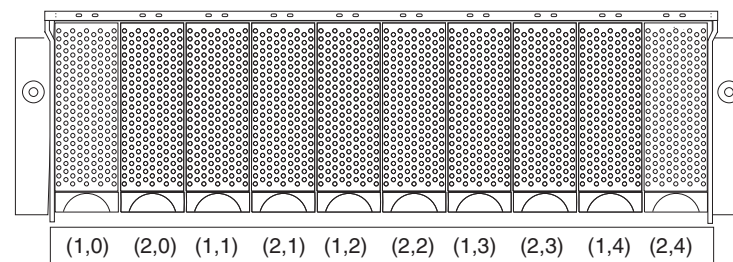


Note: Only the IBM ServeRAID, ServeRAID II, ServeRAID-3H, and Fibre RAID controller provide support for the amber Fault LEDs.

EXP15 drive numbering

There are *two SCSI channels* (1, 2) in the expansion unit. Each channel uses five SCSI ID numbers. Each disk drive within the expansion unit has a unique channel number and SCSI ID number, based on its physical location in the expansion unit.

When a drive is plugged into the midplane, its channel number and SCSI ID are set automatically. The following figure shows bus and SCSI ID values when option switch 1 is set to the on (up) state. Use the option switch on the ESM board to change the ID settings.

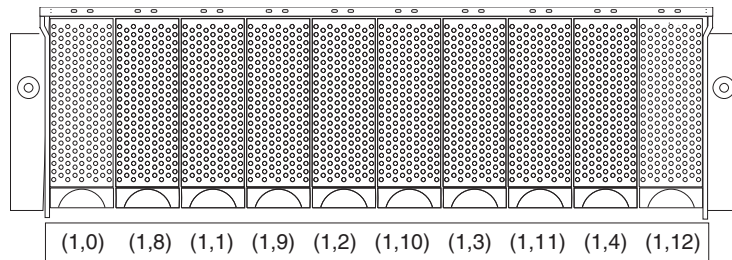


The first number represents the channel number and the second is the SCSI ID.

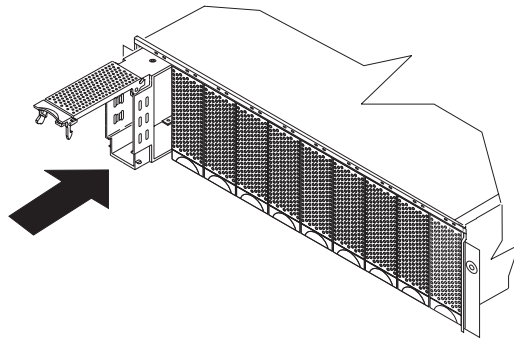
Notes:

1. For IBM ServeRAID, the view configuration screens show bay numbers, not SCSI IDs. To calculate the bay number, add 1 to the SCSI ID.
2. A blank label is provided in the drive tray behind the drive latch. Use this label to record the address location information for each drive before you remove it. If you install a drive in the wrong bay, data will be lost.
3. 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. Failure to replace the drives in their correct bays can result in loss of data.

If the two channels are daisy chained using option switch 1 in the off position, then the SCSI IDs are as shown and the drives are all on the same channel.



EXP15 replacing drives (hot-swap)



To remove the hot-swap drives:

1. Pull on the bottom of the tray lever to release the lever.
2. Lift the lever and slide the drive partially out of the slot.

Note: Wait at least 20 seconds before fully removing the drive from the expansion unit to allow for spin down. Allowing for spin down avoids possible damage to the drive.

See “EXP15 drive numbering” on page 277 when replacing drives.

3. Install the new drive, making sure at least ten seconds have passed before you install the new drive tray. Unlatch and open the drive lever and insert the drive.
4. Lock the lever in place.
5. Check the LEDs.
 - a. When drives are ready for use, the green Active LEDs should be off and the Power/Fault LEDs should be glowing green. (A flashing amber LED indicates a drive rebuild).

- b. If the Power/Fault light is solid amber, pull up on the drive latch and lift the drive lever to pull the drive partially out of the bay. Wait at least 20 seconds before fully removing the drive from the expansion unit to allow for spin down. If the SCSI adapter is the IBM ServeRAID; go to the *ServeRAID User's Guide* for additional information and procedures on changing the state of the drive from the current Default state to any other state (for example, HSP, RDY, rebuild drive to ONL, and so on). The amber LED should go off within 10 seconds of the drive state change (to something other than DDD).

In some cases, if the SCSI adapter is the IBM ServeRAID II, the drive automatically resets to either a hotspare (HSP) or be rebuilt (ONL). See the *ServeRAID II User's Guide* for additional information. If the state change in the ServeRAID II configuration does not change automatically (amber LED does not go off), then refer to the *ServeRAID II User's Guide* for directions on how to perform a manual drive state change. The amber LED should go off within 10 seconds of a drive state change (to something other than DDD).

If the state change in the RAID configuration does not change automatically, refer to the *RAID Controller User's Guide* for directions on how to perform a drive state change.

Table 40. LED drives status for EXP15 Storage Expansion Unit.

LED	Description
Activity (green)	Indicates read/write or inquiry operation
Power/Fault (green)	Indicates drive present
Power/Fault (amber/green Flashing)	Indicates drive rebuild
Power/Fault (amber)	Indicates a drive failure

EXP15 fan controls and indicators

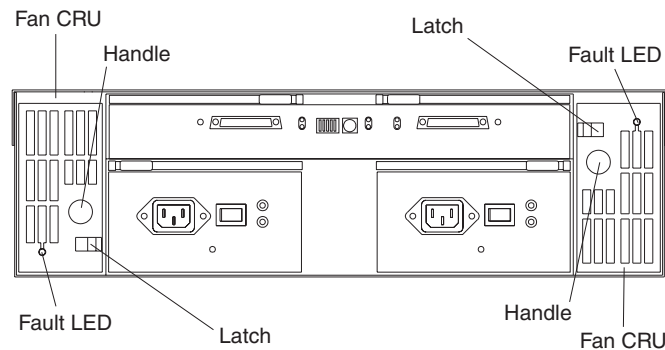
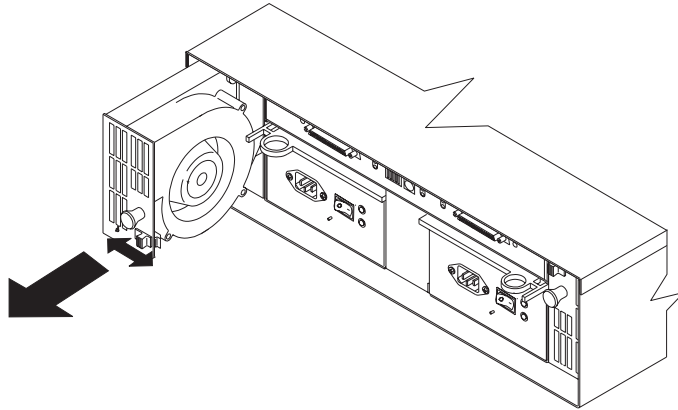


Table 41. Fan LED indications for EXP15 Storage Expansion Unit.

LED	Description
Fault LEDs (amber)	LEDs are On when a fan fails.

EXP15 replacing fans (hot-swap)



To Remove Cooling Fans:

1. Check the LEDs on the back of the expansion unit.
2. Slide the latch left or right to unlock the fan.
3. Use the handle (black knob) to pull the fan from the expansion unit.
4. Install the new fan by inserting it into the expansion slot and making sure it is seated into the midplane connector. Slide the latch into the middle position.
5. Check the LEDs. If the fault LEDs do not turn off after a few seconds, see “Symptom-to-FRU index for EXP15 and EXP200” on page 273.

Note: The fan units are hot-swap redundant; however, when one fan fails, the failing fan unit needs to be replaced within 48 hours in order to maintain redundancy and optimum cooling. When replacing the failed fan unit, insure that this replacement is performed in less than 10 minutes to prevent any overheating. If it takes longer than 10 minutes to replace the fan unit, you must shut down the expansion unit to keep the unit from overheating.

For information on expansion unit shutdown, see “Performing a shutdown” on page 271.

EXP15 power supply controls and indicators

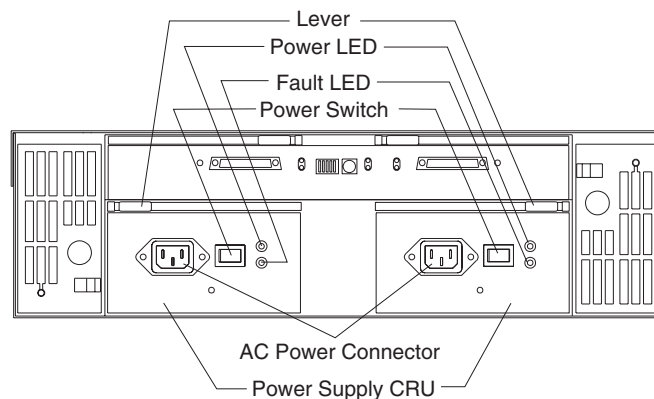
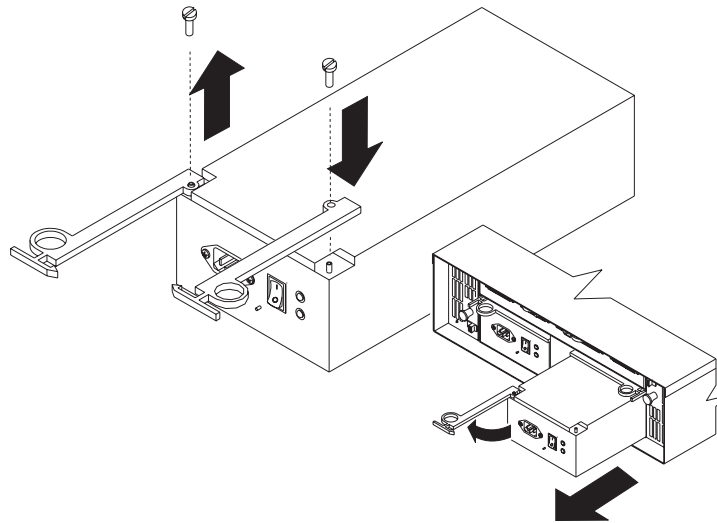


Table 42. Power supply LED indications for EXP15 Storage Expansion Unit.

LED	Description
Power (green)	LEDs are On when power switches are turned on.
Fault (amber)	If only the amber LED is on, then power supply is off.
Power (green) and Fault (amber)	Both the green and amber LEDs on indicates a power supply failure.

EXP15 replacing power supplies (hot-swap)



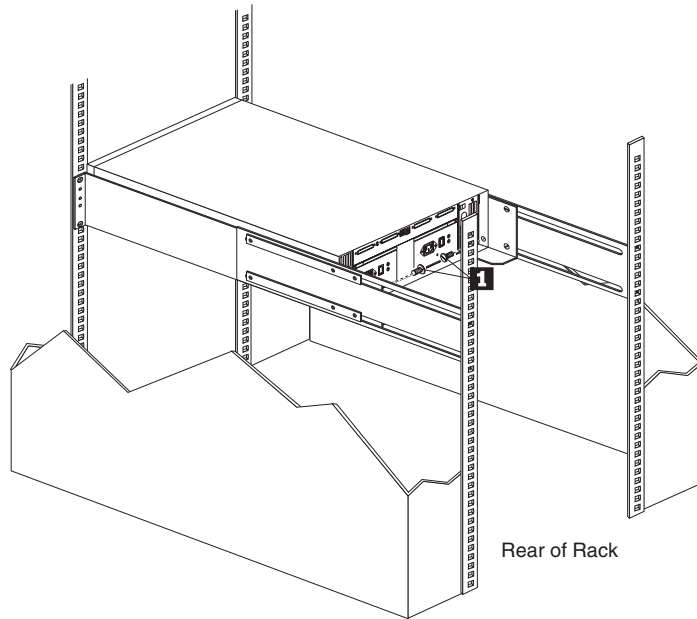
To remove a power supply:

1. Turn the switch on the power supply to the Off position.
2. Unplug the supply power cord from the electrical outlet.
3. Disconnect the power cord from the power supply.
4. Grasp each pull-ring and squeeze the latches to release.
5. Pull open lever and remove power supply.

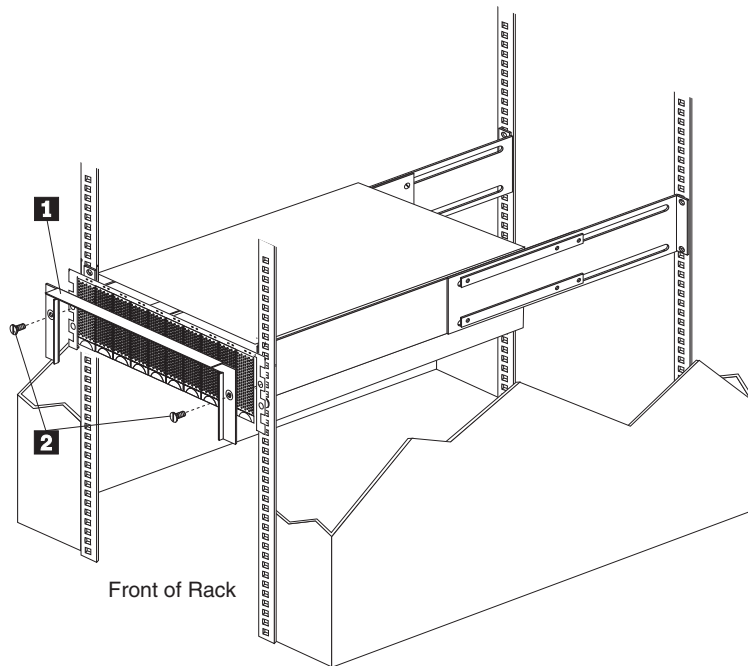
Note: When installing a new power supply, make sure that the latch is mounted to the side of the supply that is toward the middle of the machine. If not, remove the lever screw, flip the lever over and replace the screw. See the figure above.

EXP15 removal from rack

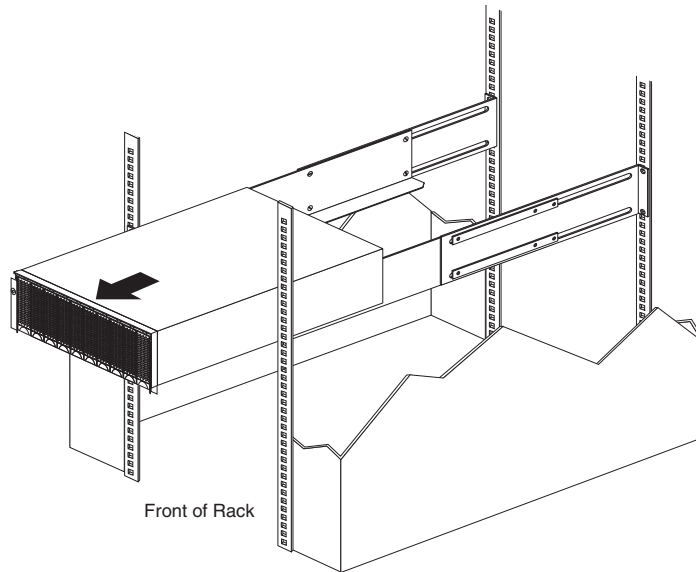
The expansion unit should only need to be removed from the rack for replacement of the midplane board/frame assembly. See "EXP15 parts listing" on page 284 for more information.



1. Remove screws **(1)** from assembly rails at rear.



2. Remove screws **(2)** and remove bezel **(1)**.

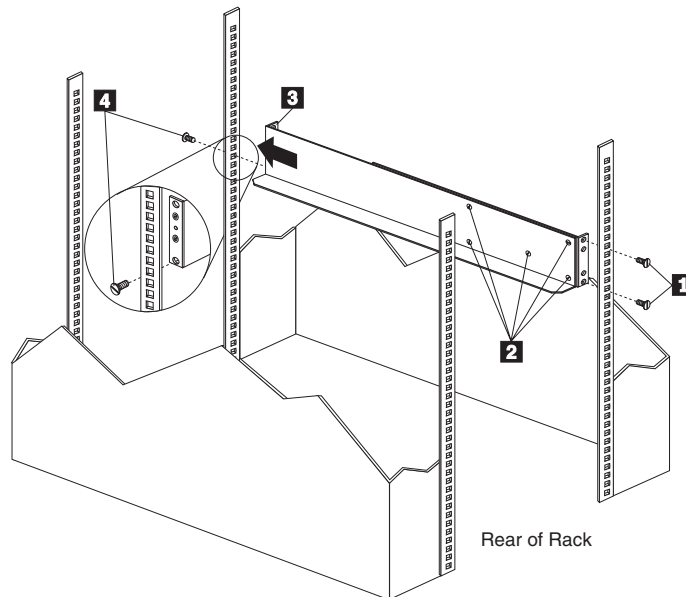


3. Slide expansion unit out of rack.

Note: Avoid touching the LED lights when removing the unit to avoid damage to the expansion unit.

EXP15 replacing rails

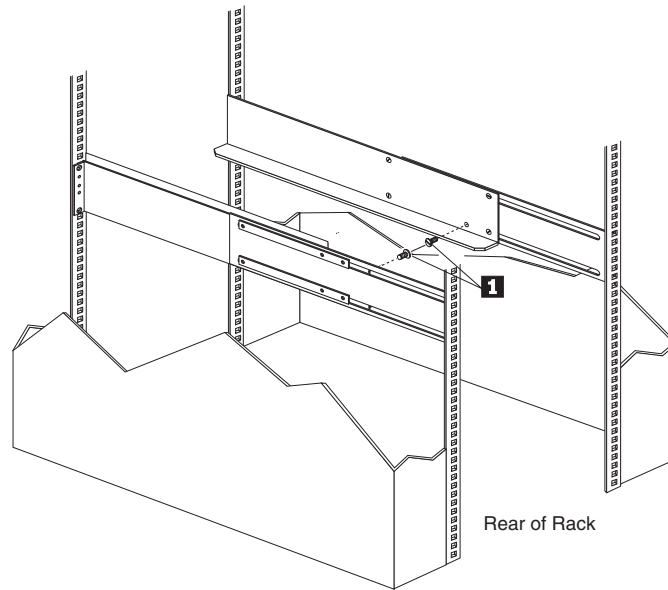
1. Align the rail assembly (provided with the hardware kit) to the rear of the rack.
 - a. Install two black hex head screws (1) in the top and bottom positions, starting with the top.
 - b. Loosely tighten the screws.



2. Loosen the five screws (four large screws and one small screw) (2) located on the interior of the rail assembly; then slide the front rail assembly forward (3) until it makes contact with the front rack rail.

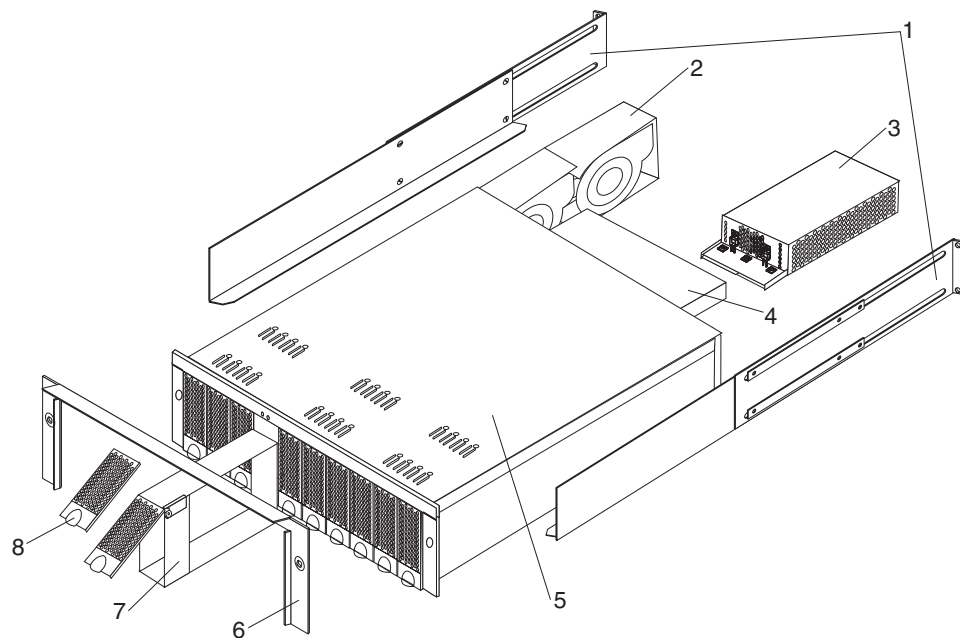
Note: Make sure the front rail position matches the rear rail position.

3. From the front of the rack, thread one (black) hex head screw (4) into the bottom position of the rail assembly and tighten firmly.
Note: Before tightening, make sure the pins are located correctly in the rail holes.
4. Firmly tighten the screws on the rear of the rack and the four interior screws on the rail assembly.
5. Repeat the rail assembly procedure on the opposite side of the rack.



6. Remove the two small 6-32 screws (1) on the interior side of the rails. Save these screws to install the expansion unit.

EXP15 parts listing



Index	System (IBM EXP15, Type 3520) Model 2RU, 2RX	FRU No.
1	Rail Kit	01K6670
2	Blower Assembly	01K6706
3	350W Power Supply Assembly	01K6709
4	Electronic Module (ESM)	01K6708
5	Midplane/Frame Note: The midplane board and frame are replaced as a unit. If either part is needed, order this FRU.	01K6707
6	Bezel, Front	01K6705
7	Blank Tray, with bezel	01K6667
8	Bezel, HF Tray	01K6666
	Miscellaneous Hardware Kit <ul style="list-style-type: none"> • ESM Lever Screws (2 each) • Power Supply Lever Screw • Power Cord Retainer • Power Cord Retainer Knurled Nut • EMC Clips (6 each) • Tray Spring • 6-32 Tray Spring Screw and nut • 6-32X1/4-Inch Drive Screws (2 each) • ESM Latch Left • ESM Latch Right • Power Supply Latch • Light Pipes (2 each) • 6-32X1/2-Inch Screw • M6 Rail Screws (2 each) • M5X8L Screw (2 each) • M3X5L Screw (2 each) • Large Spacer (2 each) 	01K6671

Options	FRU No.
LVD SCSI Cable, 2 Meter external	03K9196
LVD SCSI Cable, 4 Meter external	03K9198
LVD SCSI Cable, 12 Meter external	03K9200
4.5 GB Hard Disk Drive with tray and bezel (7200 RPM)	01K6675
4.5 GB Hard Disk Drive with tray and bezel (10,000 RPM)	01K6682
9.1 GB Hard Disk Drive with tray and bezel (7,200 RPM)	01K6679
9.1 GB Hard Disk Drive with tray and bezel (10,000 RPM)	02K0459
18.2 GB Hard Disk Drive with tray and bezel (7,200 RPM)	01K6718
18.2 GB Hard Disk Drive with tray and bezel (10,000 RPM)	02K0462

Options	FRU No.
HF tray with holes (restricted)	01K6677

Table 43. EXP15 power cords.

Power Cords	FRU No.
Arabic	14F0033
Belgium	1339520
Bulgaria	1339520
Czech Republic	1339520
Denmark	13F9997
Finland	1339520
France	1339520
Germany	1339520
Hungary	1339520
Israel	14F0087
Italy	14F0069
Latvia	1339520
Netherlands	1339520
Norway	1339520
Poland	1339520
Portugal	1339520
Serbia	1339520
Slovakia	1339520
South Africa	14F0015
Spain	1339520
Switzerland	1339520
Switzerland (French/German)	14F0051
U.S. English	62X1045
U.K./Ireland	14F0033
Yugoslavia	1339520

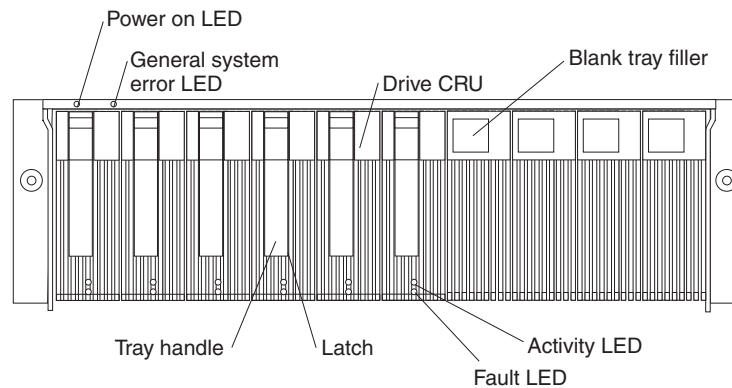
Locations and installation procedures for EXP200

This section provides locations and installation procedures specifically for EXP200 enclosures.

- “EXP200 front controls and indicators” on page 287
- “EXP200 drive numbering” on page 287
- “EXP200 replacing drives (hot-swap)” on page 289
- “EXP200 fan controls and indicators” on page 290
- “EXP200 replacing fans (hot-swap)” on page 291

- “EXP200 power supply controls and indicators” on page 292
- “EXP200 replacing power supplies (hot-swap)” on page 292
- “Preparing the EXP200 expansion unit” on page 293
- “Installing the EXP200 expansion unit in a rack” on page 295
- “Installing the EXP200 expansion unit in a tower conversion kit” on page 297
- “Installing the EXP200 expansion unit in a NetBAY enclosure” on page 298

EXP200 front controls and indicators

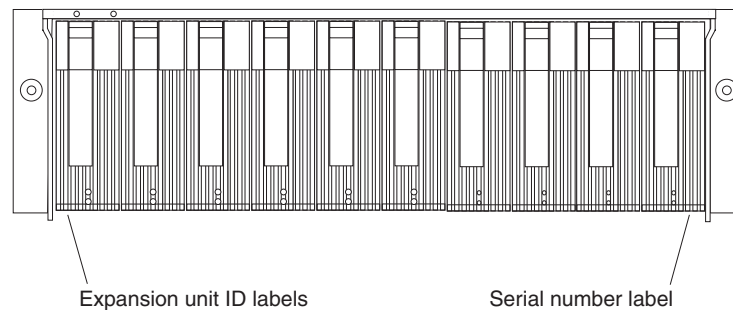


Note: Only the IBM ServeRAID, ServeRAID II, ServeRAID-3H, and Fibre RAID controller provide support for the amber Fault LEDs.

EXP200 drive numbering

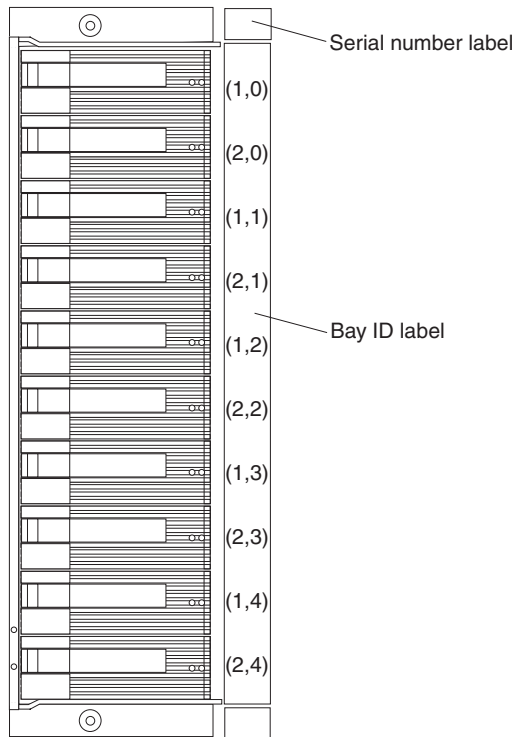
There are *two SCSI channels* (1, 2) in the expansion unit. Each channel uses five SCSI ID numbers. Each disk drive within the expansion unit has a unique channel number and SCSI ID number, based on its physical location in the expansion unit.

When a drive is plugged into the midplane, its channel number and SCSI ID are set automatically. The following figure shows bus and SCSI ID values when option switch 1 is set to On and switch 5 is off. Use the option switch on the ESM board to change the ID settings.



The first number represents the channel number and the second is the SCSI ID.

See the following figure for bus and SCSI ID values when option switch 1 is set to On and switch 5 is on (for tower orientation). Use the option switch on the ESM board to change the ID settings.

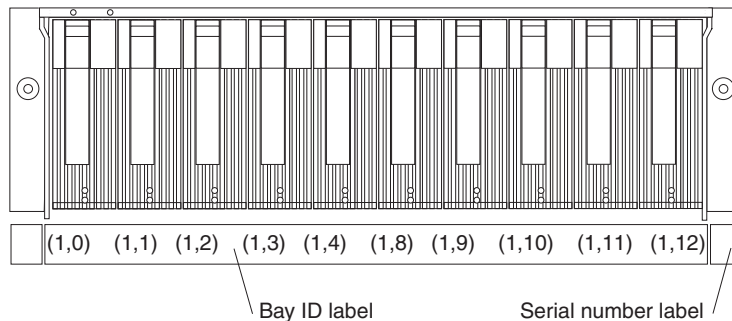


The first number represents the channel number and the second is the SCSI ID.

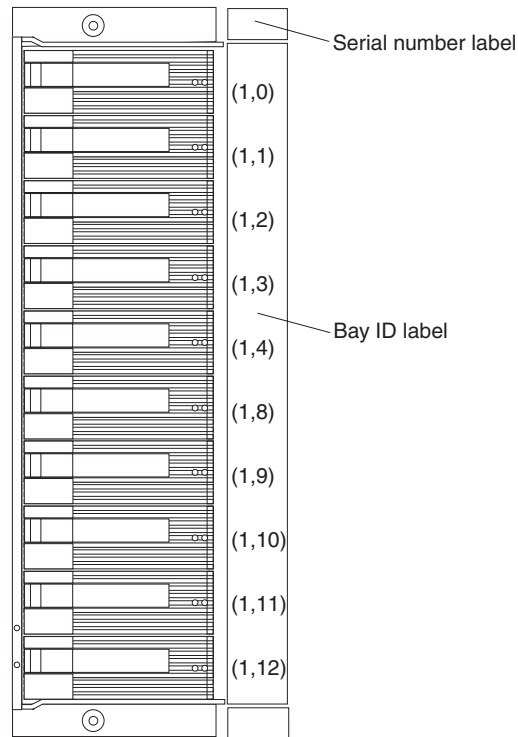
Notes:

1. For IBM ServeRAID, the view configuration screens show bay numbers, not SCSI IDs. To calculate the bay number, add 1 to the SCSI ID.
2. A label is provided on the front of the drive tray. Use this label to record the address location information for each drive before you remove it. If you install a drive in the wrong bay, data will be lost.
3. 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. Failure to replace the drives in their correct bays can result in loss of data.

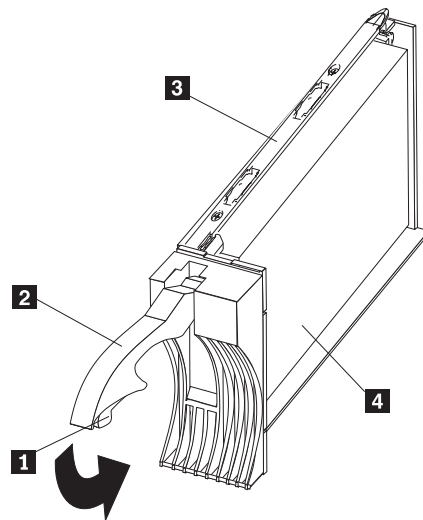
If the two channels are daisy chained using option switch 1 in the off position and switch 5 is off, then the SCSI IDs are as shown and the drives are all on the same channel.



If the two channels are daisy chained using option switch 1 in the off position and switch 5 is on (for tower orientation), then the SCSI IDs are as shown and the drives are all on the same channel.



EXP200 replacing drives (hot-swap)



To remove the hot-swap drives:

1. Press on the inside of the bottom of the tray handle to release the blue latch (1).
2. Pull the handle (2) on the tray (3) out into the open position.
3. Lift the drive CRU partially out of the bay.

Note: Wait at least 20 seconds before fully removing the drive from the expansion unit to allow for spin down. Allowing for spin down avoids possible damage to the drive.

See "EXP200 drive numbering" on page 287 when replacing drives.

4. If you are replacing a slim-high drive, ensure that the filler piece remains in place for use with the new drive.
5. Install the new drive, making sure at least ten seconds have passed before you install the new drive tray. Gently push the drive into the empty bay until the tray handle (2) touches the expansion unit bezel.
6. Push the tray handle (2) down into the closed (latched) position.
7. Check the LEDs.
 - a. When drives are ready for use, the green Activity LED and the amber Fault LED should be off.
 - b. If the Fault light is solid amber, pull up on the drive latch and lift the drive lever to pull the drive partially out of the bay. Wait at least 20 seconds before fully removing the drive from the expansion unit to allow for spin down. If the SCSI adapter is the IBM ServeRAID, go to the *ServeRAID User's Guide* for additional information and procedures on changing the state of the drive from the current Default state to any other state (for example, HSP, RDY, rebuild drive to ONL, and so on). The amber LED should go off within 10 seconds of the drive state change (to something other than DDD).

In some cases, if the SCSI adapter is the IBM ServeRAID II, the drive automatically resets to either a hotspare (HSP) or be rebuilt (ONL). See the *ServeRAID II User's Guide* for additional information. If the state change in the ServeRAID II configuration does not change automatically (amber LED does not go off), then refer to the *ServeRAID II User's Guide* for directions on how to perform a manual drive state change. The amber LED should go off within 10 seconds of a drive state change (to something other than DDD).

If the state change in the RAID configuration does not change automatically, refer to the *RAID Controller User's Guide* for directions on how to perform a drive state change.

Table 44. LED drive status for EXP200 Storage Expansion unit.

LED	Description
Activity (green/flashing)	Indicates read/write or inquiry operation
Fault (amber/flashing)	Indicates drive rebuild or that drive has been identified by software
Fault (amber)	Indicates a drive failure

EXP200 fan controls and indicators

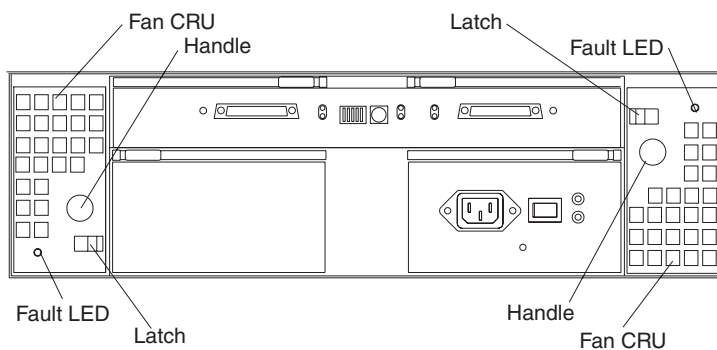
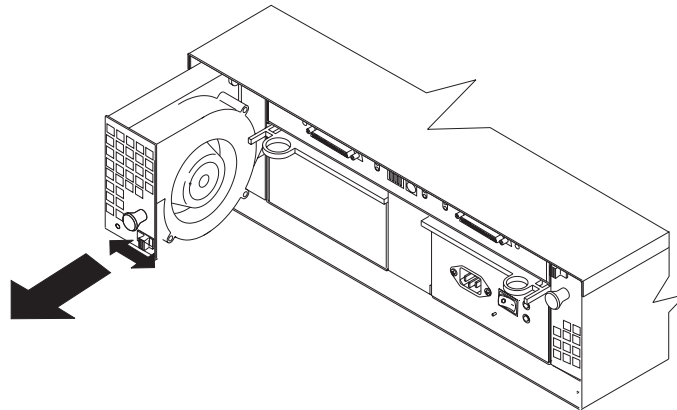


Table 45. Fan LED indications for EXP200 Storage Expansion unit.

LED	Description
Fault LEDs (amber)	LEDs are On when a fan fails.

EXP200 replacing fans (hot-swap)



To Remove Cooling Fans:

1. Check the LEDs on the back of the expansion unit.
2. Slide the latch left or right to unlock the fan.
3. Use the handle (black knob) to pull the fan from the expansion unit.
4. Install the new fan by inserting it into the expansion slot and making sure it is seated into the midplane connector. Rotate the fan 180° if it does not go into the slot. Slide the latch into the middle position.
5. Check the LEDs. If the fault LEDs do not turn off after a few seconds, see “Symptom-to-FRU index for EXP15 and EXP200” on page 273.

Note: The fan units are hot-swap redundant; however, when one fan fails, the failing fan unit needs to be replaced within 48 hours in order to maintain redundancy and optimum cooling. When replacing the failed fan unit, insure that this replacement is performed in less than 10 minutes to prevent any overheating. If it takes longer than 10 minutes to replace the fan unit, you must shut down the expansion unit to keep the unit from overheating.

For information on expansion unit shutdown, see “Performing a shutdown” on page 271.

EXP200 power supply controls and indicators

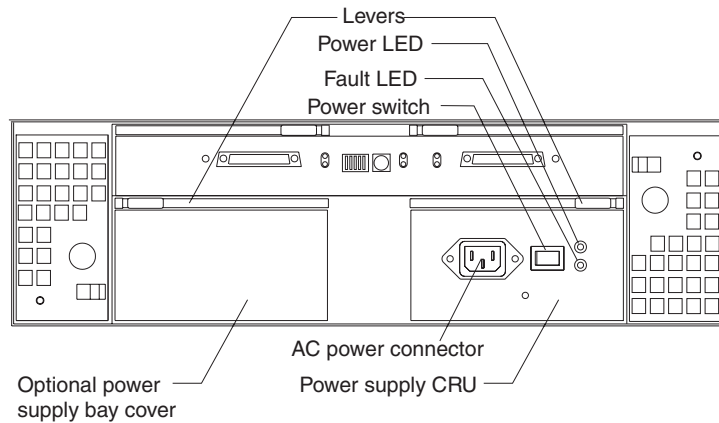
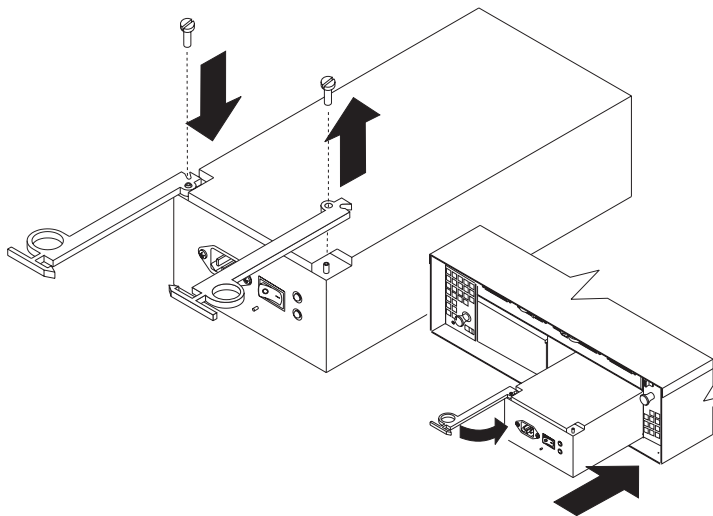


Table 46. Power supply LED indications for EXP200 Storage Expansion unit.

LED	Description
Power (green)	LEDs are On when power switches are turned on.
Fault (amber)	If only the amber LED is on, then the power supply is turned off.
Power (green) and Fault (amber)	Both the green and amber LEDs on indicates a power supply failure.

EXP200 replacing power supplies (hot-swap)



Attention: The base unit with one power supply is *not* redundant. You must install the redundant power supply option to make your unit redundant. If you unplug the standard power supply from the basic configuration without having the redundant power option installed, you will lose power to the expansion unit and you might lose data.

To remove a power supply:

1. Turn the switch on the power supply to the Off position.
2. Unplug the supply power cord from the electrical outlet.

3. Disconnect the power cord from the power supply.
4. Grasp each pull-ring and squeeze the latches to release.
5. Pull open lever and remove power supply.

Note: When installing a new power supply, make sure that the latch is mounted to the side of the supply that is toward the middle of the machine. If not, remove the lever screw, flip the lever over and replace the screw. See the figure above.

Preparing the EXP200 expansion unit

This section explains how to prepare the expansion unit for installation by removing the CRUs (customer replaceable units) and by setting the interface options.

Removing CRUs

It is easier to lift the expansion unit and install it in a rack or tower enclosure if you remove all CRUs (drives, fans, and power supplies) first. A fully loaded expansion unit with 10 disk drives, two fan units, and the second power supply installed weighs 36.1 kg (79.5 lbs). The standard unit shipped with one power supply and two fan units weighs 22.5 kg (49.5 lbs). If you remove all the CRUs, you can reduce the overall weight.

Attention: If you have data stored on the drives, label the drives before you remove them. Then when you replace the drives, install them in the exact drive bays from which you removed them.

Attention: The expansion unit is shipped with the decorative bezel attached to the front of the unit with two white screws and nuts. This bezel protects the light pipes located above the drive trays. Leave the decorative bezel in place until you are instructed to remove it during the installation process.

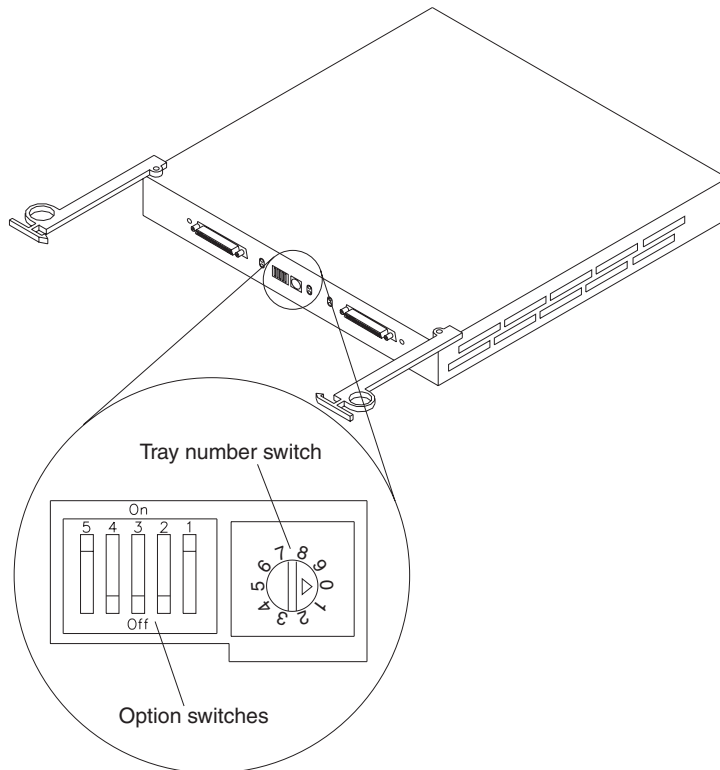
Setting the interface options

There are five option switches and a tray number switch located on the back of the expansion unit. It is easier to set these switches before you install the expansion unit in a rack or tower enclosure.

Attention: Option switch settings must always be set while the expansion unit and host server are powered off. Failure to do so will result in loss of data.

Option Switch 1 controls the SCSI bus and ID settings, and Option Switch 5 controls the rack and tower installation modes. Option Switches 2 through 4 are Reserved; leave these switches in the Off position.

The tray number switch has ten settings (0-9). You can use these settings to identify the tray number for the expansion unit. System-management software, such as IBM Netfinity Manager®, uses this tray number when it provides data and alerts for the expansion unit.



SCSI bus and ID settings: When you install a drive CRU in the expansion unit, the drive tray plugs into a printed circuit board called the *midplane*. The midplane sets the SCSI bus number and ID automatically, based on the setting of Option Switch 1 and the physical location (bay) of the drive CRU.

Your expansion unit supports up to two external SCSI buses and up to two internal SCSI buses. Each internal SCSI bus uses five SCSI IDs. When you install the expansion unit, you can set Option Switch 1 on the ESM board to create two separate five drive SCSI buses, or you can leave it set as one, daisy-chained ten drive SCSI bus.

- **Option Switch 1 set to Off:**

With this default setting, all 10 disk drive bays are on a single SCSI bus. The midplane assigns the SCSI IDs for the drive bays in ascending order from left to right (rack mode) or from top to bottom (tower mode) as follows: 0, 1, 2, 3, 4, 8, 9, 10, 11, 12. The system-management SCSI accessed fault tolerant enclosure (SAF-TE) processor uses SCSI ID 15. When Option Switch 1 is set to the Off position, you can use either external cable connector.

- **Option Switch 1 set to On:**

When Option Switch 1 is set to the On position, two independent internal five-drive SCSI buses are created. External SCSI Bus 1 maps to internal SCSI Bus 1 and external SCSI Bus 2 maps to internal SCSI Bus 2. The midplane assigns the five internal Bus-1 bays SCSI IDs 0, 1, 2, 3, and 4; and the five internal Bus-2 bays SCSI IDs 0, 1, 2, 3, and 4. On each SCSI bus, the system-management processor uses SCSI ID 15.

Important information

If you are using a ServeRAID software version earlier than Version 3.50, the View Configuration screens might show SCSI IDs or bay numbers. If the data shown on the View Configuration screen begins with 0, it denotes SCSI IDs. If the data shown on the View Configuration screen begins with 1, it denotes bay numbers.

Rack and tower mode settings: Option Switch 5 on the ESM board is the rack and tower mode switch. Switch 5 must be in the Off position when the unit is placed in a rack and in the On position if the unit is placed in a tower. When shipped, Option Switch 5 is set to the rack (Off) position.

When Option Switch 5 is in the On position, two changes to your expansion unit occur. First, the SCSI ID ordering is reversed. This SCSI ID reversal provides SCSI IDs in ascending order from top to bottom, when the expansion unit is installed in a tower. Second, the general system error indicator on the front panel is swapped with the power-on LED, placing the green power-on LED above the general-system error indicator.

Tray number settings: Use the tray number switch on the ESM board to set a tray identification number for the expansion unit. You can set a number from 0-9. System-management software, such as IBM Netfinity Manager and Symplivity Storage Manager, uses this identification number when it provides data and alerts for the expansion unit.

Installing the EXP200 expansion unit in a rack

The EXP200 expansion unit requires 3U of EIA rack mounting space. Before installing the expansion unit in your rack you must:

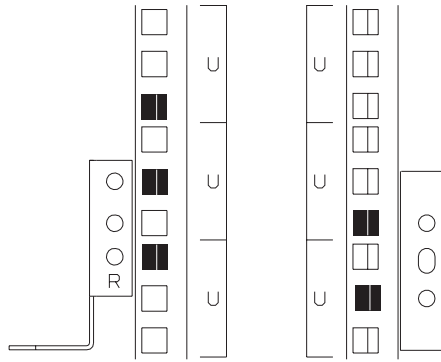
- Plan device installation starting from the bottom of the rack.
- Refer to the rack documentation for safety and cabling considerations. Ensure that your planned installation is within the rack enclosure guidelines for heat generation, electrical requirements, air flow, and mechanical loading.

Note: Because of the limited space in some racks, it might be easier to connect and route cables before you install the mounting brackets and hardware devices.

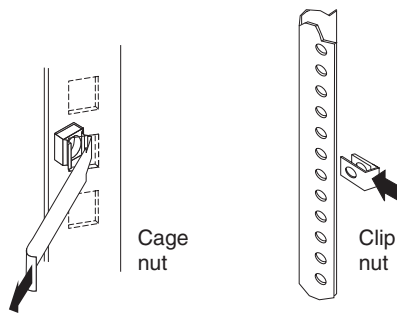
- Position the unit in the rack to allow for proper air circulation around and through the expansion unit.
- Turn off power to your rack.
- Refer to the rack documentation for instructions on removing its doors and side panels.

Use the rack mounting template that comes with the expansion unit to locate the rack mounting holes and install the unit into a rack cabinet. If you misplace the template, you can use the following steps to install your expansion unit:

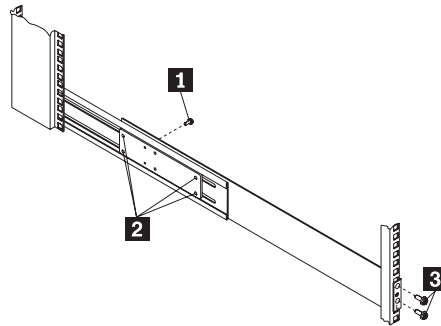
1. Use the following figure of front and rear rack mounting flanges to determine the appropriate rack mounting holes for installing cage nuts or clip nuts to secure your EXP200 rails.



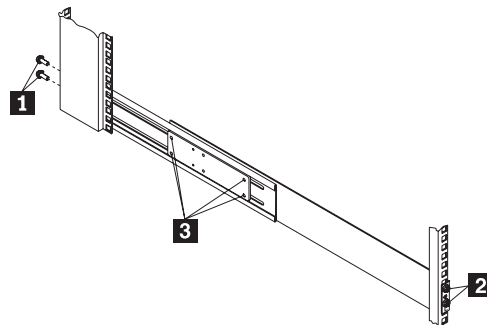
Note: Use clip nuts if your rack has round holes. If your rack has square holes, you can use the rack insertion tool or a flat-blade screwdriver to install cage nuts.



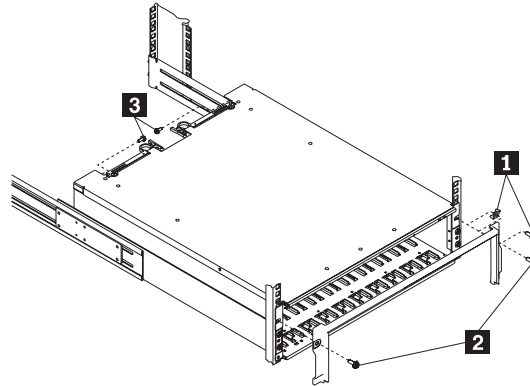
2. On the rail marked L, remove and save the small screw (1); then, loosen the four large screws (2).



3. Hold the rail against the outside of the left rack mounting flange and loosely insert the front black hex screws (3).
4. Extend the rail outside of the rear rack mounting flange; then, install and tighten both rear black hex screws (1).



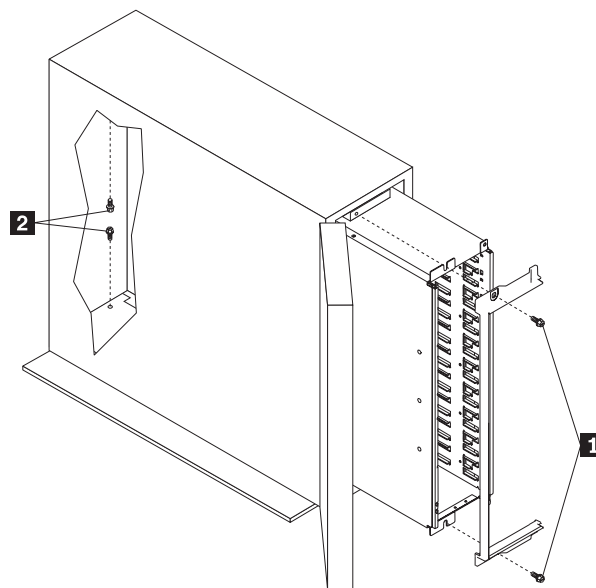
5. Tighten the two front screws (2); then, tighten the four large screws (3).
Repeat step 2 through step 5 to install the rail marked R on the right side of the rack.
6. Slide the expansion unit into the rack; then, remove and discard both white screws and wingnuts (1) from the bezel.



7. Align the bezel locator pins with the expansion unit; then, secure the bezel and EXP200 with two black hex screws (2).
8. Use the two small screws (3) (removed in step 2) to secure the rear of the expansion unit.
9. Verify that Option Switch 5 is set to Off (see "Setting the interface options" on page 293 for further device settings).
10. Install hard drives, fans, and power supplies in the EXP200 expansion unit

Installing the EXP200 expansion unit in a tower conversion kit

The EXP200 Rack-to-Tower Conversion Kit provides an enclosure for a single EXP200 expansion unit. Use the mounting hardware that comes with the EXP200 expansion unit to install the unit in the enclosure as follows:



1. Unlock and open the enclosure door.

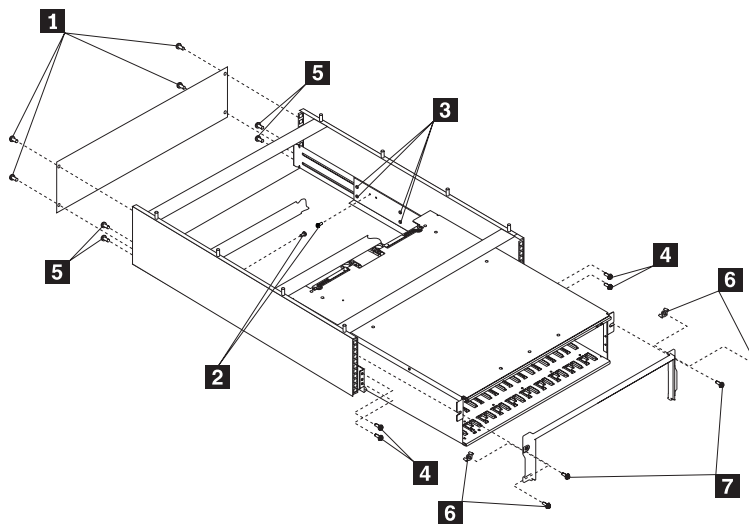
2. Turn the EXP200 expansion unit counter-clockwise onto its left side and slide it into the enclosure; then, remove the white screws and wingnuts from the EXP200 bezel.
3. Align the bezel locator pins with the expansion unit; then, secure the bezel and EXP200 with black hex screws (1) on the top and bottom.
4. Remove the two small screws from the rails that come with the EXP200 expansion unit; then, secure the rear of the expansion unit with the small screws (2) on the top and bottom.
5. Verify that Option Switch 5 is set to On (see "Setting the interface options" on page 293 for further device settings).
6. Install hard drives, fans, and power supplies in the EXP200 expansion unit.

Installing the EXP200 expansion unit in a NetBAY enclosure

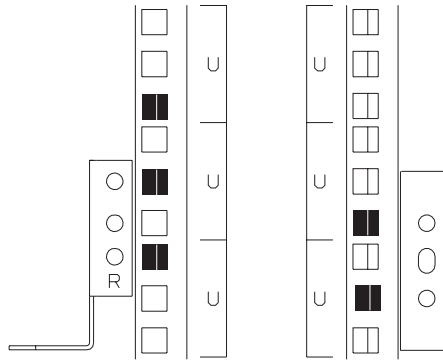
NetBAY enclosures are stackable and each can store a different device, such as the EXP200 expansion unit. You can also attach a server on top of the enclosure. Refer to the NetBAY documentation for details on installing other devices.

Note: Due to the depth of the NetBAY3E enclosure, it might be difficult to set the expansion unit option switches after the unit is installed. Verify that Option Switch 5 is set to Off and Option Switch 1 and the tray ID switch are set properly for your environment (see "Setting the interface options" on page 293 for further device settings).

To install the expansion unit in the enclosure, use the following procedure:

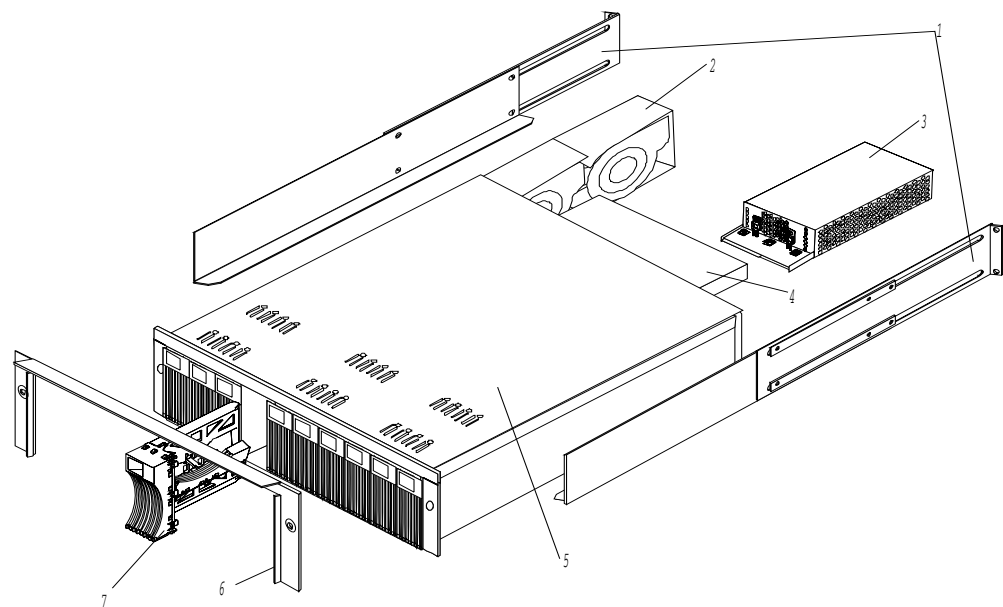


1. Remove the rear of the enclosure (1).
2. Use the following figure to determine the appropriate enclosure mounting holes for installing cage nuts to secure your device and rails.



3. On the rail marked L, remove and save the small screw (2); then, loosen the four large screws (3).
4. Hold the rail against the outside of the left enclosure mounting flange and loosely insert the front black hex screws (4).
5. Extend the rail outside of the rear enclosure mounting flange; then, install and tighten both rear black hex screws (5).
6. Tighten the two front screws (4); then, tighten the four large screws (3).
Repeat step 3 through step 6 to install the rail marked R on the right side of the enclosure.
7. Slide the expansion unit into the enclosure; then, remove and discard both white screws and wingnuts (6) from the bezel.
8. Align the bezel locator pins with the expansion unit; then, secure the bezel and EXP200 with two black hex screws (7).
9. Use the two small screws (2) (removed in step 3) to secure the rear of the expansion unit.
10. Install hard drives, fans, and power supplies in the EXP200 expansion unit.

EXP200 parts listing



Index	System (IBM EXP200, Type 3530) Model 1RU, 1RX		FRU No.
1	Rail Kit Left/Right		37L0067
2	Blower Assembly		37L0057
3	350W Power Supply Assembly		37L0059
	Power Supply Blank		09N7264
4	Electronic Module (ESM, LVD/LVD)		37L0063
5	Midplane/Frame Note: The midplane board and frame are replaced as a unit. If either part is needed, order the above FRU.		37L0061
6	Decorative Bezel, EXP200		37L0065
7	Blank Tray Assembly		37L6708
	Tower Enclosure		37L0120
	Tower Lock/Pawl		37L0121
	Tower Feet		09N7266
	Miscellaneous Hardware Kit		37L0068
	<ul style="list-style-type: none"> • ESM Lever Screws (2 each) • Power Supply Lever Screw • Power Cord Retainer • Power Cord Retainer Knurled Nut • EMC Clips (6 each) • Label - Box ID • Labels - Rack SCSI ID • Labels - Tower SCSI ID • ESM Latch Left 	<ul style="list-style-type: none"> • ESM Latch Right • Power Supply Latch • Light Pipes (2 each) • 6-32X1/2-Inch Flat Head Screw • M6 Rail Screws (2 each) • ESM Cam Channel (2 each) • M6 Nut Clips (2 each) • M6 "C" Clips (2 each) • M5X8L Flat Head Screw (2 each) 	
		LVD SCSI Cable, 2 Meter external	03K9196
		LVD SCSI Cable, 4 Meter external	03K9198
		LVD SCSI Cable, 12 Meter external	03K9200
		LVD SCSI Cable, 20 Meter external	37L0053
		Line Cord, 9 Foot	6952300
		Line Cord Jumper, High Voltage	36L8886

Table 47. EXP200 power cords.

Power Cords	FRU No.		Power Cords	FRU No.
Arabic	14F0033		Netherlands	13F9979
Argentina	13F9940		Norway	13F9979
Australia	13F9940		Poland	13F9979
Belgium	13F9979		Portugal	13F9979
Bulgaria	13F9979		Serbia	13F9979
Canada	6952300		Slovakia	13F9979
Czech Republic	13F9979		South Africa	14F0015
Denmark	13F9997		Spain	13F9979
Finland	13F9979		Switzerland	13F9979
France	13F9979		Switzerland (French/German)	14F0051
Germany	13F9979		Thailand	1838574
Hungary	13F9979		U.S. English	6952300
Israel	14F0087		U.K./Ireland	14F0033
Italy	14F0069		Yugoslavia	13F9979
Latvia	13F9979			

Chapter 11. IBM FAStT EXP500 enclosure

Note: The problem determination (PD) maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

The IBM Netfinity FAStT EXP500 enclosure is compatible with the following IBM products:

- Type 3552 FAStT500 RAID controller (see Chapter 7 on page 65)
- FAStT200 type 3542 and FAStT200 HA type 3542 (see Chapter 9 on page 209)
- Type 1742 FAStT700 controller

Features

The following table summarizes the features of the EXP500 type 3560 enclosure. For a list of the operating specifications, such as weight, height, and heat output, see “Specifications” on page 307.

General

- Modular components:
 - High-capacity disk drives
 - Environmental services monitor (ESM) boards
 - Power supplies
 - Cooling fans
- Technology:
 - Supports disk arrays
 - Supports clustering
 - Fibre Channel host interface
 - Redundant data storage, cooling system, power system, and ESM boards
 - Hot-swap technology for drives, power supplies, fans, and ESM boards
- User interface:
 - Built-in power, activity, and fault indicators
 - Identification labeling on customer replaceable units (CRUs), rear indicator lights, switches, and connectors
 - Easy-to-replace drives, power supplies, ESM boards, and fans

Disk drive storage

- Maximum drives per expansion unit: 10

ESM boards

- Technology and interfaces:
 - Fibre Channel: 40-pin FC disk drives
 - Fibre Channel interface: Four, GBICs connectors for incoming and outgoing FC cables (two GBICs on each ESM board)

Diagnostics and test information

Important

The service procedures are designed to help you isolate problems. They are written with the assumption that you have model-specific training on all computers, or that you are familiar with the computers, functions, terminology, and service-related information provided in this manual and the appropriate IBM PC/Netfinity Server Hardware Maintenance Manual.

The following is a list of problems and references for diagnosing the IBM FAStT EXP500 type 3530.

Problem	Reference
Hard Disk Drive Numbering	See "Fibre Channel (FC) loop and ID settings" on page 310.
Error Codes/Error Messages	Refer to the Symptom-to-FRU Index for the server that the Storage Expansion Unit you are servicing is connected to.
Expansion Unit Options Switches	See "Installing the expansion unit" on page 308.
Front Controls and Indications	See "Front controls and indicators" on page 327.
Rear Controls and Indications	See "Rear controls, indicators, and connectors" on page 328.

Additional service information

- "Turning the expansion unit on and off"
- "Performing an emergency shutdown" on page 305
- "Restoring power after an emergency" on page 306
- "Clustering support" on page 306
- "Getting help on the World Wide Web" on page 306
- "Specifications" on page 307

Turning the expansion unit on and off

This section contains instructions for turning the expansion unit on and off under normal and emergency circumstances.

If you are turning on the expansion unit after an emergency shutdown or power outage, refer to "Restoring power after an emergency" on page 306.

Turning on the expansion unit

Use this procedure to turn on the power for the initial startup of the expansion unit.

1. Verify that:
 - a. All communication and power cables are plugged into the back of the expansion unit and an ac power outlet.
 - b. All hard disk drives are locked securely in place.
 - c. The tray number switches on the expansion unit are set correctly. (See "Tray number settings" on page 310 for more information.)
2. Check the system documentation for all the hardware devices you intend to turn on and determine the proper startup sequence.

Note: Be sure to turn on the IBM EXP500 before the server.

3. Turn on the power to each device, based on the startup sequence.

Attention: If you are restarting the system after a normal shutdown, wait at least 10 seconds before you turn on the power supply switches.

4. Turn on both power supply switches on the back of the unit.

The expansion unit might take a few seconds to power up. During this time, you might see the amber and green LEDs on the expansion unit turn on and off intermittently. When the startup sequence is complete, only the green LEDs on the front and back and the amber Bypass LEDs for unconnected GBIC ports should remain on. If other amber LEDs remain lit, refer to “Symptom-to-FRU index” on page 331.

Turning off the expansion unit

Attention: Except in an emergency, never turn off the power if any Fault LEDs are lit on the expansion unit. Correct the fault before you turn off the power, using the proper troubleshooting or servicing procedure. This will ensure that the expansion unit will power up correctly later. For guidance, see “Symptom-to-FRU index” on page 331.

The expansion unit is designed to run continuously, 24 hours a day. After you turn on the expansion unit, 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”).

CAUTION:

The power control button on the device and the power switch on 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. Check the system documentation for all hardware devices you intend to turn off and determine the proper power-down sequence.
2. Make sure that all I/O activity has stopped.
3. Make sure that all amber Fault LEDs are off. If any Fault LEDs are lit (drives, power supplies, or fans), correct the problem before you turn off the power. For guidance, see “Symptom-to-FRU index” on page 331.
4. Turn off both power supply switches on the back on the expansion unit.

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 expansion unit loses power unexpectedly, it might be due to a hardware failure in the power system or midplane (see “Symptom-to-FRU index” on page 331).

Use this procedure to shut down during an emergency.

1. If you have time, stop all activity and check the LEDs (front and back). Make note of any Fault LEDs that are lit so you can correct the problem when you turn on the power again.
2. Turn off all power supply switches; then, unplug the power cords from the expansion unit.

Restoring power after an emergency

Use this procedure to restart the expansion unit if you turned off the power supply switches during an emergency shut down, or if a power failure or a power outage occurred.

1. After the emergency situation is over or power is restored, check the expansion unit 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 switches are in the off position; then, plug in the expansion unit power cords.
3. Check the system documentation for the hardware devices you intend to power up and determine the proper startup sequence.

Note: Be sure to turn on the IBM EXP500 before the server.

4. Turn on the power to each device, based on the startup sequence.
5. Turn on both power supply switches on the back of the IBM EXP500.
6. Only the green LEDs on the front and back and the amber Bypass LEDs for unconnected GBIC ports should remain on. If other amber Fault LEDs are on, see “Symptom-to-FRU index” on page 331 for instructions.
7. Use your installed software application as appropriate to check the status of the expansion unit.

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 after clustering has been set up, 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 IBM EXP500, 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>

Specifications

The following summarizes the operating specifications of the EXP500.

Size (with front panel and without mounting rails)

- Depth: 56.3 cm (22.2 in)
- Height: 12.8 cm (5 in)
- Width: 44.7 cm (17.6 in)

Weight

- Standard expansion unit as shipped: 25 kg (54.5 lbs)
- Typical expansion unit fully loaded: 35.5 kg (78 lbs)

Electrical input

- Sine-wave input (50 to 60 Hz) is required
- Input Voltage:
 - Low range:
 - Minimum: 90 V ac
 - Maximum: 127 V ac
 - High range:
 - Minimum: 198 V ac
 - Maximum: 257 V ac
 - Input kilovolt-amperes (kVA) approximately:
 - Minimum configuration: 0.06 kVA
 - Maximum configuration: 0.36 kVA

Environment

- Air temperature:
 - Expansion unit on:
 - 10° to 35° C
 - (50° to 95° F)
 - Altitude: 0 to 914 m (3000 ft.)
 - Expansion unit on:
 - 10° to 32° C
 - (50° to 90° F)
 - Altitude: 914 m (3000 ft.) to 2133 m (7000 ft.)
- Humidity:
 - 8% to 80%

Acoustical noise emissions values

For open bay (0 drives installed) and typical system configurations (8 hard drives installed).

- Sound Power (idling):
 - 6.3 bels (open bay)
 - 6.5 bels (typical)
- Sound Power (operating):
 - 6.3 bels (open bay)

- 6.6 bels (typical)
- Sound Pressure (idling):
 - 47 dBA (open bay)
 - 49 dBA (typical)
- Sound Pressure (operating):
 - 47 dBA (open bay)
 - 50 dBA (typical)

These levels are measured in controlled acoustical environments according to 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.

Locations and installation procedures

The following information supports the EXP500.

- “Installing the expansion unit”
- “Installing and replacing devices” on page 314
- “IBM FAStT EXP500 bays” on page 326
- “Fan, ESM, and power supply bays” on page 326
- “Front controls and indicators” on page 327
- “Rear controls, indicators, and connectors” on page 328
- “ESM boards user controls” on page 330
- “System-management software support” on page 331

Installing the expansion unit

Use the following information to install the expansion unit in an EIA standard rack cabinet.

Getting started

Before you begin, review the following tasks and assumptions:

- If you are installing the expansion unit in a rack, you have already installed the other components in the rack and moved the rack to its permanent operating location.
- You have already installed the controllers and appropriate host adapters.
- There are optical Fibre Channel (FC) cables attached to the controllers or other previously installed IBM Fibre Array Storage Technology (FAStT) EXP500 expansion units, ready for final connection to the expansion unit.
- The installation site meets all area, environmental, power, and site requirements for the expansion unit. Refer to the expansion unit requirements listed under “Specifications” on page 307.

Preparing the expansion unit

The following information explains how to prepare the expansion unit for installation by removing the CRUs (customer replaceable units) and by setting the interface options.

Removing CRUs: It is easier to lift the expansion unit and install it in a rack if you remove all CRUs (drives, fans, power supplies, and ESM cards) first. A fully loaded expansion unit with 10 disk drives, two fan units, two ESM boards, and the two power supplies installed weighs 35.5 kg (78 lbs). If you remove all the CRUs, you can reduce the overall weight.

Attention: If you have data stored on the drives, label the drives before you remove them. Then when you replace the drives, install them in the same drive bays from which you removed them. Otherwise, you might lose data.

See “Installing and replacing devices” on page 314 for the information needed to remove the CRUs.

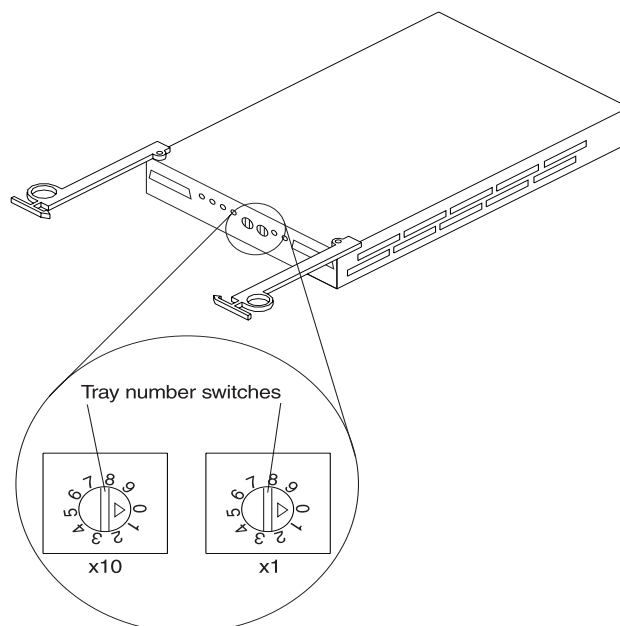


CAUTION:
Use safe practices when lifting.

Attention: The expansion unit is shipped with the decorative bezel attached to the front of the unit with two white screws and nuts. This bezel protects the light pipes located above the drive trays. Leave the decorative bezel in place until you are instructed to remove it during the installation process.

Setting the interface options: There are two rotary tray number switches on each ESM board located on the back of the expansion unit. It is easier to set these switches before you install the expansion unit in a rack.

The switch on the left of the ESM board is for the extended ID, which is the tens position (x10). The switch on the right is for the base ID, which is the ones position (x1). The tray number switches have 10 settings (0-9). Use these settings to identify the ID of the expansion unit.



Fibre Channel (FC) loop and ID settings: When you install a drive CRU in the expansion unit, the drive tray plugs into a printed circuit board called the *midplane*. The midplane sets the fibre channel loop ID automatically, based on the setting of the tray number switch and the physical location (bay) of the drive CRU.

Tray number settings: Each ESM board has two tray number switches. These rotary switches (values 0-9) set various addresses and IDs. The base ID switch (x1) is for the ones position and the extended ID switch (x10) is for the tens position. The settings of the two switches, when used together, provide a two-digit ID of the expansion unit. The system management software uses this ID to provide correlation between the system management graphics and the physical expansion unit; the ID identifies which physical unit corresponds to the system management status.

You can set the expansion unit ID to any value from 00-99. Each expansion unit attached to a Fibre Channel controller must have a unique ID.

The base ID switch (x1) also sets the physical IDs of the drives within the expansion unit. Some controllers might require all drives on the FC loop to have a unique, hard-assigned address. Refer to your controller documentation to determine whether unique, hard-assigned addresses are required.

For each expansion unit ID, set the tray number for both ESM boards to the same value. Set the tray number for each pair of ESM boards to a unique value. The value must be different from all other pairs of ESM boards attached to the controller.

Attention: Each expansion unit tray number on both ESM boards must match exactly. Otherwise, the expansion unit might not function properly in the event of an ESM board failure.

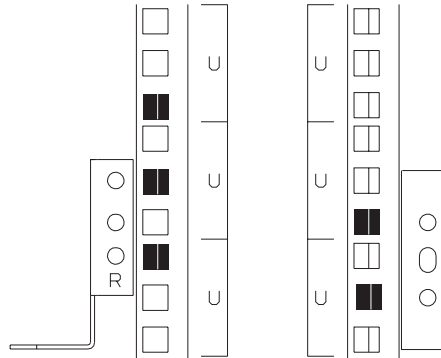
Installing the expansion unit in a rack

The EXP500 expansion unit requires 3U of EIA rack mounting space. Before installing the expansion unit in a rack, it is important that you do the following:

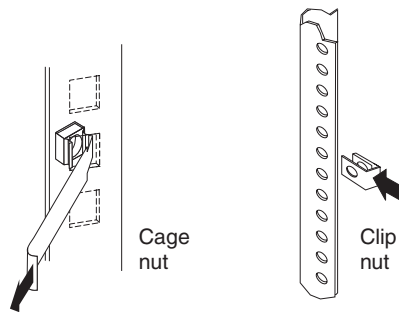
- Review the rack documentation for safety and cabling considerations. Ensure that your planned installation is within the rack-enclosure guidelines for heat generation, electrical requirements, air flow, and mechanical loading.
Note: Because of the limited space in some racks, it might be easier to connect and route cables before you install the mounting brackets and hardware devices.
- Install the expansion unit in a maximum 35° C environment.
- To ensure proper air flow, position the unit in the rack so that the air vents are not blocked. Usually 15 cm (6 inches) of air space is sufficient.
- To ensure the rack stability, load the rack starting from the bottom.
- If you install multiple components in the rack, do not overload the power outlets.
- Plan device installation starting from the bottom of the rack.
- Turn off power to your rack.
- Refer to the rack documentation for instructions on removing its doors and side panels.
- Connect the expansion unit to a properly grounded outlet.

Use the rack-mounting template that comes with the expansion unit to locate the rack mounting holes and install the unit into a rack cabinet. If you misplace the template, you can use the following steps to install your expansion unit:

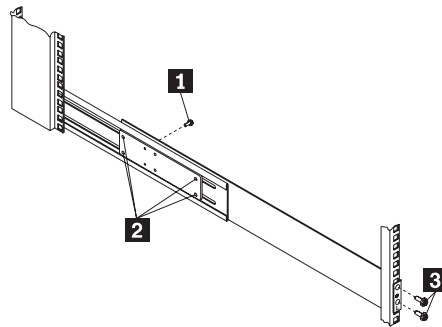
1. Use the following figure of front and rear rack mounting flanges to determine the appropriate rack mounting holes for installing cage nuts or clip nuts to secure your IBM FASTT EXP500 rails.



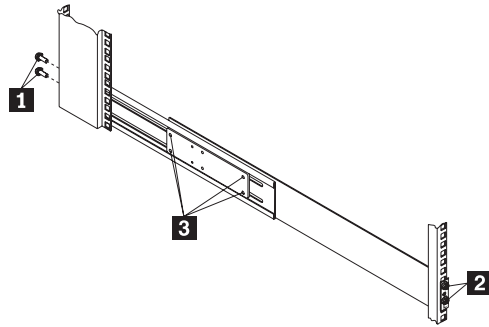
Note: Use clip nuts if your rack has round holes. If your rack has square holes, you can use the rack insertion tool or a flat-blade screwdriver to install cage nuts.



2. On the rail marked L, remove and save the small screw (1); then, loosen the four large screws (2).



3. Hold the rail against the outside of the left rack mounting flange and loosely insert the front black hex screws (3).
4. Extend the rail outside of the rear rack mounting flange; then, install and tighten both rear black hex screws (1).



5. Tighten the two front screws (2); then, tighten the four large screws (3).
Repeat step 2 through step 5 to install the rail marked R on the right side of the rack.



CAUTION:
Use safe practices when lifting.

6. Lift and then slide the expansion unit into the rack; then, remove and discard both white screws and wing nuts (1) from the bezel.
7. Align the bezel locator pins with the expansion unit; then, secure the bezel and IBM FAStT EXP500 with two black hex screws (2).
8. Use the two small screws (3) (removed in step 2) to secure the rear of the expansion unit.
9. Install hard disk drives, fans, ESM boards, and power supplies in the EXP500 expansion unit according to “Installing and replacing devices” on page 314; then, return here to complete the installation.
10. Continue with “Completing the installation”.

Completing the installation

This section provides the information needed to complete the installation. Instructions for installing the identification labels and cabling the expansion unit are included.

Installing identification labels: Your expansion unit comes with two expansion unit ID labels.



1. Install the expansion unit ID labels.
 - a. Verify the setting of the tray number switches (0-9).
 - b. Apply the expansion unit ID labels that match the setting for the tray number switches.
2. Continue with "Cabling the expansion unit".

Cabling the expansion unit: This section provides the Fibre Channel expansion unit power cabling information. After you attach your expansion unit power cables, use the instruction provided in "Turning the expansion unit on and off" on page 304 for the initial startup of the expansion unit.

The IBM FASTT EXP500 provides redundant loop support. A redundant IBM FASTT EXP500 loop consists of one or more expansion units connected to a host (controller) using two sets of FC cables. If one FC fails, the host uses the other IBM FASTT EXP500 loop to maintain I/O to the IBM FASTT EXP500 array group.

Fibre Channel loop: A Fibre Channel (FC) loop consists of FC disk drives connected to each other and to one or more controllers. A loop can support multiple controllers, a large number of disk drives, and other addressable entities such as system management logic chips. Refer to your controller documentation for information on controller-dependent hardware configuration details. Some controllers might have restrictions on the maximum number of disk drives supported on a loop, cabling restrictions, and other requirements.

GBICs: Your IBM FASTT EXP500 expansion unit supports large, complex and redundant, disk drive loop configurations. Each ESM board has two GBIC ports. These GBIC ports are labeled with (input) and (output). You build a loop by connecting one or more IBM FASTT EXP500 expansion units to one or more controllers. You then use dual fiber-optic cables to connect one IBM FASTT EXP500 expansion unit to another in a daisy-chain. It takes two GBICs on the ESM board to connect a single IBM FASTT EXP500 expansion unit to a controller in a redundant loop.

Optical Fibre Channel cable restrictions

Controllers that are FC compliant can use any external cable length offered by IBM in any clustered or nonclustered application.

Power cabling: The expansion unit 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 uninterruptible power supply (UPS), or to an external source, such as a properly grounded electrical outlet.

If you have not already done so, attach the power supply cord as follows:

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 supply power cord into a properly grounded electrical outlet.
5. Go to “Turning on the expansion unit” on page 304 for the initial startup of the expansion unit.

Installing and replacing devices

Use the following information to help you install or remove customer replaceable units (CRUs), such as hot-swap drives, fans, ESM boards, and power supplies.

Working with hot-swap drives

Before you begin

- Read the safety and handling guidelines provided in this document.
- Ensure that your current system configuration is working properly.
- Back up all important data before you make changes to storage devices, such as hard disk drives.

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

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

Blank trays

Expansion units without a full set of drives (10) contain blank trays in the unused drive bays. Before installing new drives, you must remove the empty trays. Save the empty trays for future use. Each of the 10 bays must always contain either a blank tray or a drive CRU. Each blank tray contains a filler piece for use with a half-high or slim-line drive.

Drive CRUs

Your expansion unit supports IBM Fibre Channel (FC) hard disk drives. These IBM drives come preinstalled in a drive tray, ready for installation. (Do not detach the drive from the tray.) This drive and tray assembly is called a *drive CRU* (customer replaceable unit). You can install the drive CRUs directly into the 10 drive bays on the front of the expansion unit.

Drive CRU labels

A label is provided on the front of the drive CRU tray. Use this label to record the location information for each drive *before* you remove it. Ensure that you keep track of the drives and their corresponding bays. (If you reinstall a drive in the wrong bay, you might lose data.)

Drive LEDs

Each drive tray has two LEDs that indicate the status for that particular drive. The drive LED states and descriptions are as follows.

Table 48. Drive LEDs for FAS*t*T EXP500 Storage Expansion unit.

LED	LED State	Definitions
Activity LED	Green flashing	The green light flashes to indicate FC activity to the drive.

Table 48. Drive LEDs for FAStT EXP500 Storage Expansion unit.

LED	LED State	Definitions
Activity LED	Green on	The green light is on to indicate the drive is properly installed.
Fault LED	Amber flashing	The amber light flashes to indicate a drive rebuild is under way, or that a drive has been identified by software.
Fault LED	Amber on	The amber light is on to indicate a drive failure.

Fibre Channel loop IDs

When you install a drive CRU in the expansion unit, the drive tray plugs into a printed circuit board called the *midplane*. The midplane sets the fibre channel loop ID automatically, based on the setting of the tray number switch and the physical location (bay) of the drive CRU.

Hot-swap hardware

Your expansion unit contains hardware that enables you to replace a failed hard disk drive without turning off the expansion unit. Therefore, you have the advantage of continuing to operate your system while a hard disk drive is being removed or installed. These drives are known as *hot-swap* drives.

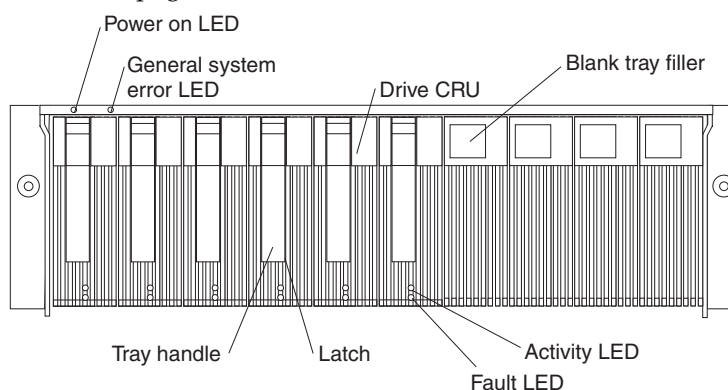
Slim-line drives

You can install slim-line, hot-swap drive CRUs, which are slightly smaller in size than the standard disk drive. These drive CRUs do not fill the entire drive bay. To maintain proper air flow and cooling when you install a slim-line drive, you must also install one of the fillers provided in the blank trays.

Installing hot-swap drives: Use the following procedure to install drives in the expansion unit. You can install additional drives while the expansion unit is powered up and running.

Note: If you are replacing a drive, see “Replacing hot-swap drives” on page 317.

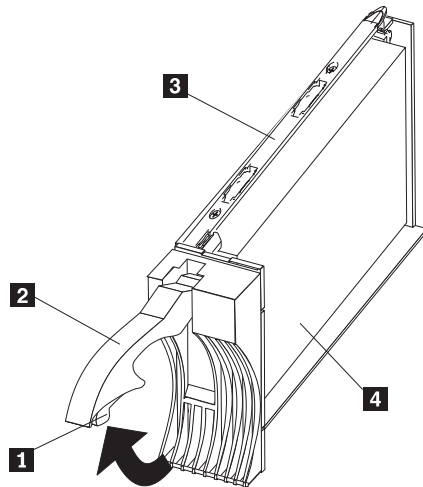
1. Read the instructions that come with the drive CRU.
2. Check for Fault LEDs. If any amber LEDs are lit, refer to “Replacing hot-swap drives” on page 317.



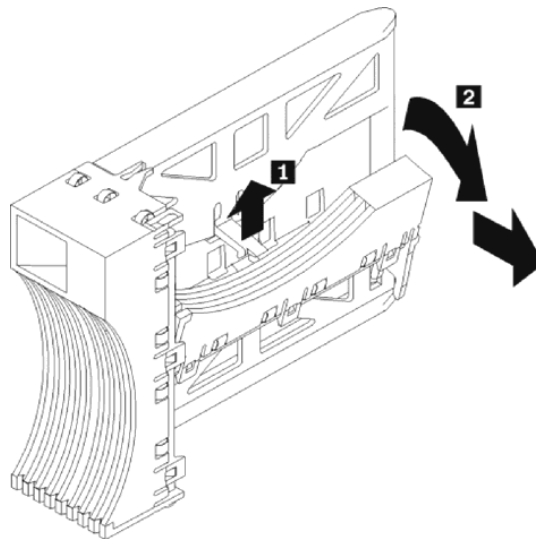
3. Determine the bay into which you want to install the drive.
4. Remove the blank tray.
 - a. Insert a finger into the square hole at the top of the blank tray to grip and pull the tray out of the drive bay.

- b. Save the blank tray for later use.
- 5. Install the drive CRU:

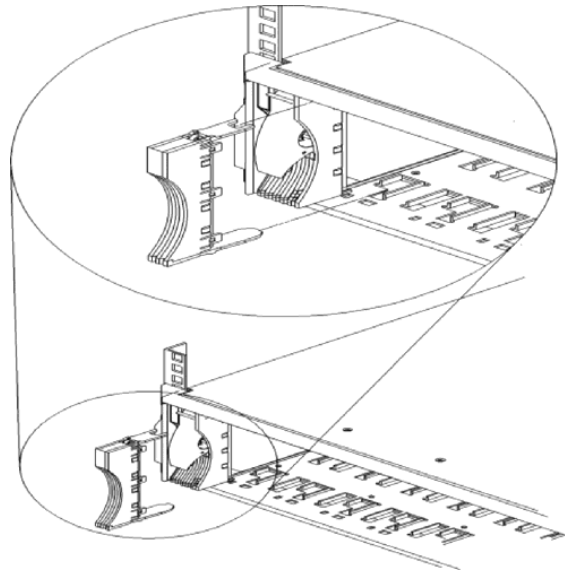
Note: The hard disk drive comes with a tray already attached. Do not attempt to detach the drive (4) from the tray (3)



- 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 expansion unit 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 a below. Otherwise, go to step 7.
 - a. Locate the filler piece on the inside of the blank tray.
 - b. Pull up on the small latch (1) inside the blank tray to release the filler piece.
 - c. Tilt the filler piece up from the blank tray (2); then, remove it from the tray as shown in the following figure.



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



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. Configure the drive using the appropriate software.

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 in the expansion unit. This includes transmission problems between the host controllers, the ESM boards, and the drives. This section explains how to replace a failed drive.

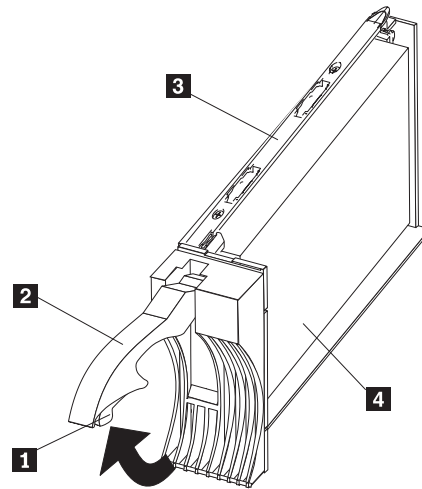
Attention: Failure to replace the drives in their correct bays might result in loss of data. If you are replacing a drive that is part of a RAID level 1 or RAID level 5 logical drive, ensure that you install the replacement drive in the correct bay.

Check the hardware and software documentation provided with your system to see whether there are restrictions regarding hard disk drive configurations. Some system Fibre Channel (FC) configurations might not allow mixing different drive capacities or types within an array.

1. 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 Fault LED is completely on and not flashing or when the drive is inactive with the green Activity LED completely on and not flashing.
2. 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 expansion unit to allow for the drive to spin down.



- e. Verify that there is proper identification (such as a label) on the drive CRU, then slide it completely out of the expansion unit.
 - f. If you are replacing a slim-line drive, ensure that the filler piece remains in place for use with the new drive.
3. Install the new drive CRU.
 - a. Gently push the drive CRU into the empty bay until the tray handle (2) touches the expansion unit bezel.
 - b. Push the tray handle (2) down into the closed (latched) position.
 4. 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.
 5. Return to normal operation.

Working with hot-swap power supplies

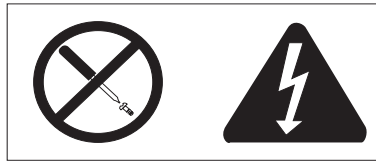
The power supplies are customer replaceable units (CRUs) and do not require preventive maintenance.

- The power supplies must always be in their proper places to maintain proper expansion-unit cooling.
- Use only the supported power supplies for your specific expansion unit.

Removing a hot-swap power supply:

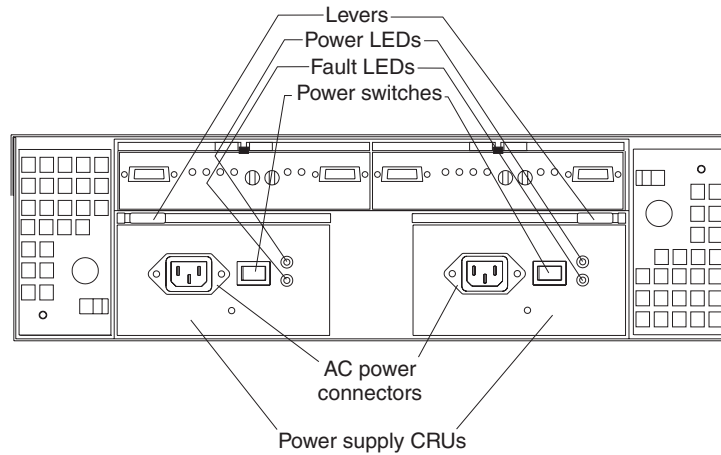
CAUTION:

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.



To remove a hot-swap power supply:

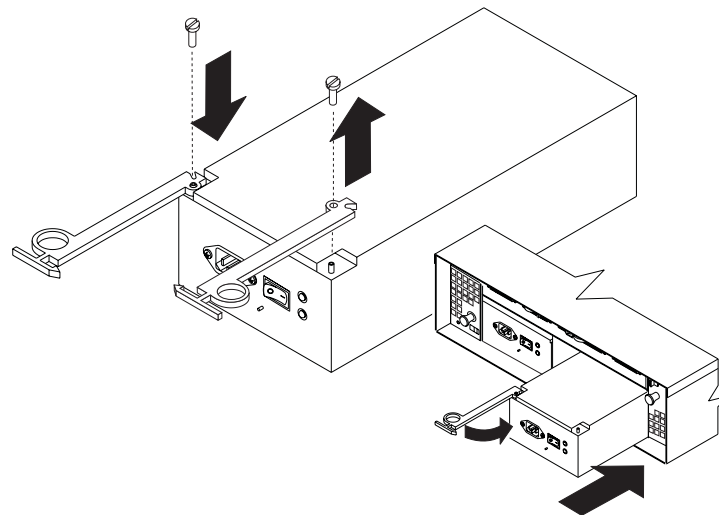
1. Turn the power supply switch to the Off position.



2. Unplug the power supply cord from the electrical outlet.
3. Disconnect the power cord from the power supply.
4. Remove the nut and clamp from the rear of the power supply.
5. Remove the power supply from the expansion unit.
 - 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 due to a failure, ensure that the power supply latch is mounted on the side of the power supply that faces the middle of the expansion unit. If not, remove the lever screw, flip the lever over and tighten the screw on the opposite side.

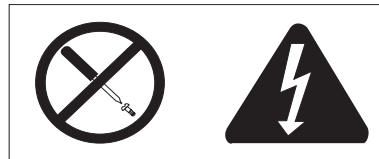


To install a hot-swap power supply:

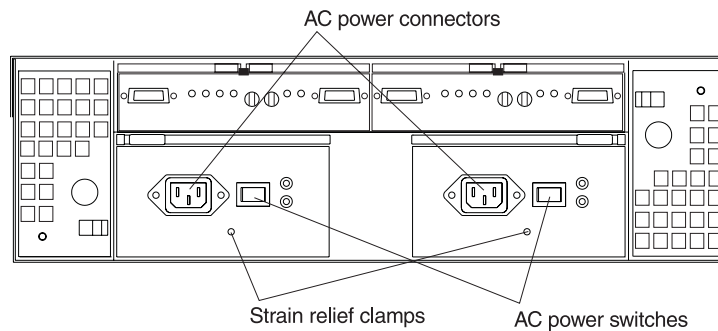


CAUTION:

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.



1. Ensure that the ac power switch on the power supply you are installing is in the Off position.
2. Install the power supply in the expansion unit.
 - a. Slide the power supply into the expansion unit. Be sure the lever is pulled straight out as you slide the power supply into the expansion unit.
 - b. Close the lever until the pull-ring latch locks in place. Make sure the lever locks into place in the expansion-unit chassis.
3. Wrap the 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 power supply.



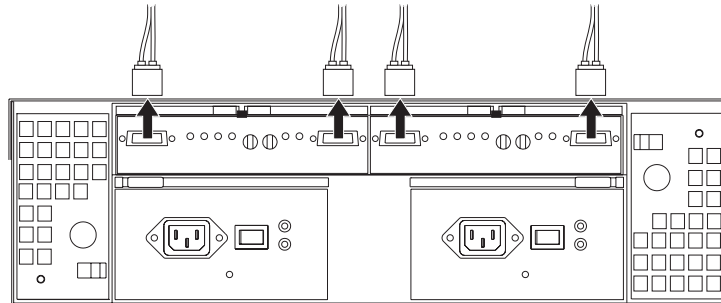
6. Plug the supply power cord into a properly grounded electrical outlet.
7. Turn the power supply switch to the On position.

Working with hot-swap ESM boards

When replacing an ESM board, remember to do the following:

1. Check the software documentation provided with your system for instructions on ESM board failure-recovery procedures. Follow the steps provided in the software documentation before continuing to step 2.
2. Label each cable to ensure that all cables are properly reconnected to the new ESM board.
3. Label the GBICs when you remove them. You must install the GBICs in the same positions on the new ESM board.
4. Remove the GBICs and FC cables from the failed ESM board.

Note: Be careful not to bend the FC cables at a sharp angle or pinch them with objects. This can decrease the performance or cause data loss.



5. To remove the failed ESM board (the Fault indicator light is lit), push down on the latch. The levers will pop out of the locked position.
6. Grasp the pull-rings and pull out on the levers, then remove the ESM board.
7. Set the tray numbers on the new ESM board to match the tray numbers on the failed ESM board.
8. Install the new ESM board by sliding it into the empty slot. Be sure the levers are pulled straight out as you slide the ESM board into the expansion unit.
9. Close the levers until the pull-ring latch locks in place. Make sure the levers lock into place in the expansion-unit chassis.
10. Reattach the GBICs and FC cables to their original locations.
11. Check the Bypass LEDs at both ends of the reattached cables. If the Bypass LEDs are on, reattach the cables and GBICs.
12. Check the Power and Fault indicator lights on the new ESM board:
 - If the Power indicator is off, the ESM board might not be inserted correctly.
 - If the Fault indicator is lit, the Power indicator does not light, or any other Fault indicator is lit, refer to "Symptom-to-FRU index" on page 331.
13. Refer to your storage management software for instructions on enabling the ESM board.

Working with GBICs

The expansion unit has four gigabit interface card (GBIC) ports (two on each ESM board). Use the GBIC ports to attach FC cables to the expansion unit.

Installing GBICs: This section provides information on installing GBICs and adding additional IBM Fibre Array Storage Technology (FAST) EXP500 expansion units to a loop. The GBICs are laser products.



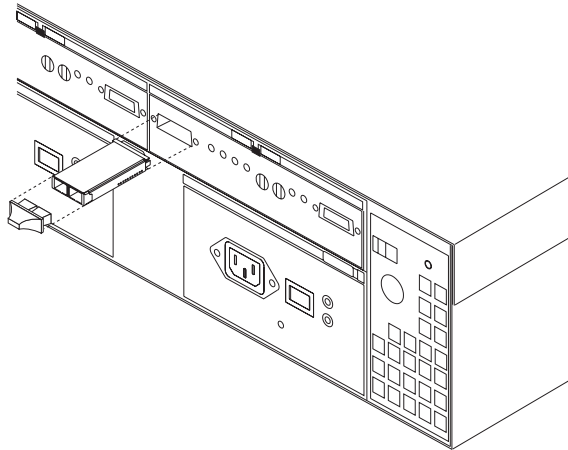
CAUTION:

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

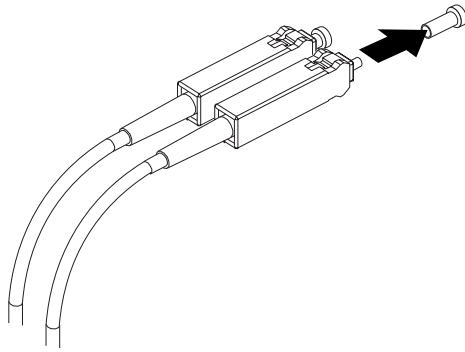
- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.
- Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation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

To install a GBIC, do the following:

1. Remove the protective cap from the GBIC.

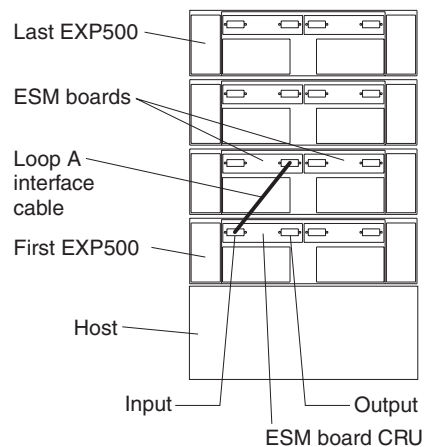


2. Move the GBIC latch to the unlocked (center) position.
3. Insert the GBIC into the GBIC port on the ESM board.
4. Move the GBIC latch back to the locked position (flush with the rear of the GBIC).
5. Remove the protective caps from the fiber-optic cable.



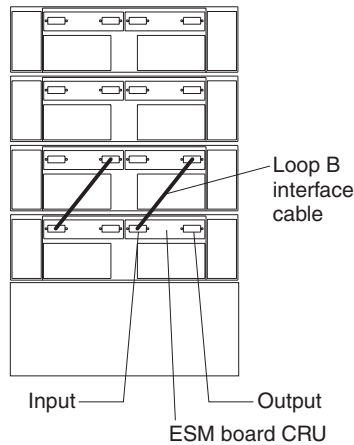
6. Connect the fiber-optic cable to the installed GBIC.

Adding IBM FAStT EXP500 expansion units to a loop: If you want to add an additional IBM FAStT EXP500 expansion unit to a loop, cable the GBIC input port on the existing ESM board (shown as First EXP500 in the following figure) to a GBIC output port on the new Netfinity FAStT EXP500 expansion unit. You can daisy-chain additional IBM FAStT EXP500 expansion units until the loop reaches the maximum defined by the controller. The controller might also have cabling configuration information or restrictions that you must follow.



IBM FAStT EXP500 loop redundancy: The IBM FAStT EXP500 expansion unit provides redundant loop support. This redundant loop support is available when the second ESM board is configured (as shown in the following figure). If an ESM board, cable, or GBIC fails on a loop, the second loop provides an additional measure of redundancy (that is, an alternative path to your disk drives).

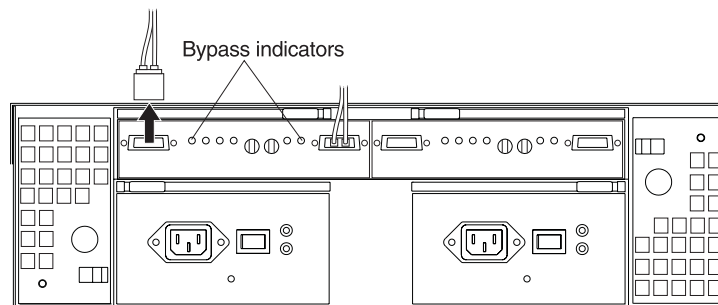
Some FC controllers might not support loop redundancy. IBM Fibre Channel (FC) disk drives are dual-ported, providing individual access from two FC loops to the same disk drive. When configuring the ESM boards, configure the second ESM board the same way you configured the first ESM board. Refer to your controller documentation for more information on dual-loop support and implementation.



The GBIC ports are labeled with (input) and (output). Some controllers might provide additional reliability features if an (input) port is connected to an (output) port. As you daisy-chain FAS/T EXP500 expansion units together, connecting (input) ports to (output) ports can facilitate reliability. In many cases, a loop will still function properly without attaching the (input) ports to (output) ports. Refer to your controller documentation for requirements on connections between input and output ports.

A lit Bypass indicator next to a GBIC can be caused by a number of things. It does not necessarily mean that the GBIC has failed. See “Symptom-to-FRU index” on page 331 for other possible causes. If you do determine that a GBIC has failed, follow this procedure to replace the failed GBIC.

1. Check the software documentation provided with your system for instructions on GBIC failure recovery procedures. Follow the steps provided in the software documentation before continuing to step 2.
2. Remove the FC cables from the GBIC.
3. Remove the failed GBIC from the GBIC port on the back of the ESM board.



4. Unpack the new GBIC.
 - Note:** Place the new GBIC on a dry, level surface near the expansion unit and away from magnetic fields. Save all packing materials in case you need to return the GBIC.
5. Read the documentation that came with the new GBIC for replacement procedures and other information.
6. Insert the new GBIC into the GBIC port on the ESM board.
7. Insert the FC cables into the new GBIC.
8. Check the Bypass indicator next to the failed GBIC:
 - If the Bypass indicator is lit, the GBIC might not be inserted correctly.

- If the Bypass indicator remains lit, or a Fault indicator on the ESM board comes on, refer to “Symptom-to-FRU index” on page 331.
9. Replace or close the back access panel, if necessary.

Working with hot-swap cooling fans

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

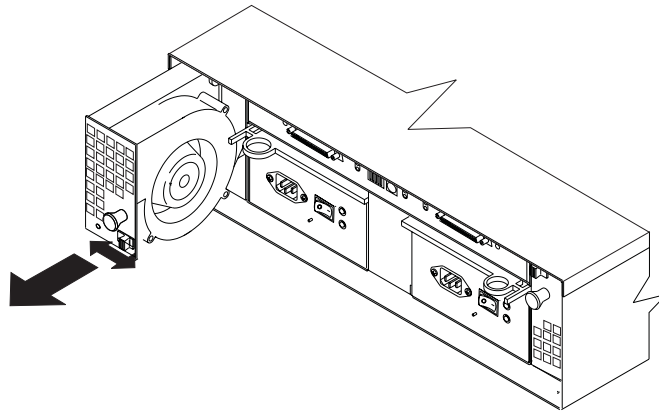
The fans are interchangeable and customer replaceable and do not require preventive maintenance. The fans help maintain proper air circulation across the components inside the expansion unit. Air flows through the expansion unit from the front to the back.

You can hot-swap the fans (replace them while the expansion unit is turned on and running), as long as you complete the exchange within 10 minutes. This time limit applies only to the total time that a fan is out of the expansion unit, beginning when you remove the failed unit and ending when you reseal the new one. This does not include the time it takes you to perform this entire procedure (checking LEDs, unpacking the new fan, and so on).

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 expansion unit.
2. If the amber Fault LED is on, remove the failed fan.
 - a. Slide the latch to unlock the fan CRU.
 - b. Use the handle (black knob) to pull the fan from the expansion unit.



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 expansion unit.
 - c. Release the latch. If the lever remains open, pull back on the fan slightly, 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 “Symptom-to-FRU index” on page 331.

IBM FAST EXP500 bays

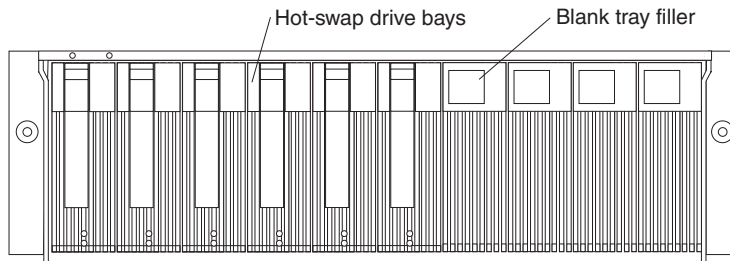
The following sections show the hot-swap CRUs on the IBM FAST EXP500 expansion unit.

The hot-swap features of the IBM FAST EXP500 expansion unit enable you to remove and replace hard disk drives, power supplies, ESM boards, and fans without turning off the expansion unit. Therefore, you can maintain the availability of your system while a hot-swap device is removed, installed, or replaced.

Hot-swap drive bays

The following figure shows the location of the hot-swap drive bays accessible from the front of your expansion unit. The IBM FAST EXP500 supports up to 10 (half-high or slim-line) 40-pin FC 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 expansion unit.

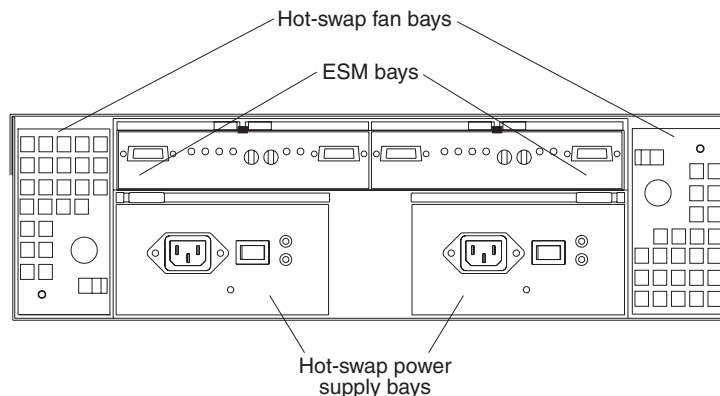
In this example figure, six of the 10 bays contain drive CRUs and four bays contain blank tray fillers. To maintain proper cooling within your expansion unit, always keep a blank tray filler in each drive bay that does not contain a drive CRU. For information on installing and replacing drive CRUs, see “Installing and replacing devices” on page 314.



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 completely on and not flashing.

Fan, ESM, and power supply bays

The following figure shows the location of the hot-swap fan bays, the hot-swap environmental services monitor (ESM) bays, and the hot-swap power supply bays.



ESM bays

Your expansion unit comes with two hot-swappable ESM boards. The environmental services monitor (ESM) boards provide a 1-gigabit FC interface to the drives and monitors the overall status of the expansion unit. Each ESM board has two GBIC connector ports for connecting your expansion unit to the controller or connecting two or more IBM FASTT EXP500 expansion units together. The ESM boards provide redundancy when both boards are configured into redundant FC loops. Refer to your FC controller documentation to determine whether the controller supports this redundancy function.

Hot-swap fan bays

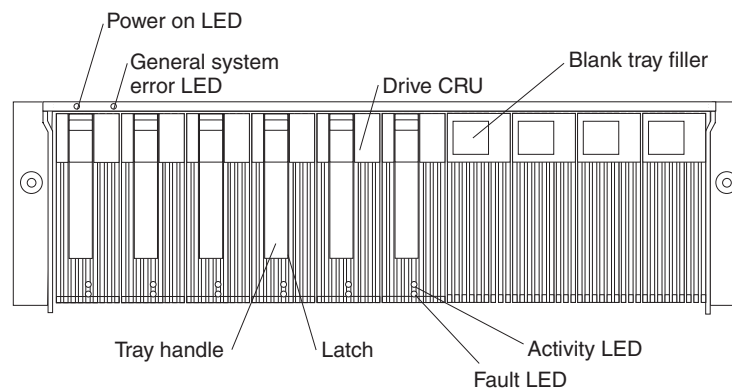
Your expansion unit has two interchangeable hot-swap and redundant fan units. Each unit contains two fans. If one fan unit fails, the second fan unit continues to operate. Both fan units must be installed to maintain proper cooling within your expansion unit, even if one fan unit is not operational.

Hot-swap power supply bays

Your expansion unit comes with two hot-swap and redundant power supplies. Both power supplies must be installed to maintain proper cooling within your expansion unit, even if one power supply is not operational.

Front controls and indicators

The primary controls on the front of the expansion unit are shown in the following figure.



Activity LED

Each drive CRU has an Activity LED. When flashing, this green LED indicates drive activity. When completely on, this green LED indicates the drive is properly installed.

Blank tray filler

Expansion units shipped without a full set of drives (10) contain blank trays in the unused drive bays. Before installing new drives, you must remove the blank trays and save them. Each of the 10 bays must always contain either a blank tray or a drive CRU. Each blank tray contains a filler piece for use with a slim-line drive.

Drive CRU

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

Fault LED

Each drive CRU has a Fault LED. When lit, this amber LED indicates a drive failure. When flashing, this amber LED indicates that a drive Identify or Rebuild process is in progress.

General system error LED

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

Latch

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

Power-on LED

When lit, this green light indicates that the unit has adequate dc power.

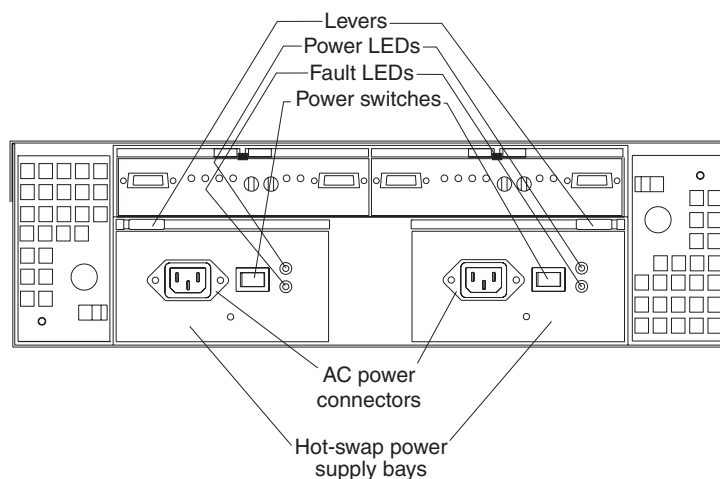
Tray handle

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

Rear controls, indicators, and connectors

Two hot-swap power supply CRUs, two hot-swap fan CRUs, and two environmental services monitor (ESM) boards are accessible from the back of the expansion unit. These components contain several controls, indicators, and connectors.

Power supply controls, indicators, and connectors



Fault LEDs

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

Levers

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

Power LEDs

These green LEDs light when the expansion unit is turned on and receiving ac power.

Power supply CRUs

The two hot-swap power supplies are located here. Both power supply CRUs must be installed, even if one power supply is not operational.

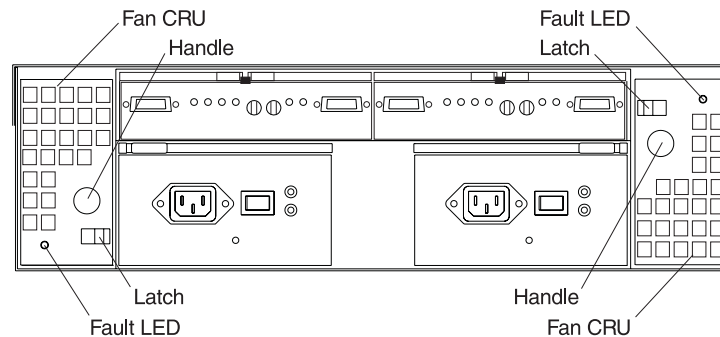
Power switches

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

Fan controls and indicators

The fans in your IBM FAStT EXP500 are hot-swappable and redundant. This means that your IBM FAStT EXP500 will continue to operate if a fan fails. It also means that you can remove and replace the fan while the IBM FAStT EXP500 is on and accessing drives.

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



Fan CRUs

There are two fan CRUs. These fans are hot-swappable and redundant.

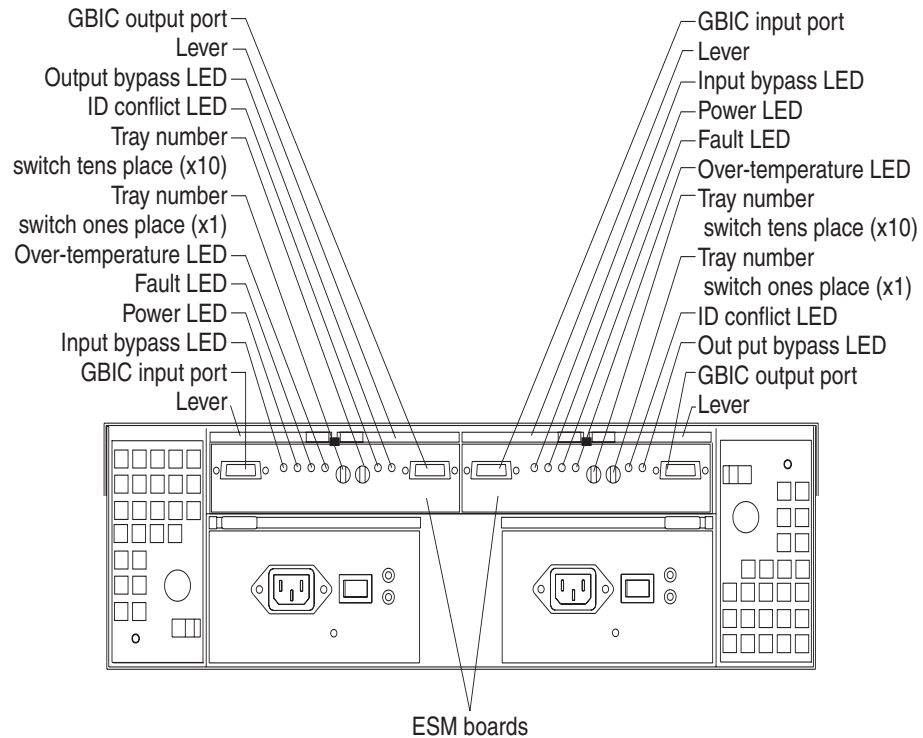
Fault LEDs

These amber LEDs light when a fan failure occurs.

Latches and handles

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

ESM boards user controls



ESM boards

The environmental services monitor (ESM) boards contain the expansion unit controls, switches, and LEDs. Each ESM board has two GBIC ports for connecting the expansion unit to the controller.

Fault LEDs

These amber LEDs light when an ESM board failure occurs.

GBIC input ports

The two GBIC input ports are for attaching the optional GBICs to the expansion unit.

GBIC output ports

The two GBIC output ports are for attaching the optional GBICs to the expansion unit.

The optional GBICs (input and output) are for attaching your optical cables to the expansion unit, then to the controller or additional expansion units. Insert the GBICs in the expansion unit GBIC ports and attach your FC cables to the GBICs, then connect the FC cables to the controller or additional expansion units.

ID conflict LEDs

These amber LEDs light if the expansion unit tray ID settings for the ESM boards do not match. In this case, the expansion unit uses the tray number of the left ESM board.

Input/ Output bypass LEDs

These amber LEDs light when no valid input signal is detected and when no

data is passed through the port. When no cable is connected to the port, the LEDs also light. Both ports on the ESM board are bypassed and the LEDs are lit in the event of an ESM board fault. In this case, the ESM Fault LED is also lit.

Levers

Use these levers when removing and inserting the ESM boards.

Power LEDs

These green LEDs are lit when there is power to the ESM board.

Over temperature LEDs

These amber LEDs light if the expansion unit overheats.

Tray number switches

These switches assign the physical addresses of the disk drives and the system management processors that are participating in the loop, and they identify the IBM FAStT EXP500 expansion unit. The base switch (x1) sets the IDs of the disk drives on the loop. The settings of both the base ID switch (x1) and the extended ID switch (x10) together are the expansion unit ID. The switches set the expansion unit ID using values of 00-99. The base ID switch (x1) is for the ones position and the extended ID switch (x10) is for the tens position.

System-management software support

The IBM FAStT EXP500 expansion unit meets the SES (SCSI-3 Enclosure Service) industry standards for external enclosures. The level of system management support is dependent upon the software and services provided by the FC controller. Refer to your controller documentation for additional information on the level of system management support provided.

Symptom-to-FRU index

Note: The PD maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

Use this chart to find solutions to problems that have definite symptoms.

Table 49. Symptom-to-FRU index for FAStT EXP500 Storage Expansion unit.

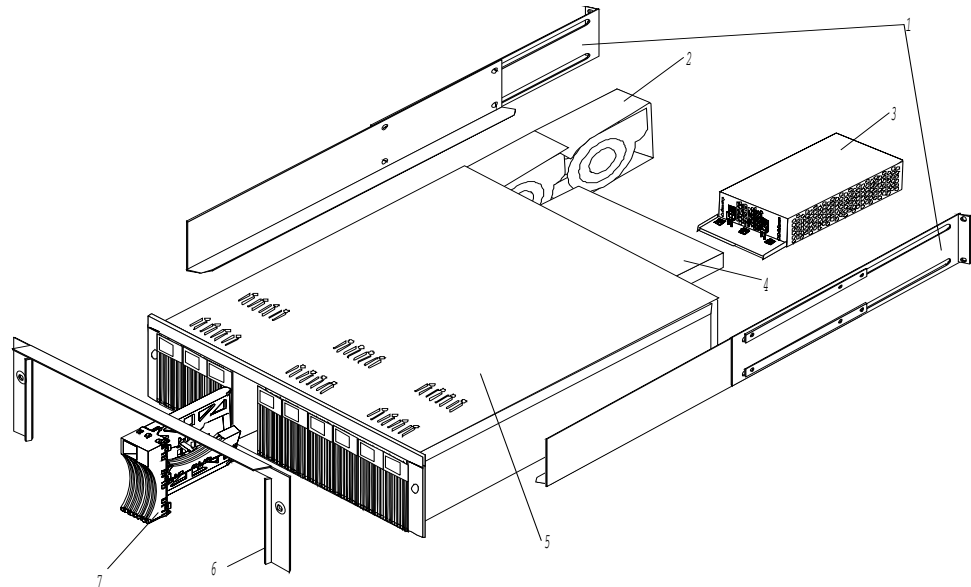
Problem Indicator	FRU/Action
Amber LED On (Front Panel)	1. General Machine Fault Check for amber LED on expansion unit. Use the RAID manager software to check the status.
Amber LED On (Hard Disk Drive)	1. Hard Disk Drive
Amber LED On (Fan)	1. Fan
Amber LED On	1. ESM board
Amber LED On, Green LED Off (Power Supply)	1. Turn Power Switch On 2. Power cord 3. Reseat Power Supply 4. Power Supply
Amber and Green LEDs On (Power Supply)	1. Power Supply

Table 49. Symptom-to-FRU index for FAST EXP500 Storage Expansion unit.

Problem Indicator	FRU/Action
All Green LEDs Off	<ol style="list-style-type: none"> 1. Check AC voltage cabinet AC voltage line inputs 2. Power Supplies 3. Midplane board
Intermittent power loss to expansion unit	<ol style="list-style-type: none"> 1. Check AC voltage line inputs, and cabinet power components 2. Power Supplies 3. Midplane board
One or more Green LEDs Off (Power Supply)	<ol style="list-style-type: none"> 1. Turn Power Switch On 2. Power cord 3. Reseat Power Supply 4. Power Supply
One or more Green LEDs On (Drives)	<ol style="list-style-type: none"> 1. No activity to the drive 2. This can be normal activity
Intermittent Power Loss	<ol style="list-style-type: none"> 1. AC power or plug 2. Power supply 3. Midplane
Random errors	<ol style="list-style-type: none"> 1. Midplane board
One or more Green LEDs blinking slowly. (All hard disk drives.)	<ol style="list-style-type: none"> 1. Check cabling scheme 2. FC Cable 3. GBIC
Hard disk drive not visible in RAID management software.	<ol style="list-style-type: none"> 1. Hard Disk Drive 2. Midplane Board
Amber temperature LED enabled in RAID management software. (ESM Board)	<ol style="list-style-type: none"> 1. Check for fan fault LED 2. Unit is overheating; check temperature. 3. ESM Board
Amber conflict LED on. (ESM Board)	<ol style="list-style-type: none"> 1. Tray numbers of ESM boards within a single FAST EXP500 do not match
GBIC bypass LED. Note: It is normal for the LED to be on when no GBIC or cable is installed.	<ol style="list-style-type: none"> 1. Check ESM fault LED 2. GBIC does not detect an incoming signal <ol style="list-style-type: none"> a. FC Cable b. GBIC or other end on the FC cable c. GBIC adjacent to amber LEDC cable

Note: If you cannot find the problem using this Symptom-to-FRU Index, test the entire system. See the server documentation for more detailed information on testing and diagnostic tools.

Parts listing



Index	System (IBM FASTT EXP500 - Type 3560, Model 1RU)	FRU No.
1	Rail Kit Left/Right (Model 1RU)	37L0067
2	Blower Assembly (Model 1RU)	09N7285
3	350W Power Supply Assembly (Model 1RU)	37L0059
4	Electronic Module (ESM, LVD/LVD) (Model 1RU)	37L0103
5	Midplane/Frame (Model 1RU) Note: The midplane board and frame are replaced as a unit. If either part is needed, order the above FRU.	37L0104
6	Decorative Bezel (Model 1RU)	37L0074
7	Blank Tray Assembly (Model 1RU)	37L6708
	Tower Enclosure (Model 1RU)	37L0120
	Tower Lock/Pawl (Model 1RU)	37L0121
	Tower Feet (Model 1RU)	09N7266
	Miscellaneous Hardware Kit (Model 1RU)	09N7288
	LVD SCSI Cable, 20 Meter external (Model 1RU)	37L0083
	Line Cord, 9 Foot (Model 1RU)	6952300
	Line Cord Jumper, High Voltage (Model 1RU)	36L8886

Table 50. EXP500 power cords.

Power Cords	FRU No.
Arabic	14F0033
Argentina	13F9940

Table 50. EXP500 power cords.

Power Cords	FRU No.
Australia	13F9940
Belgium	13F9979
Bulgaria	13F9979
Canada	6952300
Czech Republic	13F9979
Denmark	13F9997
Finland	13F9979
France	13F9979
Germany	13F9979
Hungary	13F9979
Israel	14F0087
Italy	14F0069
Latvia	13F9979
Netherlands	13F9979
Norway	13F9979
Poland	13F9979
Portugal	13F9979
Serbia	13F9979
Slovakia	13F9979
South Africa	14F0015
Spain	13F9979
Switzerland	13F9979
Switzerland (French/German)	14F0051
Thailand	1838574
U.S. English	6952300
U.K./Ireland	14F0033
Yugoslavia	13F9979

Chapter 12. IBM Storage Area Network Data Gateway Router (2108-R03)

Note: The problem determination (PD) maps found in the *Fibre Channel Problem Determination Guide* provide you with additional diagnostic aids.

Introduction

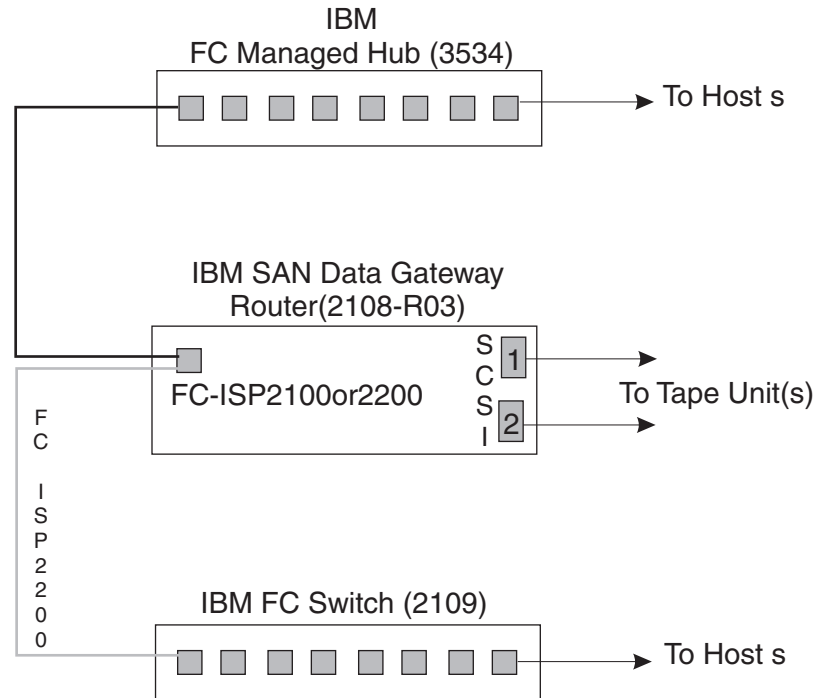
The IBM Storage Area Network Data Gateway Router (2108-R03) provides Fibre Channel-to-Small Computer Systems Interface (SCSI) connectivity. Typically, tape devices are connected to the SCSI side of the router with Hosts communication through the Fibre Channel interface.

This chapter describes the functionality of the IBM Storage Area Network Data Gateway Router (SDG) as well as the service and diagnostic tools that you may use to diagnose and repair the SDG Router. This chapter is organized as follows:

- Key Features of the SDG Router
- Block Diagram
- Connections
- Fibre Channel port modes and connection options
- Power-up and start sequence guidelines
- SDG Router network setup
- Service aids
 - LED indicators
 - Power-on-self-test (POST)
 - Health check
 - Event log
 - Service Port commands
 - Diagnostics

The Service aids should provide you with sufficient information and guidance to determine whether the unit is functional and how to diagnose problems. For actual FRU isolation please access the full Service Guide and the MAPs on the website: <http://www.storage.ibm.com/hardsoft/products/sagateway/2108r03/Document/sf1sgmst.pdf>, or by referring to the manual supplied with your SDG Router.

The following figure shows a typical topology where an SDG Router would be used.



The SDG Router can also be connected to the switch (Fabric), provided the FC card type is an ISP2200.

Key Features

Fibre Channel

The SDG Router FC interface for Host attachment is a plug-in Fibre Channel card. The SDG Router can accommodate 1 FC cards providing optical port connectivity. The card contains either a ISP2100 controller or the ISP2200 controller. The ISP2100 supports only Private loop whereas the ISP2200 supports Private loop and Fabric connection. The port supports long wave and short wave laser with SC fiber-optic connectors. The link data rate is 1 Gb\s.

SCSI Channels

The SCSI channels can be up to two Ultra-Wide SE, DE or LVD SCSI channels with internal termination. Each SCSI channel supports up to 15 SCSI target IDs and up to 32 LUNs per ID (subject to an overall total of 128 devices). The SDG Router itself uses one ID, leaving a total of 127 IDs for SCSI devices. The tape devices that are typically connected to the SDG Router are the IBM 3447, 3449, and 3502, although any IBM Tape device with a SCSI interface may be supported.

Ethernet

The SDG Router has an RJ-45 connector for out-of- band management of the router through the network.

Service Port

A Service Port is also included to allow Personal Computers to locally manage the SDG Router and initiate diagnostics. The connection is accomplished through the use

of a 9-pin-to-9-pin null-modem cable (supplied). The Service port should be connected and configured as follows:

1. Connect the null modem cable (and the 9- to 25-pin adapter if applicable) between the computer serial (COM) port and the SDG Router service port.
2. Turn on the service terminal.
3. On the service terminal, double-click the hyperTerminal icon.
4. In the New Connection dialog box, enter **SDG Router** for the name and click OK.
5. In the Connect To dialog box, for the **Connect using** field, select the COM port number that you have chosen and click OK.
6. In the COM Properties dialog box, select the following:
 - Bits per second: 19 200
 - Data bits: 8
 - Parity: None
 - Stop bits: 1
 - Flow Control: Xon/Xoff
7. Click **OK**.

Verifying the connection

If the SDG Router is already on, then characters typed in the terminal should be visible to the operator. The simplest test is to press the Enter key. The SDG Router will respond by displaying a command prompt like:

```
Router >
```

When the SDG Router is restarting, several messages are displayed on the service terminal. A successful start is indicated by the last message:

```
Done executing start-up script.
```

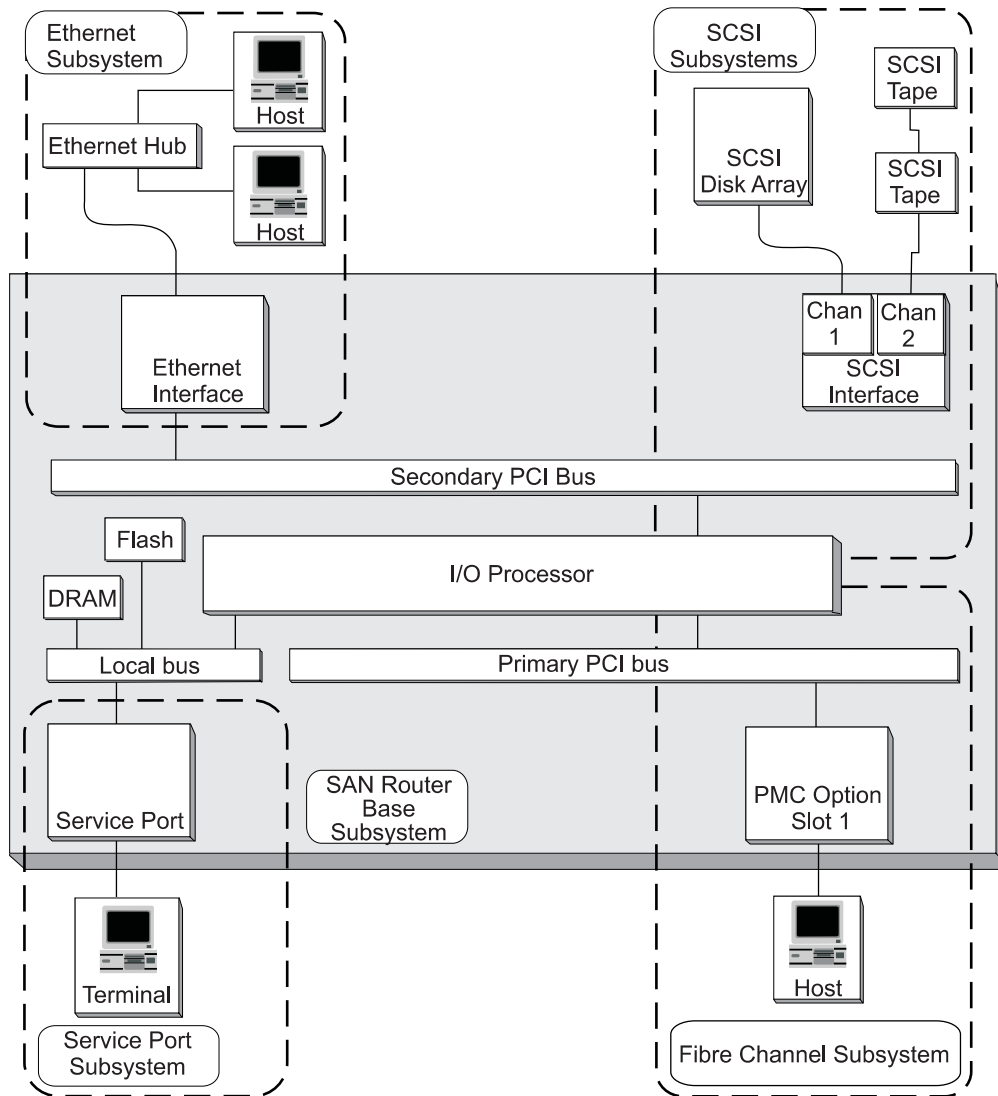
StorWatch Specialist

The IBM StorWatch[®] SDG Router Specialist (hereafter referred to as StorWatch Specialist) offers full capability for remote management, configuration and event notification. Each SDG Router has internal event logging, event analysis and periodic health check for predictive failure analysis (PFA). These management, configuration and notification capabilities are accessible by way of standard SNMP protocol for use with major network management applications. The StorWatch Specialist offers the Sun Java[®] application software for SDG Router remote management and configuration. For a complete description of the StorWatch Specialist and user's guide, please go to the following website:

<http://www.storage.ibm.com/hardsoft/products/sangateway/2108r03/Document/sf1iumst.pdf>

Block Diagram

The following figure shows the SDG Router Subsystems.



SCSI connections

SCSI devices are attached to any of the SCSI connectors on the rear of the SDG Router. The device types and speeds, as well as cabling, target IDs, and termination are discussed in this section. High quality cables with the correct latches or screws must be used at all times to ensure reliable connections. Cables are not provided with the SDG Router.

Note: Ensure that you read this section before you attach any devices to the Router. See Table 51 on page 339.

Transfer rates – Ultra, fast, and asynchronous: The SCSI protocol defines two methods of data transfer: synchronous and asynchronous. Asynchronous transfers can run as fast as 5 MHz, while synchronous transfers can run as fast as 20 MHz (Ultra). The rate of transfer is negotiated between a SCSI initiator, such as the SDG Router, and each target. For each target device identified during a bus scan, the SDG

Router requests a transfer rate at the Ultra transfer rate. The target replies with the maximum transfer rate it will support, up to the one requested by the SDG Router.

Note: In general, devices that are capable of running at Ultra speeds should not be mixed on a bus with slower devices.

Wide and narrow SCSI buses: A SCSI bus can be either narrow (8 bit) or wide (16 bit). The SDG Router SCSI buses are all wide, but can be connected to narrow devices with the correct cable adapters. Although it is possible to mix narrow and wide devices on a single SCSI bus, this configuration is not recommended. If any of the devices supports Ultra speeds, then a mix of narrow and wide devices is prohibited. In order for the SDG Router to locate and communicate with the devices, each device on the SCSI bus must be assigned a unique target ID. On a wide (16-bit) SCSI bus, the SCSI standard allows for a total of 16 target IDs. On a narrow (8-bit) SCSI bus, the SCSI standard allows for a total of 8 target IDs. There are no requirements about the ordering or position of the target IDs on the SCSI bus. The only requirement is that there be no duplicate target IDs. The SDG Router uses ID 7. Thus, peripheral devices can use IDs 0 through 6 and 8 through 15, typically selected by a switch or jumpers.

Attention: Make sure you do not assign more than one device on a bus to the same target ID. This will prevent that bus from working correctly. The SCSI protocol also defines a priority-based arbitration method, based on the target ID of the device attaching to the bus. The SCSI ID priority order is, from highest to lowest, 7, 6, 5, 4, 3, 2, 1, 0, 15, 14, 13, 12, 11, 10, 9, and 8.

Limitation of DE, SE, and LVD bus length: Differential ended (DE) allows longer bus lengths and is reliable even when the lengths of cable between devices are not consistent. A DE SCSI bus can be as long as 25 m. An SE SCSI bus can be as long as 6 m. An LVD (Low Voltage Differential) bus can support up to 12m cables.

Note: LVD is not supported by the SDG Router. LVD devices can typically set their interface mode to either SE or LVD depending on the bus to which they are attached.

Table of SCSI terminology and limitations: Table 51 defines the number of devices supported, based on the negotiated transfer type. When reviewing the limitations of a bus, the capabilities of the fastest devices must be considered. The bus length indicates total SCSI bus length, including any internal device cables, rather than the length between any two devices.

Table 51. SCSI Terminology and Limitations.

Transfer type	Maximum bus speed (MBPS)	Bus width (bits)	Bus length, DE (max., m) LVD (max., m) SE (max., m)	Maximum device support
Fast Wide SCSI	20	16	25 12 6	16
Wide Ultra SCSI	40	16	25 12 6	16

SCSI bus termination

Each end of a SCSI bus must be terminated correctly. The SDG Router provides termination on each of its buses. The terminators can be disabled using a jumper on

the SDG Router system board or from the StorWatch Specialist. Each interface has a separate control for the terminators.

Attention: Incorrect SCSI bus termination can result in excessive errors on the SCSI bus, data corruption, and the inability to communicate with target devices.

The SDG Router provides termination power on all SCSI buses for external terminators.

Many SCSI target devices have internal terminators. It is imperative that the terminators be disabled for all devices except those at the physical ends of the SCSI bus.

DE bus termination

For DE interfaces, only differential terminators can be used.

Attention: A single-ended terminator connected to a DE SCSI channel can cause that bus to be unusable.

Problems on the SCSI bus

When a SCSI bus fails to operate correctly, it is usually caused by incorrect connections to the SCSI bus. Common problems include the following:

- **Missing terminator at the end of a SCSI bus**
Check that an external terminator is attached or that the end device has termination enabled.
- **Excessive termination**
Check that all devices, other than the end devices, have termination disabled.
- **Multiple devices at the same ID**
If two or more devices are configured at the same SCSI ID, only one of those devices can be used by the SDG Router, and data transfers to that device are unreliable. Check that only one device is set to each ID.
- **Target device set to initiator's ID**
If a target device is set to the same ID as the SDG Router (ID 7), the bus will be unstable and data corruption can result. Check that no target devices are set to ID 7.
- **Bent pins in a SCSI connector**
The pins in the SCSI connectors are somewhat fragile. Inspect each connector to find pins that were bent when the connector was attached. Replace any cables that have bent pins.
- **Improper device type**
A DE device on an SE bus or an SE device on a DE bus will cause the bus to be unusable.
- **Incorrect terminator type**
A DE terminator on an SE bus or an SE terminator on a DE bus will cause the bus to be unusable.
- **Inadequate cables**
Older cables might not be suitable for running at Ultra speeds. Be sure all cables are rated for Ultra.
- **Mixed cable types**
If a SCSI bus has both round cables and flat ribbon cables, it might have problems when running at Ultra speeds. Use the same cable type consistently for all segments of the SCSI bus.
- **Unshielded cables**
An unshielded SCSI cable used externally to a cabinet can cause reliability

problems, due to interference from other electrical devices. Use only shielded cables.

Fibre Channel port modes and connection options

The Fibre Channel PMC card contains either the ISP2100 controller or the ISP2200 controllers. The ISP2200 has additional initiator port modes and connection options. Use the `fcShow` command (page 347) to view the status of the Fibre Channel interface.

The ISP2100 supports initiator and target modes on a local loop. The default port mode setting is `istarget` and its connection type is always `loop`. Only loop-capable devices can be attached to it (Fabric is not supported).

The ISP2200 supports both the private and public Fibre Channel, Fabric loop attachment with options for loop and point-to-point connection options. The default port mode setting is `target` and the default connection setting is `loop`.

Note: You can change the Port mode options and connection types by using the StorWatch Specialist. For example to set the ISP2200 to Fabric Log in, set the connection type to Point to Point preferred.

Port mode options

Target

In this mode, the port operates as a target and allows a Fibre Channel initiator (or FC switch) to attach to it. The port operates in either private loop or public loop host depending on whether a host or Fabric is attached to it.

- If a host is attached, the port operates as a private target.
- If Fabric is attached, the port operates as a public target.

Initiator

In this mode, the port operates as an initiator allowing Fibre Channel targets to be attached to it.

- For the ISP2100, the initiator port mode is always private loop.
- For the ISP2200, you can choose an initiator port mode option.

Target and initiator

In this mode, the port can access target devices on the Fibre Channel, and initiators on the Fibre Channel can access the targets attached to the SDG Router.

- For the ISP2100, the port switches between target and initiator modes.
- For the ISP2200, the port operates simultaneously as a target and initiator, and you can choose an initiator port mode option.

ISP2200 initiator port mode options

Private

In this option, the SDG Router scans the local loop for devices but does not check for Fabric devices. You can select this option if you are connecting target devices directly to the port.

Public

In this option, the SDG Router scans the loop for Fabric devices. If it finds a

Fabric device, it logs-in and queries the name server for target devices that are available on the Fabric.

- If the SDG Router finds targets attached to the Fabric, it adds all of them to the device map. You can select this option if you are connecting a Fibre Channel switch to the port and you want the SDG Router to have access to the available target devices attached to the switch.
- If target devices are connected directly to the port, it automatically switches to private mode.

ISP2200 connection type options

Loop With this connection option, the port operates with attached loop-capable devices. If a point-to-point device is attached, the SDG Router cannot communicate with it.

Point-to-point

With this connection option, the port supports point-to-point Fabric connection (F-Port Login). It also operates in "old-port mode" for compatibility with N-Port devices that do not support loop. If loop-capable devices are attached, the SDG Router cannot communicate with them.

Loop preferred

With this connection option, the port operates in loop mode. However, if the port detects a connection to an N-Port device, it automatically switches to the point-to-point option.

Point-to-point preferred

With this connection option, the port operates in point-to-point mode. However, if the port detects a connection to a loop device, it automatically switches to the loop option.

Power-up and start sequence guidelines

Connecting power

The SDG Router must be connected to ac power with a voltage of 100 - 127 or 200 - 240 volts, at a frequency of 50 to 60 Hz. A power switch is located next to the power connector on the rear panel of the SDG Router.

Start Sequence

You must start the SDG Router and the attached host and target devices in a specific order. The following procedure describes the order in which you must restart.

Attention: Before you restart the SDG Router, you must stop all I/O operations between the host and the SCSI devices.

1. Turn on the SCSI devices. You must turn on all SCSI devices that are attached to the SDG Router before you turn on or restart the SDG Router.
2. Restart the SDG Router. You can invoke a SCSI rescan or restart from the service terminal. The SDG Router scans the SCSI buses as it starts. If you add or remove SCSI devices after the SDG Router has started, it does not detect the changes. After the SDG Router has finished the startup cycle, the Ready light on the front panel blinks at one-second intervals.
3. After the SDG Router has finished the startup cycle, turn on or restart the hosts that are connected by the Fibre Channel to the SDG Router.

SDG Router network setup

The SDG Router must be connected to a 10Base-T Ethernet network for use with the StorWatch Specialist software. An RJ-45 connector is located on the rear panel of the SDG Router for connection to the Ethernet. You will need to first configure the IP address by connecting a terminal or terminal emulator to the service port of the SDG Router.

If you encounter problems configuring the network, the Ethernet port might be defective. See "Ethernet Test" on page 359.

1. Enable the Ethernet port.

By default, the Ethernet port on the SDG Router is disabled. To enable the port, use the **ethEnable** command. The SDG Router must be restarted to activate the Ethernet port.

```
foster > ethEnable
Ethernet will be enabled on the next boot
value = 0 = 0x0
foster >
```

2. Restart the SDG Router.

The SDG Router must be restarted to activate the Ethernet port, using the **reboot** command.

```
foster > reboot
```

To set up the network address refer to the examples below. For each of these examples, substitute the values obtained when you initially set up the network parameters of your SDG router (see the *SAN Set Up Guide*).

1. Set the host name.

The **hostNameSet** command sets the host name. In this example, the host name of the SDG Router was "Router" and is now being set to "foster."

The shell prompt will change to reflect the new name.

```
Router > hostNameSet "foster"
Target hostname set to foster
value = 0 = 0x0
foster >
```

2. Set the host network address.

The **ethAddrSet** command sets the network address. The IP address is specified as four decimal number separated by periods.

```
foster > ethAddrSet "192.168.1.54"
Host Address set to 192.168.1.54 for Ethernet interface
value = 0 = 0x0
```

If you need to set a netmask, specify it after the network address:

```
foster > ethAddrSet "10.0.0.2", "255.0.0.0"
```

3. Set the network routes and default SDG Router.

If a network gateway is needed for the SDG Router to communicate with other systems, you must specify one using the **gateAddrSet** command.

```
foster > gateAddrSet "192.168.1.1"
value = 0 = 0x0
```

When more complicated routing is required to reach the StorWatch Specialist server, use the **route** command to specify the destination address, as a full address (single host) or as an abbreviated subnet address, and specify the address of the gateway that is reachable on the local subnet.

```
foster > route "add", "206.0.0", "192.168.1.1"
value = 0 = 0x0
```

Service Aids

The SDG Router service capabilities include the following:

- LED indicators
- Power-on-self-test (POST)
- Health Check
- Event Log
- Service Port commands
- Diagnostics

LED indicators

The LEDs on the front panel provides a visual indication of the status and activity of the SDG and its interfaces. The LEDs are refreshed automatically about 5 times per second.

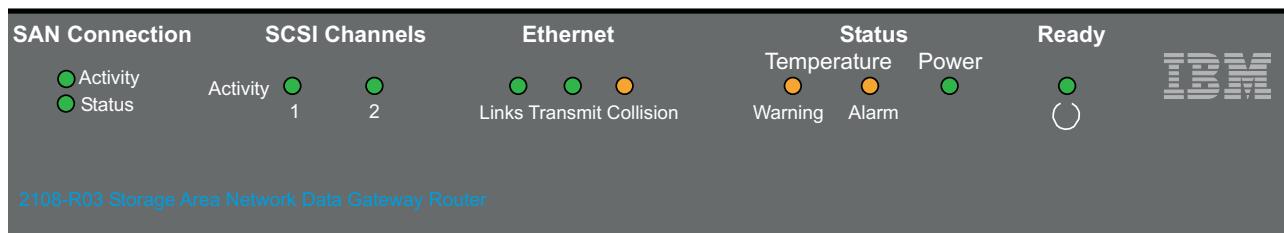


Table 52. LED Indicators.

LED's (G=Green) (A=Amber)	Function	On	Off	Flash
<i>SAN Connection</i>				
Activity (G)	Link traffic			SAN interface activity
Status (G)	Link status	Link Active	No transmission (Link down)	

Table 52. LED Indicators.

LED's (G=Green) (A=Amber)	Function	On	Off	Flash
<i>SCSI (G)</i>				
Activity (1 and 2)	SCSI Activity	SCSI traffic	No SCSI traffic	SCSI Interface activity
<i>ETHERNET</i>				
Link (G)	Status	Link active	Link down	
Transmit (G)	Status	Transmission in progress		
Collision (A)	Status	Collision occurred		
<i>TEMPERATURE</i>				
WARNING (A)	Preventive failure indicator	Temperature Warning	No temperature problem	N/A
Alarm (A)	Information	Temperature exceeded	No temperature problem	N/A
<i>Power Main (G)</i>	Information	Power applied	No power	N/A
<i>Ready (G)</i>	Information	SDG Failure if on for more than 2 sec.	SDG Failure	Flashes during Startup cycle and once every second thereafter (normal)

Power-on-self-test (POST)

POST is divided into two functionally distinct parts: the initial-POST (IPOST) and the secondary-POST (SPOST)

IPOST is the first stage of POST and it thoroughly tests the on-board, dynamic random-access memory (DRAM) arrays. IPOST runs from the on-board flash memory. Upon successful completion, IPOST locates SPOST, copies it to DRAM, and then transfers program control to SPOST.

SPOST is the second stage of post. SPOST configures the SDG Router's PCI bus. SPOST then locates, loads, and runs the licensed internal code (LIC).

Health Check

The health check program queries all subsystems for their operational status. The health check has four levels. A level 1 health check is the most basic, and health check level 4 is the most complete check.

Event Log

The SDG Router maintains an event log within its on-board flash file system. You can query these logs from the SDG Router service port. Event codes and messages that are generated by the SDG Router subsystems are recorded in this log file.

Service Port Commands

An extensive command set is available to manage the SDG Router, obtain Status, and run Diagnostics. The commands described below have been extracted from the *SDG Service Guide*. They have been selected to provide you with some basic tools to determine the functional status of the SDG Router. Refer to Appendixes A and B of the *SDG Service Guide* for a description of all the commands.

Table 53. Service Port Commands.

Group	Description	Page
diagBoot	Used to transition the SDG Router from normal operation to Diagnostic mode (see normalBoot below)	347
diagHelp	Displays a list of diagnostic commands	347
fcShow	Displays the status of the Fibre Channel interface	347
fcShowDevs	Displays information about the devices that are accessible from the Fibre Channel interface	348
fcShowNames	Displays the node and port names (addresses) of the Fibre Channel	349
hardwareConfig	Diagnostic mode only. Stores FRU VPD information in the SDG non-volatile memory (see sysVpdShow below)	350
help	Displays a list of the commands	350
hlthChkHelp	Displays the list of health check commands	351
hlthChkNow	Initiates the health check for the SDG. Results are displayed.	351
loggerDump	Dumps records from the system event log to the terminal console	351
loggerDumpCurrent	Dumps only the records that were logged since the system was last started are dumped.	351
macShow	Displays the Media Access Control address for the Ethernet interface	352
mapShowDatabase	Device database listing the connected devices	352
mapShowDevs	Displays the cross-reference map of device addresses.	353
normalBoot	Restores the SDG to normal operating conditions. Used only to transition from diagnostic mode to normal mode.	354
reboot	Preferred method for restarting the SDG Router	354
scsiRescan	Performs a rescan of the SCSI channel(s) to look for new devices	354
scsiShow	Lists all SCSI channels and the attached devices for each channel	355
showBox	Displays a picture of the SDG showing the components present	355
sysConfigShow	Displays current parameter settings.	356
sysVpdShow	Displays Vital Product Data (VPD) information	356

Table 53. Service Port Commands.

Group	Description	Page
targets	Lists and describes each device currently attached	358
version	Lists the firmware version level	358

The following descriptions are from *Storage Area Network Data Gateway Router Installation and User's Guide* pages 73-97; they also are listed in the *Storage Area Network Data Gateway Router Service Guide* as Appendixes A and B.

diagBoot

Use the **diagBoot** command only to transition the SDG Router from normal operation to the special diagnostic mode. The command first ensures that the `ffs0:mt` directory exists, then it verifies that the files `diagnstk.o` and `diagnstk.rc` are in the flash file system. If they are in the root directory, it moves them to the `ffs0:mt` directory.

The **diagBoot** command copies the existing boot parameters to a file in the `ffs0:mt` directory on the SDG Router. It then installs the new boot parameters that direct the SDG Router to start using the special diagnostic startup script, `ffs0:mt/diagnstk.rc`. It renames the persistent map file `config/device.map` as `config/device.bak`. Finally, **diagBoot** issues a reboot command to put the changes into effect.

Note: Power cycling the SDG Router does not re-instate it to normal mode if previously set to diagnostic mode. Use **normalBoot** command (page 354) to re-initialize the router to normal mode

diagHelp

The **diagHelp** command displays a list of the diagnostic commands.

```
Router > diagHelp
```

The following commands are available in diagnostic mode only:

```
ddfTest: Test DDF Memory
elTest: Test Ethernet port w/loop-back cable
fcSlotTest <portnum> : Test specified Fibre Channel port w/loop-back
cable
hardwareConfig: Re-inventory FRUs and update Vital Product Data
normalBoot: Shutdown and restart in normal mode
scsiChannelTest <x,y>: Test specified SCSI Channels w/loop-back cable
```

fcShow

The **fcShow** command displays the channel status for the Fibre Channel interface.

The following example is for a SDG Router single-port Fibre Channel PMC card (ISP2200 controller). The firmware state for interfaces that have a live connection to a Fibre Channel device are shown as Ready. An interface that has no live connection is shown as "Sync Lost".

```
Router > fcShow
```

```
-----
Fibre Channel Controllers
-----
```

```
Ctrl : PCI Addr : ISP : Firmware : FW : Ctrl : Nvram : Loop
Id : Bs Dv Fn : Type : State : Version : Addr : Addr : ID}
```

1 : 00 06 00 : 2200 : Ready : 2.01.2 : c0d98700 : 90001100 : 2 1

value = 80 = 0x50 = ©P©

Router >

The following describes the example fields:

Ctrl ID

The channel number for this interface

PCI Addr

The PCI address of the interface, showing bus, device ID, and function number

ISPType

The type of Fibre Channel controller, ISP2100 or ISP2200

Firmware State

The current state of the interface as reported by the Fibre Channel PMC adapter firmware. The firmware states are:

- **Configuration Wait:** Firmware is not initialized.
- **Waiting for AL_PA :** Firmware is performing or waiting to perform loop initialization.
- **Waiting for login:** Firmware is attempting port and process logins with all loop ports.
- **Ready:** Indicates that the interface is connected, operational and ready to process SCSI commands. Any other value indicates intermediate states or interface failure.
- **Sync Lost:** The firmware has detected a loss-of-sync condition and is resynchronizing the serial link receiver. This is the state reported when the Fibre Channel link does not detect a connection to a Fibre Channel device.
- **Error:** The firmware has detected an unrecoverable error condition.
- **Nonparticipating:** The firmware is not participating on the loop because it did not acquire an arbitrated loop physical address (AL_PA) during initialization.
- **Failed:** The firmware is not responding to commands.

FW Version

The version of firmware on the Fibre Channel PMC adapter

Ctrl Addr

A pointer to an internal data structure that is used for some diagnostic operations

Nvram Addr

The memory address of the parameter RAM for this interface

Loop ID

The Fibre Channel loop ID for this interface

fcShowDevs

The **fcShowDevs** command displays information about the devices that are accessible from each Fibre Channel interface. The display shows the LUN that the SDG Router has assigned to each device, the SCSI Channel that the device is attached to, the actual SCSI ID and LUN of the device, the vendor, product, revision and serial number of the device.

```

Router > fcShowDevs
FC 1:
LUN Chan Id Lun Vendor Product Rev SN
-----
0 0 0 OPATHLIGHT SAN Router Local 0252 00000060450d00c0
2 3 4 0IBM 03570c11 5324 000000000260
3 3 4 1IBM 03570c11 5324 000000000260
value = 3 = 0x3
Router > Router > fcShowDevs
FC 1:
LUN Chan Id Lun Vendor Product Rev SN
-----
0 0 0 OPATHLGHT SAN Router 0339 00000060451600db
1 1 0 0 ATL L500 6320000 001E JF91101163
2 1 1 OQUANTUM DLT7000 2150 CX921S1423
4 1 2 OQUANTUM DLT7000 2150 CX905S4607
6 2 0 OQUANTUM Powerstor L200 001E JW81477118
8 2 1 OQUANTUM DLT7000 2150 CX919S5223
LUN Chan Id Lun Vendor Product Rev SN
FC 4:
0 0 0 OPATHLGHT SAN Router 0339 00000060451600db
-----
1 1 0 0 ATL L500 6320000 001E JF91101163
2 1 1 OQUANTUM DLT7000 2150 CX921S1423
4 1 2 OQUANTUM DLT7000 2150 CX905S4607
6 2 0 OQUANTUM Powerstor L200 001E JW81477118
8 2 1 OQUANTUM DLT7000 2150 CX919S5223
value =6 =0x6
Router >

```

fcShowNames

The **fcShowNames** command displays the node and port names (addresses) of the Fibre Channels.

```

Router > fcShowNames
-----
Ctrl : PCI Addr : ISP : Node : Port
Id : Bs Dv Fn : Type : Name : Name
-----
1 : 00 06 00 : 2200 : 10000060.451603bb : 20010060.451603bb
4 : 00 07 00 : 2200 : 10000060.451603bb : 20020060.451603bb
-----
value = 64 = 0x40 = ◎◎◎
Router >

```

The following describes the example fields:

Ctrl id

The channel number for the interface

PCI Addr

The PCI address of the interface, showing bus, device ID, and function number

ISPType

The type of Fibre Channel controller, ISP2100 or ISP2200

Node Name

The Fibre Channel node name for the SDG Router

Port Name

The Fibre Channel port name for the interface

hardwareConfig

In order to use this command, the SDG Router must be in diagnostic mode. The **hardwareConfig** command records the configurations of installed FRUs by copying them to the nonvolatile vital product data (VPD) stored on the SDG Router base.

The fields that are updated are the SCSI channel types and PMC type. The service representative enters the **hardwareConfig** command after replacing any FRUs. This causes the SDG Router to update the VPD.

```
Router> hardwareConfig
==== Recording Hardware Configuration ====
Scanning PMC option slots...
Scanning SCSI IO Modules...
Checking memory sizes...
MemSize PCI-0 is 64 Mbytes ...Done
value = 0 = 0x0
Router >
```

help

The **help** command displays a list of the shell commands.

```
Router > help
help Print this list
cleHelp Print Command Log Entry info
diagHelp Print Diagnostic Help info
hlthChkHelp Print Health Check Help info
mapHelp Print Device Map Help info
netHelp Print Network Help info
snmpHelp Print SNMP Help info
userHelp Print User account info
cd "path" Set current working path
copy ["in"][,"out"] Copy in file to out file (0 = std in/out)
h [n] Print (or set) shell history
ls ["path"[,long]] List contents of directory
ll ["path"] List contents of directory - long format
pwd Print working path
rename "old","new" Change name of file
rm ["name"] Remove (delete) a file
shellLock Lock or unlock shell command interface
version Print Version info
whoami Print user name
clearReservation [devId] Clear reservation on a target (may reset
target)
diagBoot Shutdown and restart in diagnostic mode
initializeBox Delete all device maps, restore factory defaults,
reboot
ridTag ["value"] Display and set serial number of replaced base unit
disableCC [option] Disable Command and Control Interface
option 1 - Report as Invalid (AIX mode)
option 2 - Fully disabled
enableCC Enable Command and Control Interface
scsiRescan [chan] Rescan SCSI Channel (all if chan not specified)
scsiShow Display info for SCSI Channels
fcShow Display info for Fibre Channels
fcShowDevs Display devices available on each Fibre Channel
fcShowNames Display Node and Port names for Fibre Channels
hostTypeShow Display Default Host Type settings
loggerDump [count] Display Logger Dump Records
```



```

loggerDumpCurrent [level] Display Logger Dump Records for current
boot
reboot Shut down and restart
reset Restart without shut down
setFcScsiChanMask [chan],[scsi],[allow] Set Channel Access Control
setFcFrameSize [chan],[size] Set FC Frame Size
setFcHardId [chan],[id] Set FC Loop ID
setHost [chan],[OS] Set default host type for FC Channel
OS may be "aix", "nt", "solaris", "hpux"
setSnaCCLun Set LUN for Controller Device (typically zero)
showBox Display graphic of current hardware configuration
sysConfigShow Display System Config Parameters
sysVpdShow Display Vital Product Data
sysVpdShowAll Display Vital Product Data for all subsystems
targets List all known target devices
uptime Display time since last boot

```

hlthChkHelp

The **hlthChkHelp** command displays a list of the health check commands.

```

Router > hlthChkHelp
hlthChkIntervalGet - Show Check Interval
hlthChkIntervalSet <interval> - Set Check Interval
hlthChkLevelGet - Show Check Level
hlthChkLevelSet <level> - Set Check Level
hlthChkNow - Run Health Check Now

```

hlthChkNow

The command causes the SDG Router to execute an immediate, level 4 health check. Results are displayed that will indicate which devices or subsystems failed the check.

```
Router> hlthChkNow
```

loggerDump [number]

The **loggerDump** command dumps records from the system event log to the console. A numeric parameter can be used to indicate the number of events to display. With no parameter specified, all events in the log file are displayed starting with the most recent events.

```

Router > loggerDump 4
*** Dumping 4 (1018 through 1021) of 1021 records ***
000008 1018 0d:00h:00m:07s:22t -- SCSI 2: Bus RESET
000009 1019 0d:00h:00m:07s:22t -- Target device added: index 0,
handle 0xc0ec2600
000010 1020 0d:00h:00m:08s:18t -- Target device added: index 10,
handle 0xc0ad2590
000011 1021 0d:00h:00m:08s:28t -- SCSI 2: New Device at Id 6, Lun 0
Router >

```

loggerDumpCurrent [level]

The **loggerDumpCurrent** command dumps records from the system event log to the console. Only the records that were logged since the system was last started are dumped. Level specifies the event log level for the events as shown in the following table.

Table 54. Event Log Levels.

Level	Name	Explanation
0	Private	Events that are never shown by the remote event viewer but are recorded in the SDG Router event log
1	Notice	Conditions that should always be reported, such as temperature alarms and device removals
2	Warning	Events that might result in a later problem
3	Information	Events that are not errors or warnings

The following is an example dump after a typical start sequence with four target devices added (one additional device is shown, which is the command and control LUN of the SDG Router itself).

```
Router > loggerDumpCurrent 1
*** Dumping 9 (1010 through 1018) current records with level >= 0 ***
000001 0d:00h:00m:05s:56t -- NOTICE: CS and LOGGING STARTED
000002 0d:00h:00m:07s:19t -- FCAL 1: LIP occurred
000003 0d:00h:00m:07s:19t -- FCAL 1: Loop up
000004 0d:00h:00m:07s:22t -- SCSI 1: Bus RESET
000005 0d:00h:00m:07s:22t -- SCSI 2: Bus RESET
000006 0d:00h:00m:07s:22t -- Target device added:index 0, handle
0xc0ec2600
000007 0d:00h:00m:08s:18t -- Target device added: index 9, handle
0xc1f9e090
000008 0d:00h:00m:08s:18t -- Target device added: index 10, handle
0xc0ad2590
000009 0d:00h:00m:08s:28t -- SCSI 2: New Device at Id 6, Lun 0
value = 0 = 0x0
Router >
```

macShow

The **macShow** command displays the media access control (MAC) address for the Ethernet interface.

```
Router > macShow
Enet MAC Address: 0.60.45.d.0.80
value = 33 = 0x21 = ©!©
Router >
```

mapShowDatabase

The SDG Router maintains a database of attached devices to ensure that each time a host attaches to the SDG Router, the target devices are seen at a consistent address. The database lists not only the devices presently connected, but also devices that have previously been connected. If a previously attached device is later reattached, it is assigned its previous address. Use the **mapShowDatabase** command to display the persistent device map table.

```
Router > mapShowDatabase
devId Type Chan tId tLun UID
-----
```

```

000 SNA 127 127 127 00000060:450d00c0
001 SCSI 001 003 000 00000060:450d00c0
002 SCSI 001 002 000 00000060:450d00c0
003 SCSI 001 001 000 00000060:450d00c0
004 SCSI 002 002 000 00000060:450d00c0
005 SCSI 002 000 000 00000060:450d00c0
006 SCSI 002 006 000 00000060:450d00c0
007 SCSI 002 009 000 00000060:450d00c0
008 SCSI 002 002 001 00000060:450d00c0
009 SCSI 002 005 000 00000060:450d00c0
010 SCSI 002 005 001 00000060:450d00c0
011 SCSI 001 000 000 00000060:450d00c0
012 SCSI 001 006 000 00000060:450d00c0
value = 0 = 0x0
Router >

```

The following describes the example fields:

devId

The index of the device in the database.

Type

The type of interface where the device is connected. SNA indicates an internal device. SCSI or Fibre Channel indicate I/O interfaces.

Chan

The channel number of the interface where the device is attached.

TId

Target ID mapping for SCSI initiators.

TLun

Target LUN mapping for SCSI initiators.

UID

For a Fibre Channel interface, the unique ID of the device. For SCSI interface, the unique ID of the SDG Router.

mapShowDevs

The SDG Router maintains a cross-reference map of device addresses. Information about the presently attached and available devices in the map can be displayed using the **mapShowDevs** command.

```

Router > mapShowDevs
devId Type Chan iId iLun UID tId tLun Handle Itl
-----
000 SNA 127 127 127 00000060.450d00c0 001 000 c0ec2600h 00000000h
009 SCSI 002 005 000 09000060.450d00c0 255 255 c1f9e090h 00000000h
010 SCSI 002 005 001 0a000060.450d00c0 255 255 c0ad2590h 00000000h
012 SCSI 001 006 000 0c000060.450d00c0 255 255 c1ffdf10h c1ffdc80h
value = 0 = 0x0
Router >

```

The following describes the example fields:

devId

The index of the device in the database.

Type

The type of interface where the device is attached to the SDG Router.

Chan

The channel number of the interface

iId

For a SCSI interface only, device ID of the device

tLun

For a SCSI interface only, the logical unit number of the device.

UID

For a Fibre Channel interface, unique ID of the device. For SCSI interface, a constructed unique ID based on the unique ID of SDG Router.

tId

Target ID mapping for SCSI initiators

tLun

Target LUN mapping for SCSI initiators

Handle

An internal pointer used for some diagnostic operations

Itl

An internal pointer used for some diagnostic operations

normalBoot

Certain commands and tests are only available in diagnostic mode. Switching to diagnostic mode saves all configuration parameters so that they are restored before returning to normal operation. Use the **normalBoot** command to restore the SDG Router to normal operating conditions.

This command is used only to transition a SDG Router from the special diagnostic mode to normal operations. It restores the boot parameters that was copied by **diagBoot**. The new persistent device map is erased, and the original map file is renamed config/device.map restoring it for use when the SDG Router restarts. The **normalBoot** command then restarts the SDG Router.

reboot

The **reboot** command requests that the SDG Router shut down existing operations and then restart. This is the preferred method of restarting the SDG Router. There are processes running within the SDG Router that might have writes pending to files within the SDG Router's flash file system. Following a **reboot** command, these processes flush their data to the flash file system, and the flash file system writes all pending data out to the flash memory. The SDG Router starts a reset cycle only after all pending data has been successfully written to the flash file system.

```
Router > reboot
```

scsiRescan [channel]

The **scsiRescan** command requests a SCSIrescan to look for new devices. If channel is specified (1 or 2), then only that channel is scanned. If channel is not specified or if channel is 0, then all channels are scanned.

Notes:

1. Rescanning a SCSI bus can delay I/O commands pending on that bus for several seconds. Do not rescan SCSI buses when this delay cannot be tolerated. If possible, scan only the bus where a new device has been added.
2. If a channel is specified, that channel is scanned and the prompt is returned on completion. If no channel is specified (or 0 is specified), SCSI channels 1 and 2 are scanned in sequence and the prompt is returned on completion.
3. When a device is discovered, there can be further device specific initialization that continues after the scan has completed. In this case, the device might not show up immediately when you issue the **fcShowDevs**

command. (Tape and changer devices that indicate a ready status are available after the scan is completed.)

4. If a SCSI target device requires replacement, remove the old device. Set the new device to the same SCSI bus ID as the old device and attach it to the same channel. Rescan the channel to update the configuration data. The new device should be available to host systems with the same LUN as the old device.

scsiShow

The **scsiShow** command lists all SCSI channels and the attached devices for each channel.

```
Router > scsiShow
SCSI Initiator Channel 1: 0xc195e670
ID LUN Vendor Product Rev | Sync/Off Width
-----|-----
0 0 IBMAS400 DFHSS4W 4545 | 12/15 16 S W Q
SCSI Initiator Channel 2: 0xc0ed3900
ID LUN Vendor Product Rev | Sync/Off Width
-----|-----
 4 0 IBM 0357011 5324 | 25/15 16 S W
4 1 IBM 0357011 5324 |
value = 0 = 0x0
Router >
```

The following describes the example fields:

ID

The SCSI ID of the target device

LUN

The SCSI LUN of the target device

Vendor

The content of the Vendor ID field from the SCSI inquiry data

Product

The content of the Product ID field from the SCSI inquiry data

Rev

The content of the Revision ID field from the SCSI inquiry data

Sync/Off

The negotiated synchronous transfer period and offset. The period is the negotiated transfer period. Multiply the period times 4 ns. to determine the actual period. However, if the period is negotiated to 12, then 50 ns. is used. The offset indicates the request/acknowledge (REQ/ACK) offset that was negotiated. A zero in these fields indicates that asynchronous transfer is in use.

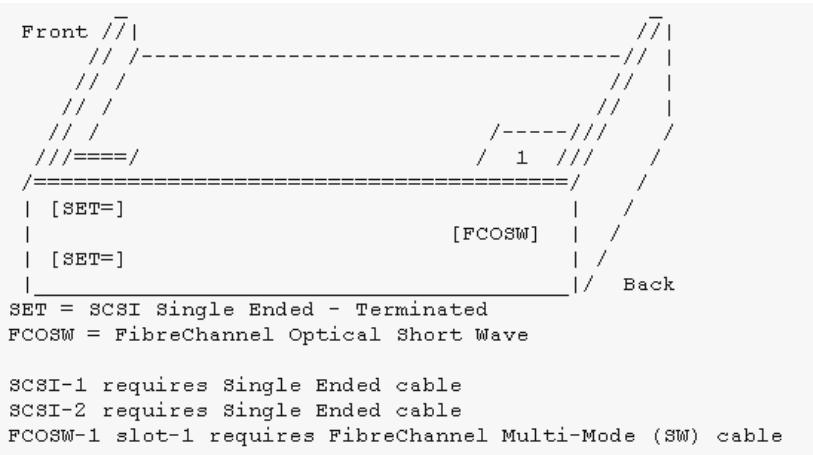
Width

The negotiated transfer width in bits, either 8 or 16

showBox

The **showBox** command displays the components currently in the SDG Router using characters to form a picture of the unit, as viewed from the rear. The following figure demonstrates how the **showBox** command displays a SDG Router that has a single-port Fibre Channel PMC installed.

Note: For SAN connection port-number assignments, see *Storage Area Network Data Gateway Router Service Guide*.



sysConfigShow

The **sysConfigShow** command displays the current system parameter settings.

The display shows whether the SDG Router command and control interface is enabled or disabled. It also shows the LUN that is assigned to it, whether enhanced tape performance features are enabled, the MAC address of the Ethernet port, and the SDG Router Fibre Channel node address.

```

Router > sysConfigShow
Current System Parameter Settings:
Command and Control Device (CC) : 0 Enabled
LUN : 0
Allow Early Write Status for Tape : 1 Enabled
Allow R/W Acceleration for Tape : 1 Enabled
Enet MAC Address: 0.60.45.16.1.4
FC Node WWN: 10000060.45160104
value =0 =0x0 Router >

```

sysVpdShow or sysVpdShowAll

The **sysVpdShow** command displays vital product data (VPD) information. The VPD for the SDG Router includes such items as serial numbers and installed memory sizes.

```

Router > sysVpdShow
===== VPD =====
name SAN Router
uid 00:60:45:16:01:04
s/n 100111
mfg Pathlight Tech
board OntarioII 1.1
" s/n 08357659
flash 2Mbyte
dram 32Mbyte
slot1 10772100 FCOSW
scsi 1: DET 2: DET
EC OTA08000H
RID Tag
value =0 =0x0
Router >

```

The following describes the example fields:

name

Product name: up to 16 characters

uid

Unique Ethernet MAC address of the product: 32 characters displayed as hexadecimal bytes separated by colons

s/n

Product serial number: up to 16 characters

mfg

Product manufacturer: up to 16 characters

board

Name of the system board contained in the base unit: up to 16 characters

" s/n

System board serial number: up to 16 characters

flash

Size of the flash memory on the system board

dram

Size of the DRAM on the system board

slot1

Card type installed in SAN connection slot one

scsi 1

SCSI type for each of the two channels, DET for "differential, terminated" and SET for "single-ended, terminated"

EC

Engineering change (EC) level for the system board: up to 16 characters

RID

RID tag identifier: up to 16 characters

The **sysVpdShowAll**

command shows more information and includes product data for the Fibre Channel PMC card.

```
Router > sysVpdShowAll
===[ Vital Product Data ]===
--[ Base Assembly ]-----
Name SAN Data Gateway Router
Mfg Pathlight Tech
UID 00:60:45:16:01:04
S/N 100111Assy HCO OTA08000H
Assy HCO OTA08000H
Board OntarioII 1.1
" S/N 08357659
Flash 2 Mbyte
Dram 32 Mbyte
RID Tag 100111
--[ Slot 1 ]-----
Type 10772100 FCOSW
S/N 123456
UID 0060.45160065
HCO SC004120H
value =0 =0x0
Router >
```

targets

The SDG Router maintains a list of target devices that are attached to the I/O channels. The **targets** command lists each device that is currently attached and provides a description of each device.

```
Router > targets
Idx Tdev Vendor Product Rev | Type Specific
-----|-----
0 0xc194a400 PATHLGH SAN Router Local 0252 | Cmd/Cntrl Status 0h
2 0xc1ffc390 IBM 03570C11 5324 | Tape: Blk Size 32768 , flags 7h
3 0xc1ffc290 IBM 03570C11 5324 | Changer: flags 7h
value =4 =0x4
Router >
```

Idx

Device Index in the target list

Tdev

An internal pointer, used for some diagnostic operations

Vendor

Content of the Vendor ID field from the SCSI Inquiry Data

Product

Content of the Product ID field from the SCSI Inquiry Data

Rev

Content of the Revision ID field from the SCSI Inquiry Data

Type Specific

For each device type, information pertinent to the device

version

The SDG Router has software that controls all functions. The **version** command displays the revision of that operating software. The first line displayed is the SDG Router firmware version. The lines that follow pertain to the operating system software version.

```
Router > version
SAN Data Gateway Router Version 0339.11 Built Dec 13 1999, 15:14:14
VxWorks (for Pathlight (i960RD)) version 5.3.1.
Kernel: WIND version 2.5.
value = 26 = 0x1a
Router >|
```

Diagnostics

The diagnostic suite is a subset of the manufacturing test program. When enabled, the diagnostic suite is capable of performing external loopback testing of all major hardware interfaces (SCSI, Fibre Channel, and Ethernet).

Toolkit P/N 34L2606 (supplied with the Router) contains the necessary loopback plugs to run the Diagnostics. It includes the following:

- Service port cable: One RS-232 null-modem cable with 9-pin connectors
- SCSI loopback cable: One short wide-Ultra cable with 68-pin connectors
- Fibre Channel: One Fibre Channel short-wavelength or long-wavelength fiber-optic loopback plug
- Ethernet: One 10Base-T Ethernet loopback cable
- Fuses: Two 250 V, 4 A time-lag fuses (type F4AL)

Diagnostic tests

To verify proper operation of the SDG or whenever a FRU has been replaced, a complete diagnostic check of the router may be performed. It is recommended that you perform these tests prior to returning the SDG Router to the customer.

Diagnostic test preparation

1. Attach the service terminal to the SDG Router.
2. Turn on the SDG Router and wait until it has finished the startup cycle.
3. From the service terminal, type **diagBoot**
4. Wait until the SDG Router has finished the startup cycle. The Shell prompt should be **diagmode>**
5. From the service terminal, type **showBox**.
6. Verify that the SDG Router is configured according to the customer's requirements.
 - a. If all installed FRUs are shown, go to "Fibre Channel tests"
 - b. If all installed FRUs are not shown, go to Chapter 3 of the 2108 Model R03 Service Guide (MAP).

Fibre Channel tests

1. Attach the Fibre Channel loopback plug to the card in PMC slot 1. (You can also use the plug from FASTT MSJ).

Note: This test works only if the card is an ISP2200. If the card is an ISP 2100, the following error is displayed: "Card in slot 0 is not Fibre Channel." You can also run FASTT MSJ to verify if the SDG Router is being detected. However, you cannot run the diagnostics (Loopback and Read/Write Buffer test) on the SDG Router.

2. From the service terminal, type **fcSlotTest 1**
 - a. If the **fcSlotTest** test completes successfully, remove the loopback plug and go to "SCSI test".
 - b. If not, go to Chapter 3 of the 2108 Model R03 Service Guide (MAP).

SCSI test

1. If there is only one SCSI interface installed, proceed to "Ethernet Test".
2. Attach the SCSI loopback cable to SCSI channels 1 and 2.
3. From the service terminal, type **scsiChannelTest 1, 2**.
 - a. If the test completes successfully, go to step 4.
 - b. If not, go to Chapter 3 of the 2108 Model R03 Service Guide (MAP).
4. Remove the SCSI loopback cable.
5. Proceed to "Ethernet Test".

Ethernet test

1. Obtain the SDG Router Ethernet network parameters from the customer. Configure the Ethernet port host name, address, routes, and enable the Ethernet. See "SDG Router network setup" on page 343
2. Attach the Ethernet loopback plug to the Ethernet port.
3. From the service terminal, type **elTest**
4. If the test completes successfully, go to step 5. If not, go to Chapter 3 of the 2108 Model R03 Service Guide (MAP).
5. Remove the Ethernet loopback plug.

Verifying SDG Router operation

1. From the service terminal, type **normalBoot**
2. Wait until the SDG Router has finished the startup cycle. The Ready light should be blinking once every second indicating the SDG Router POST was successful. If the light remains on or is off, go to Chapter 3 of the 2108 Model R03 Service Guide (MAP).

Appendix A. Using IBM Fast!UTIL

This appendix provides detailed configuration information for advanced users who want to customize the configuration of the following adapters:

- IBM Fibre Channel Adapter (FRU 01K7354)
- IBM FAStT Host Adapter (FRU 09N7292)
- IBM FAStT FC-2 Adapter (FRU 19K1246)

For more information about these adapters, see Chapter 3, “Fibre Channel Adapter (FRU 01K7354),” on page 15, Chapter 4, “IBM FAStT Host Adapter (FRU 09N7292),” on page 19, and Chapter 5, “IBM FAStT FC-2 Host Bus Adapter (19K1246),” on page 31.

You can configure the adapters and the connected Fibre Channel devices using the Fast!UTIL utility.

Starting Fast!UTIL

To access Fast!UTIL, press Ctrl+Q (or Alt+Q for 2100) during the adapter BIOS initialization (it might take a few seconds for the Fast!UTIL menu to appear). If you have more than one adapter, Fast!UTIL prompts you to select the adapter you want to configure. After changing the settings, Fast!UTIL restarts your system to load the new parameters.

Important: If the configuration settings are incorrect, your adapter will not function properly.

Fast!UTIL options

This section describes the Fast!UTIL options. The first option on the **Fast!UTIL Options** menu is **Configuration Settings**. The settings configure the Fibre Channel devices and the adapter to which they are attached.

Host Adapter settings

You can access this option from the **Configuration Settings** menu in Fast!UTIL by selecting **Host Adapter Settings**. The current default settings for the host adapters are listed in the following three tables and are described in this section.

Note: All settings for the IBM Fibre Channel Adapter (FRU 01K7354) are accessed from the **Host Adapter Settings** menu option. The FAStT Host Adapter (FRU 09N7292) and the FAStT FC-2 Adapter (FRU 19K1246) offer additional settings available from the **Advanced Adapter Settings** menu option. Any settings for the Fibre Channel Adapter (FRU 01K7354) not described in this section are described in “Advanced Adapter settings” on page 363.

Table 55. IBM Fibre Channel Adapter (FRU 01K7354) host adapter settings.

Setting	Options	Default
Host adapter BIOS	Enabled or Disabled	Disabled
Enable LUNs	Yes or No	Yes

Table 55. IBM Fibre Channel Adapter (FRU 01K7354) host adapter settings.

Setting	Options	Default
Execution throttle	1 - 256	256
Drivers load RISC code	Enabled or Disabled	Enabled
Frame size	512, 1024, 2048	2048
IOCB allocation	1-512 buffers	256 buffers
Loop reset delay	0-15 seconds	8 seconds
Extended error logging	Enabled or Disabled	Disabled
Port down retry count	0-255	30

Table 56. FAStT Host Adapter (FRU 09N7292) host adapter settings.

Setting	Options	Default
Host adapter BIOS	Enabled or Disabled	Disabled
Frame size	512, 1024, 2048	2048
Loop reset delay	0-15 seconds	5 seconds
Adapter hard loop ID	Enabled or Disabled	Enabled
Hard loop ID	0-125	125

Table 57. FAStT FC-2 (FRU 19K1246) host adapter settings.

Setting	Options	Default
Host adapter BIOS	Enabled or Disabled	Disabled
Frame size	512, 1024, 2048	2048
Loop reset delay	0-60 seconds	5 seconds
Adapter hard loop ID	Enabled or Disabled	Enabled
Hard loop ID	0-125	125

Host adapter BIOS: When this option is set to Disabled, the ROM BIOS code on the adapter is disabled, freeing space in upper memory. This setting must be enabled if you are starting from a Fibre Channel hard disk that is attached to the adapter. The default is Disabled.

Frame size: This setting specifies the maximum frame length supported by the adapter. The default size is 2048. If you are using F-Port (point-to-point) connections, the default is best for maximum performance.

Loop reset delay: After resetting the loops, the firmware does not initiate any loop activity for the number of seconds specified in this setting. The default is 5 seconds.

Adapter hard loop ID: This setting forces the adapter to use the ID specified in the Hard loop ID setting. The default is Enabled. [For FAStT Host Adapter (FRU 09N7292) and FAStT FC-2 Adapter (FRU 19K1246) only.]

Hard loop ID: When the adapter hard loop ID is set to Enabled, the adapter uses the ID specified in this setting. The default ID is 125.

Note: Adapter settings and default values may vary, based on the version of BIOS code installed for the adapter.

Selectable Boot settings

You can access the **Selectable Boot Settings** option from the **Configuration Settings** menu. When this option is set to Enabled, you can select the node name from which you want to start up (boot). When this option is set to Enabled, the node will start from the selected Fibre Channel hard disk, ignoring any IDE hard disks attached to your server. When this option is set to Disabled, the Boot ID and Boot LUN parameters have no effect.

The BIOS code in some new systems supports selectable boot, which supersedes the Fast!UTIL selectable boot setting. To start from a Fibre Channel hard disk attached to the adapter, select the attached Fibre Channel hard disk from the system BIOS menu.

Note: This option applies only to disk devices; it does not apply to CDs, tape drives, and other nondisk devices.

Adapter Hard ID settings

You can access this option from the **Configuration Settings** menu. It forces the adapter to use the selected hard ID (0-125). The default is set to 125.

Restore Default settings

You can access this option from the **Configuration Settings** menu. It restores the adapter default settings.

Raw NVRAM data

This option displays the adapter nonvolatile random access memory (NVRAM) contents in hexadecimal format. This is a troubleshooting tool; you cannot modify the data.

Advanced Adapter settings

You can access this option from the **Configuration Settings** menu by selecting **Advanced Adapter Settings**. The current default settings for the adapter are listed in the following three tables and are described in this section.

Note: The **Advanced Adapter Settings** menu option is available only for the FAST Host Adapter (FRU 09N7292) and the FAST FC-2 Adapter (FRU 19K1246). All settings for the IBM Fibre Channel Adapter (FRU 01K7354) are accessed from the **Host Adapter Settings** menu option.

Table 58. FAST Host Adapter (FRU 09N7292) advanced adapter settings.

Setting	Options	Default
Execution throttle	1-256	256
Fast command posting	Enabled or Disabled	Enabled
>4GByte addressing	Enabled or Disabled	Disabled
LUNs per target	0, 8, 16, 32, 64, 128, 256	0

Table 58. FAS*t*T Host Adapter (FRU 09N7292) advanced adapter settings.

Setting	Options	Default
Enable LIP reset	Yes or No	No
Enable LIP full login	Yes or No	Yes
Enable target reset	Yes or No	Yes
Login retry count	0-255	30
Port down retry count	0-255	30
Drivers load RISC code	Enabled or Disabled	Enabled
Enable database updates	Yes or No	No
Disable database load	Yes or No	No
IOCB allocation	1-512 buffers	256 buffers
Extended error logging	Enabled or Disabled	Disabled

Table 59. FAS*t*T FC-2 Adapter (FRU 19K1246) advanced adapter settings.

Setting	Options	Default
Execution throttle	1-256	256
Fast command posting	Enabled or Disabled	Disabled
>4GByte addressing	Enabled or Disabled	Disabled
LUNs per target	0, 8, 16, 32, 64, 128, 256	0
Enable LIP reset	Yes or No	No
Enable LIP full login	Yes or No	Yes
Enable target reset	Yes or No	Yes
Login retry count	0-255	30
Port down retry count	0-255	30
Drivers load RISC code	Enabled or Disabled	Enabled
Enable database updates	Yes or No	No
Disable database load	Yes or No	No
IOCB allocation	1-512 buffers	256 buffers
Extended error logging	Enabled or Disabled	Disabled

Execution throttle: This setting specifies the maximum number of commands executing on any one port. When a port reaches its execution throttle, Fast!UTIL does not run any new commands until the current command is completed. The valid options for this setting are 1-256. The default (optimum) is 256.

Fast command posting: This setting decreases command execution time by minimizing the number of interrupts. The default is Enabled for the FAS*t*T Host Adapter (FRU 09N7292) and Disabled for the FAS*t*T FC-2 Adapter (19K1246).

>4GByte addressing: Enable this option when the system has more than 4 GB of memory available. The default is Disabled.

LUNs per target [for IBM Fibre Channel Adapter (FRU 01K7354)]: Specifies the number of LUNs per target. Multiple logical unit number (LUN) support is typically for redundant array of independent disks (RAID) enclosures that use LUNs to map drives. The default is 8. For Netware, set the number of LUNs to 32.

LUNs per target [for FAStT Host Adapter (FRU 09N7292) and FAStT FC-2 Adapter (FRU 19K1246)]: This setting specifies the number of LUNs per target. Multiple logical unit number (LUN) support is typically for redundant array of independent disks (RAID) enclosures that use LUNs to map drives. The default is 0. For Netware, set the number of LUNs to 32.

Enable LIP reset: This setting determines the type of loop initialization process (LIP) reset that is used when the operating system initiates a bus reset routine. When this option is set to **Yes**, the device driver initiates a global LIP reset to clear the target device reservations. When this option is set to **No**, the device driver initiates a global LIP reset with full login. The default is **No**.

Enable LIP full logon: This setting instructs the ISP chip to log into all ports after any LIP. The default is **Yes**.

Enable target reset: This setting enables the device drivers to issue a Target Reset command to all devices on the loop when a SCSI Bus Reset command is issued. The default is **Yes**.

Login retry count: This setting specifies the number of times the software tries to log into a device. The default is 30 retries.

Port down retry count: This setting specifies the number of times the software retries a command to a port that is returning port-down status. The default is 30 retries.

Drivers load RISC code: When this option is set to **Enabled**, the adapter uses the RISC firmware that is embedded in the software device driver. When this option is set to **Disabled**, the software device driver loads the RISC firmware found in the adapter BIOS code. The default is **Enabled**.

Note: To load the embedded device driver software, the device driver being loaded must support this setting. If the device driver does not support this setting, the result is the same as if this option is set to **Disabled**, regardless of the setting. Leaving this option enabled ensures a certified combination of software device driver and RISC firmware.

Enable database updates: When this option is set to **Enabled**, the software can save the loop configuration information in flash memory as the system powers down. The default is **No**.

Disable database load: When this option is set to **Enabled**, the device database is read from the Registry during driver initialization. When this option is set to **Disabled**, the device database is created dynamically during device driver initialization. The default is **No**.

Note: This option usually applies to the Windows NT and Windows 2000 operating system environments.

IOCB allocation: This option specifies the maximum number of buffers from the firmware buffer pool that are allocated to any one port. The default setting is 256 buffers.

Extended error logging: This option provides additional error and debugging information to the operating system. When this option is set to **Enabled**, events are logged into the Windows NT Event Viewer or Windows 2000 Event Viewer (depending on the environment you are in). The default is **Disabled**.

Extended Firmware settings

You can access this option from the **Configuration Settings** menu by selecting **Extended Firmware Settings**. The current default settings for the host adapter are listed in Table 60 and are described in this section.

Note: The **Extended Firmware Settings** menu option is available only for the FAS^TT Host Adapter (FRU 09N7292) and the FAS^TT FC-2 Adapter (FRU 19K1246). Extended firmware settings are not available for the IBM Fibre Channel Adapter (FRU 01K7354).

Table 60. Extended firmware settings for FAS^TT Host Adapter (FRU 09N7292) and FAS^TT FC-2 Adapter (FRU 19K1246).

Setting	Options	Default
Extended control block	Enabled or Disabled	Enabled
RIO operation mode	0, 1, 2, 3, 4	0
Connection Options [for FAS ^T T Host Adapter (FRU 09N7292)]	0, 1, 2, 3	3
Connection Options [for FAS ^T T FC-2 Adapter (FRU 19K1246)]	0, 1, 2	2
NonParticipating hard ID	Enabled or Disabled	Disabled
Class 2 service	Enabled or Disabled	Disabled
ACK0	Enabled or Disabled	Disabled
Fibre Channel tape support	Enabled or Disabled	Disabled
Fibre Channel confirm	Enabled or Disabled	Disabled
Command reference number	Enabled or Disabled	Disabled
Read transfer ready	Enabled or Disabled	Disabled
Response timer	0-255	0
Interrupt delay timer	0-255	0
Data rate [for FAS ^T T FC-2 Adapter (FRU 19K1246) only]	0-2	2

Extended control block: This setting enables all other extended firmware settings. The default is Enabled.

RIO operation mode: This setting specifies the reduced interrupt operation (RIO) modes, if supported by the software device driver. RIO modes enable posting multiple command completions in a single interrupt (see Table 61). The default is 0.

Table 61. RIO operation modes for FAS^TT Host Adapter (FRU 09N7292) and FAS^TT FC-2 Adapter (FRU 19K1246).

Option	Operation mode
0	No multiple responses
1	Multiple responses, 16-bit handles, interrupt host

Table 61. RIO operation modes for FAStT Host Adapter (FRU 09N7292) and FAStT FC-2 Adapter (FRU 19K1246).

Option	Operation mode
2	Multiple responses, 32-bit handles, interrupt host
3	Multiple responses, 16-bit handles, delay host interrupt
4	Multiple responses, 32-bit handles, delay host interrupt

Connection options: This setting defines the type of connection (loop or point-to-point) or connection preference (see Table 62). The default is 3 for the FAStT Host Adapter (FRU 09N7292) or 2 for the FAStT FC-2 Adapter (FRU 19K1246).

Table 62. Connection options for FAStT Host Adapter (FRU 09N7292) and FAStT FC-2 Adapter (FRU 19K1246).

Option	Type of connection
0	Loop only
1	Point-to-point only
2	Loop preferred; otherwise, point-to-point
3 [for FAStT Host Adapter (FRU 09N7292) only]	Point-to-point; otherwise, loop

Nonparticipating hard ID: This setting is reserved. The default is Disabled.

Class 2 service: This setting enables Class 2 service parameters to be provided during all automatic logins (loop ports). The default is Disabled.

ACK0: This setting determines the type of acknowledgment (ACK) used. When this option is set to Enabled, sequence ACK is used. When this option is set to Disabled, frame ACK is used. The default is Disabled.

Note: You must enable the Class 2 service setting to use the ACK0 setting.

Fibre Channel tape support: This setting is reserved for Fibre Channel tape support. The default is Disabled.

Fibre Channel confirm: This setting enables the host to send the FCP confirmation frame when requested by the target. The default is Disabled.

Command reference number: This setting is reserved for Fibre Channel tape support. The default is Disabled.

Read transfer ready: This setting is reserved. The default is Disabled.

Response timer: This setting contains the value (in 100-microsecond increments) used by a timer to limit the wait time for accumulating multiple responses. For example, if this field is 8, the time limit is 800 microseconds. The default is 0.

Interrupt delay timer: This setting contains the value (in 100-microsecond increments) used by a timer to set the wait time between accessing (DMA) a set of handles and generating an interrupt. The default is 0.

Data rate [for FAStT FC-2 Adapter (FRU 19K1246) only]: This setting determines the data rate (see Table 63 on page 368). When set to 2, the FAStT FC-2 Adapter

determines what rate your system can accommodate and sets the rate accordingly. The default is 2.

Table 63. Data rate options for FAStT FC-2 Adapter (FRU 19K1246).

Option	Data Rate
0	1 Gb per second
1	2 Gb per second
2	Auto

Scan Fibre Channel devices

Use this option to scan the Fibre Channel loop and list all the connected devices by loop ID. Information about each device is listed, for example, vendor name, product name, and revision. This information is useful when you are configuring your adapter and attached devices.

Fibre Channel disk utility

Attention: Performing a low-level format removes all data on the disk.

Use this option to scan the Fibre Channel loop bus and list all the connected devices by loop ID. You can select a disk device and perform a low-level format or verify the disk media.

Select host adapter

Use this option to select, configure, or view a specific adapter if you have multiple adapters in your system.

Appendix B. Related service information

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 receptacles4. 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.
Note: In the UK, by law, the telephone cable must be connected after the power cord.	Note: In the UK, the power cord must be disconnected after the telephone cable.



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.

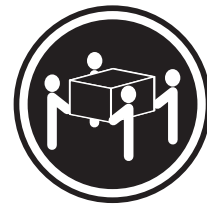
DANGER

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.

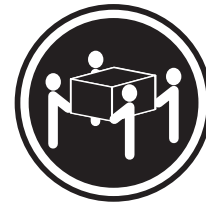
PERIGO

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



危險

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.

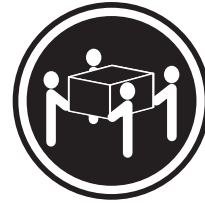
DANGER

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 lösen. 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 lösen, 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 lösen
1. Alle Geräte ausschalten und Netzstecker ziehen.	1. Alle Geräte ausschalten.
2. Zuerst alle Kabel an Einheiten anschließen.	2. Zuerst Netzstecker von Steckdose lösen.
3. ZSignalkabel an Anschlußbuchsen anschließen.	3. Signalkabel von Anschlußbuchsen lösen.
4. Netzstecker an Steckdose anschließen.	4. Alle Kabel von Einheiten lösen.
5. Gerät einschalten.	



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.

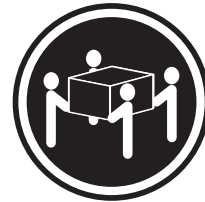
VORSICHT

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
1. SPEGNERE tutti i dispositivi.	1. SPEGNERE tutti i dispositivi.
2. Collegare prima tutti i cavi alle unità.	2. Rimuovere prima il(i) cavo(i) di alimentazione dalla presa elettrica.
3. Collegare i cavi di segnale alle prese.	3. Rimuovere i cavi di segnale dalle prese.
4. Collegare il(i) cavo(i) di alimentazione alla presa elettrica.	4. Rimuovere tutti i cavi dalle unità.
5. ACCENDERE le 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.

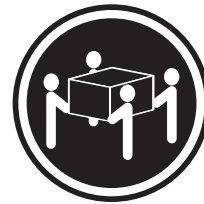
PERICOLO

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.



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

1. 모든 스위치를 켜다.
2. 먼저 모든 케이블을 장치에 연결한다.
3. 신호선을 콘센트에 연결한다.
4. 전원을 콘센트에 연결한다.
5. 장치 스위치를 켜다.

연결해제하려면

1. 모든 스위치를 끈다.
2. 먼저 모든 케이블을 장치에 제거한다.
3. 신호선을 콘센트에서 제거한다.
4. 장치에서 모든 케이블을 제거한다.

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. 배터리에 리튬이 포함되어 있으므로 제대로 사용, 처리 또는 처분하지 않으면 폭발할 수 있습니다.

다음을 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.



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
1. Apague todos los componentes (OFF).	1. Encienda todos los componentes (ON).
2. En primer lugar, conecte todos los cables a los dispositivos.	2. En primer lugar, retire los cables de alimentación de las tomas.
3. Conecte los cables de señal a los receptáculos.	3. Retire los cables de señal de los receptáculos.
4. Conecte los cables de alimentación a las tomas.	4. Retire todos los cables de los dispositivos.
5. Encienda el dispositivo (ON).	



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.

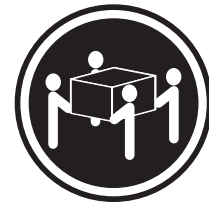
PELIGRO

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)

Precaución:

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



Precaución:

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.

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

Term	Information
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
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

Term	Information
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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